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New data on the geology of the archaeological site at Vinča (Belgrade, Serbia)

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Abstract. Landslides threaten Vinča, a world famous archaeological site of Neolithic culture. For this reason, a field investigation and geologic-geotechnical research of the cores of seven exploration boreholes were carried out. A very interesting structural setting was identified. The oldest stratigraphic unit consists of Middle Miocene Sarmatian sediments, which were discovered along the right bank of Danube River and within its riverbed about 300 m upstream from the archaeological site. These Sarmatian strata give evidence that the Danube River eroded the right bank. In addition, within its recent valley, there is a fault zone along which a block on the right bank was uplifted while a block on the left bank of the river that was subsided. All the boreholes passed through sediments of a previously unknown geological formation. It lies unconformably over Sarmatian strip marls and makes the base for Pleistocene loessoid sediments (approx. 10 m under the surface). These sediments were formed in a marsh-lake environment with a strong river influence. According to its superposition, the supposed age of this formation is the Plio-Pleistocene. Above the right bank of the Danube River, there are steep sections where Pleistocene swamp loessoid sediments were found. True loess deposits are not present here, but are in the hinterland of the right bank of the Danube River. The loess delluvium was deposited over the Pleistocene sediments. On the right bank of the Danube River, below the archaeological site, there are the anthropogenic water compacted sands that were previously incorrectly shown on geological maps as alluvial fans.

Key words: Stratigraphy, Sarmatian, Plio-Pleistocene, Quaternary, Vinča archaeological site.

Абстракт. Винча, светски познати археолошки локалитет неолитске културе, угрожен је клизиштима. Из тог разлога, урађена су геолошко-геотехничка истраживања језгра седам истражних бушотина као и непосредна теренска мерења. Том приликом је идентификован и врло занимљив структурно-тектонски склоп терена. Најстарија стратиграфска јединица су сарматски фино-ламинирани, тракасти лапорци који су откривени дуж десне обале Дунава као и у самом кориту реке, 300 m узводно од археолошког локалитета. Њихов просторни положај указује да данашњи Дунав еродира своју десну обалу. Осим тога, дуж савремене речне долине Дунава, постоји раседна зона дуж које је блок на десној обали издигнут насупрот блока на левој обали реке, који је спуштен. Свих седам бушотина је набушило седименте до сада, непознате геолошке формације. Они леже дискордантно преко сарматских тракастих лапораца, који нису набушени у овим бушотинама, а чине непосредну подлогу плеистоценским лесоидним наслагама (приближно 10 m испод површине терена). Ови седименти су формирани у барско-језерској средини са јаким утицајем реке. Према суперпозицији, старост ове формације би била у интервалу Плио-Плеистоцен. Изнад десне обале Дунава, постоје стрми одсеци на којима су такође пронађени плеистоценски барски лесоидни седименти. Прави лес није присутан овде, али га има даље у залеђу десне обале Дунава. Лесни делувијум је депонован изнад плеистоценских седимената. На десној обали Дунава, испод археолошког налазишта, присутни су антропогени наноси рефулираног песка који је раније погрешно приказан на геолошким картама као алувијални нанос.

Кључне речи: Стратиграфија, сармат, Плио-плеистоцен, квартар, археолошки локалитет Винча.

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Introduction

An archaeological site of the Neolithic culture of Belo Brdo (White Hill) is situated on the right bank of the Danube River in the village of Vinča (N 44°45'43'', E 20°37'23'' – Fig. 1), 14 km downstream from Belgrade. It was first discovered in 1908 by the Serbian archaeologist Miloje Vasić (VASIĆ 1932). Since then, with several interruptions, numerous archaeological excavations have been carried out. The last campaign was finished a few years ago (1998–2009). Vinča-Belo Brdo was introduced into the treasury of world heritage as an object of prehistoric cultures. It is almost entirely made up of the remains of a human settlement and was occupied several times from the Early Neolithic (ca. 5000 BC) through to the medieval period (NIKOLIĆ & VUKOVIĆ 2008; SREJOVIĆ & TASIĆ 1990). There are many artefacts and, jewellery and objects made of precious and rare metals, vases, various materials, and real treasure that were procured from other parts of Europe (ANTONOVIĆ 2002; DIMITRIJEVIĆ & TRIPKOVIĆ 2006, DIMITRIJEVIĆ *et al.* 2010). The archaeological site is a very important part of the touristic offer of Belgrade. Currently, the entire Vinča archaeological site is closed for tourists and protected with thick layer of sand due to the landslide problems. For this reason, geological and geotechnical investigations were performed. Based on data from previous papers, it is surprising that during 104 years of archaeological excavations, neither geological explorations, drillings nor detailed geological research were performed. Some of the geological data cited in the literature are incorrect to date (for example, loess as the substrate for the anthropogenic-archaeological layers – IVKOVIĆ *et al.* 1966). Therefore, geological and geotechnical investigations presented herein represent the first serious study at the archaeological site. The results give a completely new view of the geological structure of the terrain.

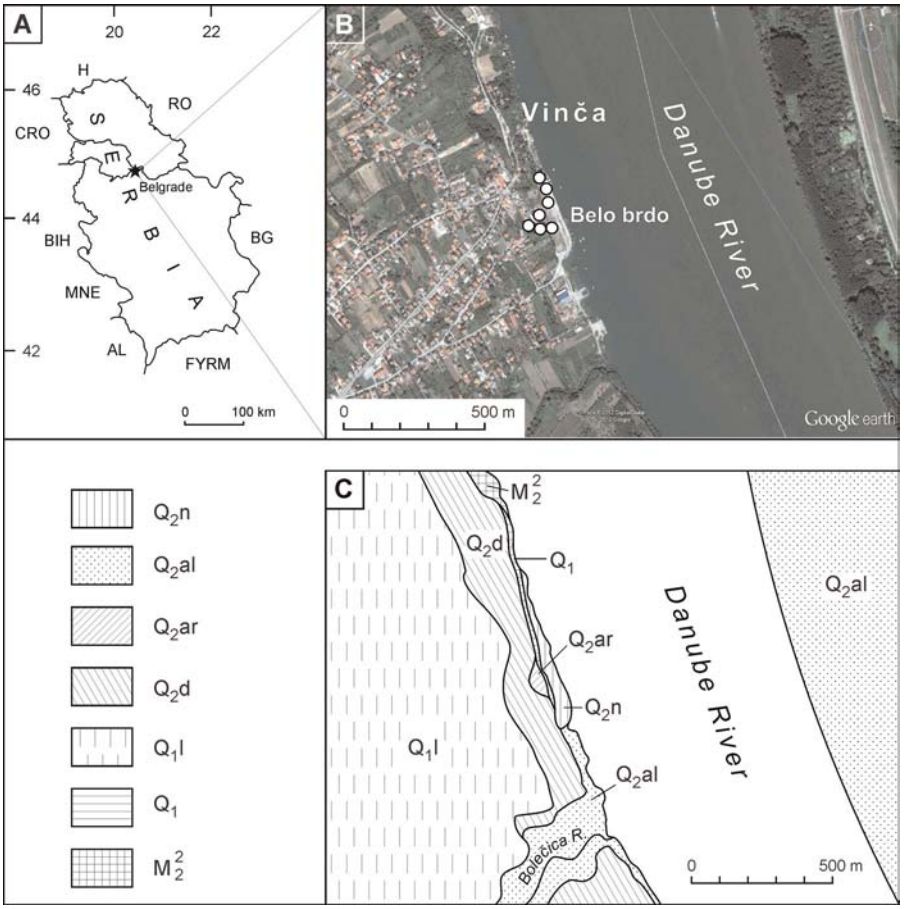

Fig. 1. **A)** The location, **B)** a satellite image of the Vinča archaeological site (Google Earth, 2012) and **C)** a simplified geological map of the investigated area. The white circles show the position of the boreholes. Key: $\mathbf{M_2^2}$, Sarmatian; $\mathbf{Q_1}$, Pleistocene (swamp loessoid); $\mathbf{Q_1L}$, Pleistocene (loess); $\mathbf{Q_2d}$, Holocene (delluvium); $\mathbf{Q_2al}$, Holocene (alluvial sediments); $\mathbf{Q_2ar}$, Holocene (archaeological layers); $\mathbf{Q_2n}$, Holocene (technogenic deposits).

Belo Brdo is of great importance for the pre-history of European civilization (VASIĆ 1932, 1936; SREJOVIĆ & TASIĆ 1990; NIKOLIĆ & VUKOVIĆ 2008; TASIĆ 2008). As such, the Serbian Government warranted it the highest level of state protection and classifies it as an archaeological site of exceptional importance. Today, Vinča has the status of Archaeological Park. Unfortunately, the site has received no appropriate treatment in practice. After so many years of excavation, the practice shows that little has been realised for it to become the most valuable object of the archaeological heritage of Serbia. It needs a lot of will, effort and financial support for the site to become one of the jewels of the geo-touristic offer of the City of Belgrade (RUNDIĆ 2010; RUNDIĆ *et al.* 2010).

Material and methods

Seven shallow boreholes were drilled in the courtyard of the Museum and the on the archaeological site

and on the right bank of the Danube River (Fig. 1, Table 1). Twenty-five cores samples were analyzed and five samples from the Danube riverbed. Preliminary stratigraphic analyses were realised in the field. No fossils were detected in the mentioned cores. Five samples from the Danube riverbed were used for palaeontological studies. A detailed biostratigraphic and micropalaeontological analysis was made at the Chair of Historical Geology, Faculty of Mining and Geology, University of Belgrade. Classical methods of the preparation of soft rock, *i.e.* cleaning (6% of hydrogen peroxide) and washing were carried out (0.5–0.063 mm sieves). 100 g of each dried residue was observed under a stereomicroscope.

Table 1. Geographic position of the investigated boreholes (WGS84).

No.	Boreholes	Coordinates (WGS84)	
1.	V-1	N 44° 45' 42.83"	E 20° 37' 21.41"
2.	V-2	N 44° 45' 41.83"	E 20° 37' 22.23"
3.	V-3	N 44° 45' 44.12"	E 20° 37' 20.31"
4.	V-4	N 44° 45' 45.49"	E 20° 37' 23.85"
5.	V-5	N 44° 45' 44.33"	E 20° 37' 24.76"
6.	V-6	N 44° 45' 43.13"	E 20° 37' 25.22"
7.	V-7	N 44° 45' 44.97"	E 20° 37' 21.80"

Stratigraphic overview

The archaeological site at Belo Brdo is located above the right bank of the Danube River, on the outskirts of the village of Vinča. Downstream, the mouth of the Bolečka River flows into the Danube. The geological structure of the involved terrain consists of Middle Miocene Sarmatian sediments and Quaternary deposits (see the first geological map of this area – Laskarev *et al*. (1932). A few decades later, a similar stratigraphic conclusion was reached by Veljković-Zajec (1953), Ivković (1966) and Stevanović (1977, 1980). They concluded the Lower Sarmatian deposits represent the geological background for different type of Quaternary sediments. Besides Sarmatian stripped and laminated marls and sandstones, sandy limestones rich in microfauna were located on the hills above the Village Vinča. They contain lot of foraminifera, which indicates the younger level of the Sarmatian. Biostratigraphically, the finding of *Nubecularia novorosica,* which is a very characteristic species for the Middle Sarmatian of Russia is very important. It suggests a strong influence from the Carpathian domain on the Pannonian Basin (Veljković-Zajec 1953). Relatively recent stratigraphic studies in this area were performed by Šumar & Rundić (1992) and Knežević & Šumar (1993, 1994). As a conclusion, they confirmed the presence of Sarmatian striped and laminated sandy marls and alevrites belonging to the Lower Sarmatian. Biostratigraphically, based on the foraminifer biozonations, it represents the basal part of the Sarmatian, the *Elphidium reginum* Zone.

Results

Middle Miocene (Sarmatian - M_2^2)

The base of geological structure near the archaeological site consists of Sarmatian brackish-marine sediments of the Late Middle Miocene. However, these sediments were not found in all the prospecting boreholes. Probably, they lie much deeper than 65 m.a. s.l. (Figs. 3, 9). Sarmatian strata were discovered on the right bank of the Danube River (N 44°45'54", E 20°37'21") about 200–300 m upstream from the archaeological site (see Figs. 2A, B). They are made of striped and laminated sandy marls, alevrites and green clay. In the lithological succession, there are an alternation of light interlayers enriched with calcium carbonate and dark, grey-green laminas enriched with clay minerals. The layers have very steep declines oriented toward the N–NE (azimuth and dip angle of the surface layer is 63/27 – see Fig. 2C). Besides, the Sarmatian layers were found in the riverbed of the Danube River. They are observed in the shallows at low water levels, and they have steeper dip angles (more than 70° – Fig. 2D). However, there are strata that oriented toward the S–SW, which probably indicate a local anticlinal structure within the Sarmatian sediments. Fossil macrofauna in the Sarmatian sediments near the Vinča archaeological site as well as in its vicinity is very rare and it is assumed to belong to the lower part of the Sarmatian (the so-called the *Rissoa* layers). Among the rare gastropods, representatives of the genus Gibulla (*Gibulla* cf. *depressa*, *Gibulla* sp.) and *Cerithium* sp. dominate. Additionally, small bones of fish, otholites (*Gadus*? sp.) and fragments of organic matter were identified.

Microfossil assemblages from three samples of the striped alevrites were studied. A relatively poor foraminiferal-ostracod fauna was identified. In these associations, the species *Anomalidoides dividens*, *Ammonia* ex. gr *beccarii, Loxoconcha* cf. *kochi, Elphidium* sp., *Quinqueloculina* sp., *Xestoleberis* sp. are dominant. The fine-grained fraction of the samples shows more mineralization of pyrite, clay minerals, quartz grains, and faunal debris. In addition, small "balls" of the algae Diatomiacae were noticed.

Biostratigraphically, the above-mentioned sediments belong to the lower part of the Volhynian Substage of the Sarmatian age – the *Elphidium reginum* Zone (Šumar & Rundić 1992). Such findings are matched with previous studies of microfauna over a slightly wider area at Vinča and Ritopek (Veljković-Zajec 1953; Šumar & Rundić 1992) and the general

Fig. 2. Sarmatian sediments on the right bank of Danube River exposed during low water level. **A,** within the riverbed; **B, C,** on the right bank; and **D,** an abrupt dip angle of marls (more than 70°).

geological settings were given a long time ago by LASKAREV *et al*. (1932) and LASKAREV (1938).

Quaternary

The whole studied area except for a narrow strip along the Danube River is covered by Quaternary deposits. Stratigraphically, they are belonging to both Quaternary epochs: the Pleistocene and Holocene. Although the age of the newly discovered stratigraphic unit is not exactly known, because of the succession of layers observed in the field, they are here considered as the base of the Quaternary.

Pleistocene (Q_1)

Pleistocene sediments have a wide distribution. Among them, two packages can be divided by superposition: 1) older deposits of unknown age that are believed to belong to the Plio-Pleistocene (Pl/Q_1) and 2) younger Pleistocene sediments singled out here as the Pleistocene (Q_1)

Plio-Pleistocene as a lower level of the Quaternary was never detected on the surface. However, these sediments were observed in all the prospecting boreholes. They occur in the base of the Pleistocene sediments below an altitude of 77 m. The lower boundary was never established because all the exploration boreholes were completed within them. Lithologically, the older Quaternary deposits are made of greyish-yellow alevrites, grey alevrites and clays with interbeds of

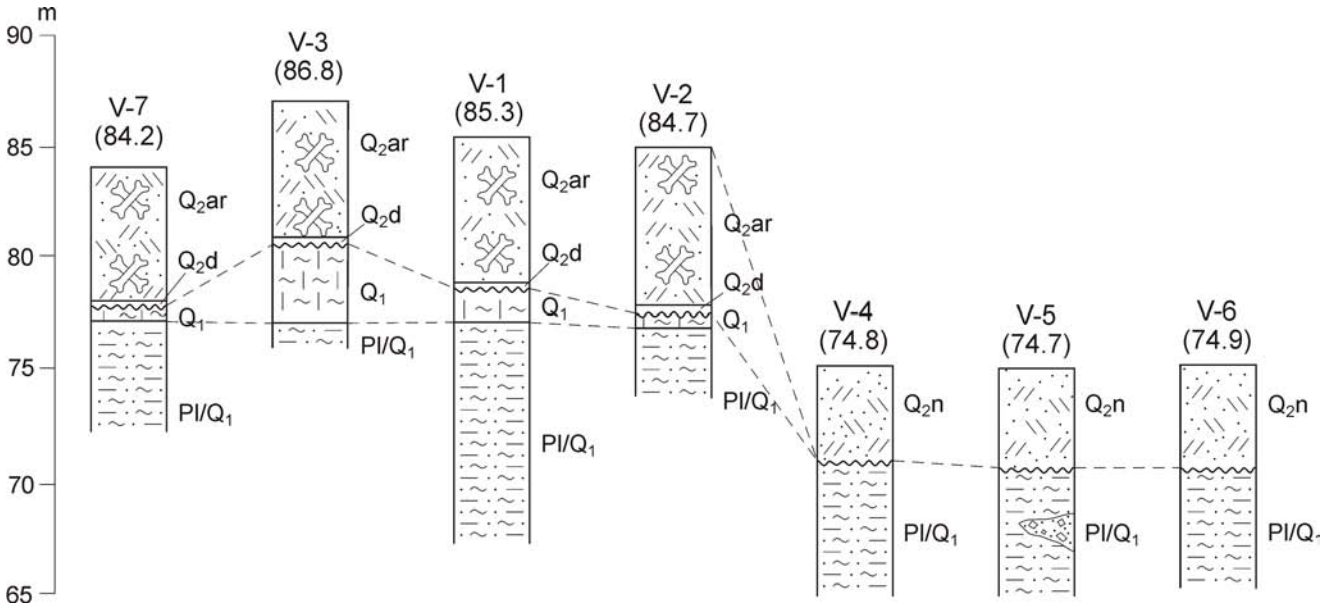

Fig. 3. Comparative lithostratigraphic sections of the investigated boreholes. Key: **Pl/Q_1,** Plio/Pleistocene; **Q_1,** Pleistocene (swamp loessoid); **Q_2d,** Holocene (delluvium); **Q_2ar,** Holocene (archaeological layers); **Q_2n,** Holocene (technogenic deposits).

Fig. 4. Location of the borehole V-5 (A) and details of cores (B) with the redeposited Sarmatian limestone (1) and grayish alevrites and clays of Plio-Pleistocene (2).

fine-grained sands. More or less similar sediments were discovered in all the boreholes located on the right bank of the Danube River (boreholes V-4, V-5, V-6, and see Fig. 3). They are found at a depth of about 4 meters from surface (ca. 71 meters a.s.l.) and contain grey and yellowish marls, and fine-grained laminated sands. In some places, they contain organic matter. Fossils are completely missing. In the other boreholes (boreholes V-1, V-2, V-3, V-7) drilled in the courtyard of the Museum and the archaeological site, the greyish-yellow alevrites, grey alevrites and clays have a maximal thickness of more than 10 m (borehole V-1). Its lower boundary is unknown because the mentioned borehole was completed within this stratigraphic unit (Fig. 3). In the borehole V-5, drilled on the right bank of the Danube River below the archaeological site, a layer of sandy gravel at a depth of 6.8 to 8.3 m was determined. Redeposited pebbles of Middle Sarmatian sandy limestone with gastropod imprints were found within it (Figs. 3, 4).

Pleistocene deposits are widespread in the village of Vinča. They were detected in the notches along the steep bank of the Danube River and around roads and other buildings. Based on superposition, so-called swamp loessoid (Q_1) and loess (Q_1l) could be separated among them.

Lithologically, the swamp loessoid consists of grey and greyish-brown alevrites, locally stratified. They are weakly permeable to waterproof. They contain the remains of marsh-aquatic fauna (mostly representatives of the family *Planorbidae*) and terrestrial fauna with the genera *Succinea, Clausilia, Valonia*, etc. (Fig. 5). These sediments developed on the right bank of the Danube River. The loess's delluvial and anthropogenic deposits were deposited over them. In genetic terms, these sediments were performed from eolian dust and delluvial detritus in an aquatic, wetland-marsh environment.

Loess (so-called the slope's loess) includes younger Pleistocene deposits formed by

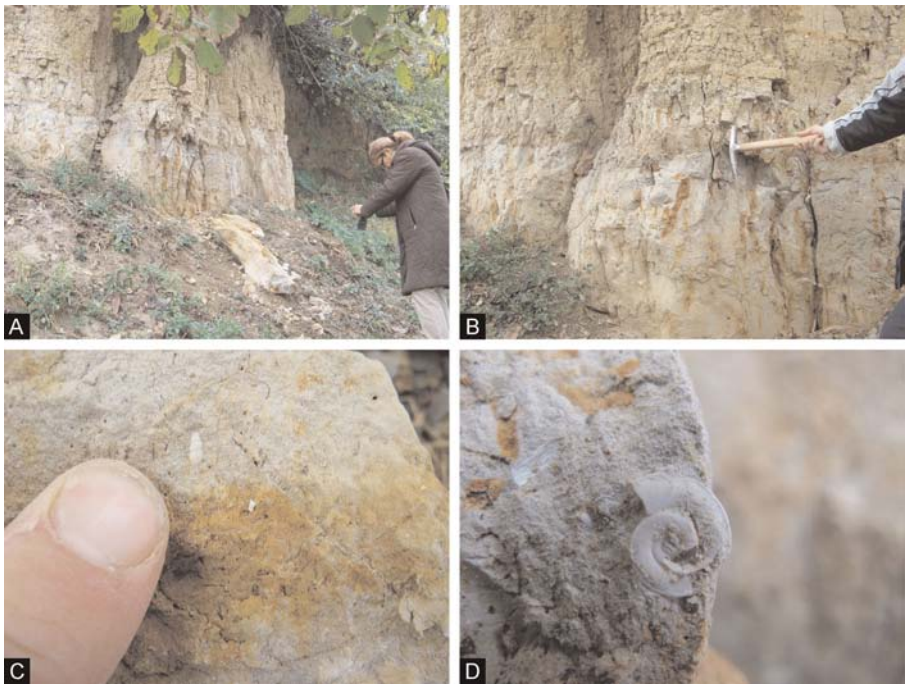

Fig. 5. The swamp loessoid at the base of steep banks of the Danube River (A, B). Terrestrial and swampy gastropods represented by the genera *Clausilia* (C) and *Planorbis* (D).

the deposition of eolian dust and mixed with delluvial deposits in the hilly terrain. It consists of greyish-yellow alevrites with pronounced vertical porosity. It has a massive structure and numerous vertical cracks and contains terrestrial fossil gastropods. It is not as widespread in the archaeological site area as at higher elevations further inland from the Danube River (Fig. 1). Based on analysis of the loess section in the brickyard at Vinča, the presence of the four loess horizons and three horizons of palaeosoil were identified. Actually, the oldest horizon of the loess deposits involves swamp loessoid sediments.

Holocene (Q_2)

The youngest Quaternary deposits have a relatively wide distribution on the surface of the studied area. A few different sediments could be separated: delluvial deposits (Q_2d), alluvial deposits (Q_2al), archaeological layers (Q_2ar) and technogenic deposits (Q_2n).

The delluvial deposits are widespread on the slopes above the right bank of the Danube River. Among them, the loess delluvial deposits are dominant (Fig. 6). They cover the swamp loessoid and make the base for the archaeological layers.

Fig. 6. Delluvial deposits as the base of the archaeological layers (in the front of the archaeological site).

The alluvial deposits occur along the Danube River. They have much narrower distribution than was shown on the existing geological map (IVKOVIĆ *et al.* 1966). Herein, they are represented by small alluvial deposits of sand and alevrites created during high water level. They cover partially exposed Sarmatian rocks or Pleistocene sediments. However, the alluvial deposits are much wider distributed near the confluence of the Bolečka and Danube River (Fig. 1), especially going upstream to the area of Veliko Selo.

The archaeological layers have been the subject of investigation for over 100 years. Their maximal thickness on the steep section to the Danube River is about 10.5 m. In the borehole V-2, drilled in the yard of the archaeological site and the Museum, the thickness of the archaeological layers is up to 7.8 m (Fig. 7). They lay over deposits of loess deluvium (humified in the upper part) the thickness of which reaches to 1.7 m. Much deeper in the borehole section, the Plio-Pleistocene unit was determined (Figs, 3, 7). Based on the review of the open section on the right bank of the Danube River and correlation of the boreholes, it could be concluded that the archaeological layers were formed in a depression within a swamp loessoid. Going towards the Danube, this depression expands and deepens, so the archaeological strata increase their thickness in that direction.

Fig. 7. A view on the archaeological layers (left) and the new the Plio-Pleistocene unit (right) in the borehole V-2 (courtyard of the archaeological site).

Among the anthropogenic sediments, the most important is a large communal dump of the City of Belgrade, upstream of the archaeological site. At the site, there are anthropogenic water compacted sand and archaeological layers. Water compacted sand is located on the right bank of the Danube River below the archaeological site and the access roads to the Danube. The thickness of these sediments in the boreholes reached up to 4.5 m (borehole V-6). On the existing geological map (IVKOVIĆ *et al.* 1966), these technogenic sediments were incorrectly marked as alluvial deposits of the Danube River.

Discussion

The geological study resulted in new knowledge about the geology of the terrain within the archaeological site of Vinča and its vicinity. The Sarmatian sediments on the right bank and the riverbed of the Danube River, showed that this part of the terrain

belongs to a tectonic block that was uplifted in relation to the blocks on the left bank of the Danube River, in Banat and the Pannonian Plain. The Sarmatian sediments have a steep dip angle that increases towards the riverbed of the Danube River (Figs. 8, 9). This suggests the existence of a fault structure along the present riverbed of the Danube River along which there was differential movements of the blocks.

Fig. 8. The very abrupt dip angles of the Sarmatian strata within the Danube riverbed.

The absence of significant alluvial deposits and the presence of Miocene outcrops indicate that the right bank of the Danube River was eroded at the Vinča archaeological site. Historically, this process has been proceeding for a long time. Most likely that, since the existence of the Vinča culture up to the present, erosion of the Danube swept away part of the embankment with the archaeological layers that were closer to the Danube. In the wider region, the Danube River valley is a composite and very complex, with the river often meandering and changing the water flow direction. Here, there are alternations of the wide river valleys with extensive alluvial plains and river sand bars with a terrain where the alluvial plain is narrow or missing.

Based on this, it is safe to state that the changing of the flow direction and position of the riverbed of the Danube River as well as the occurrence of meanders occurred in the recent geological past (since the Early Neolithic to the present). It is possible that once the left bank of the Danube River was located much closer to the archaeological site of Starčevo (Early Neolithic Period). Later, the Danube River gradually shifted more towards the south, closer to the archaeological site of Vinča. Since the end of the Neolithic to the present, the Danube River has incised into the right bank with a part of the prehistoric settlement at Vinča. This certainly had a great influence and is a specific structural and lithological composition of the terrain. Similar investigations were performed along the Sava River, upstream from its confluence with the Danube. They also suggest large neotectonic mobility during the Late Miocene and Pliocene, and the creation of the differently subsided block structures (Marović & Knežević 1985; Marović *et al.* 2007). At that time, the creation of these great rivers valleys was initiated (Knežević & Ganić 2005, 2008; Ganić *et al*. 2011; Rundić *et al*. 2011). In the area of the archaeological site of Vinča, this study has shown the existence of a previously unknown geological formation that was discovered in the presented boreholes.

According to available data, the lower boundary of this formation was not determined but is known to lie unconformably over the Sarmatian and below the archaeological settlement (Fig. 9). According to superposition and facial characteristics, these younger sediments originated from a lake-river-marsh environment. A detailed age of this new formation and its facial features should be studied in future investigation. After the present study, it is possible to define only the approximate age that varies between Upper Pliocene–Lower Pleistocene. Thus, on the right bank of the Danube River, in the basis of archaeological layers, there is no loess deposits previously mentioned in the all archaeological papers and field guides. In fact, the swamp loessoid sediments lie below the loess deluvium. In a wide bay within a swamp, the loessoid sediments, were partially infilled by loess deluvium,

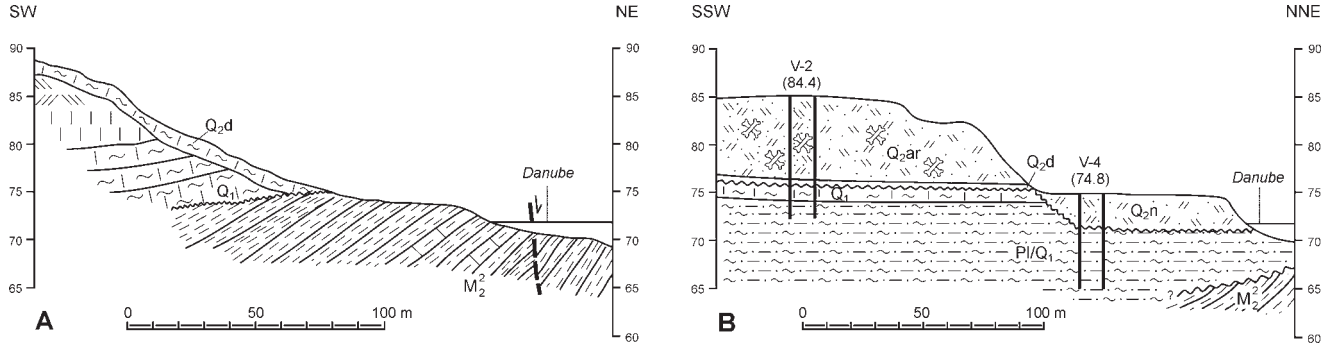

Fig. 9. Simplified geological cross-sections of the investigated area. **A,** upstream of the archaeological site; **B,** near the archaeological site. For the key see Figs. 1, 3. ≀ – Assumed fault.

there are archaeological remains of prehistoric settlement. In the borehole V-2, in the courtyard of the archaeological site, the thickness of anthropogenic layers is approximately 7.8 meter and increases toward the bank of the Danube River (up to 10.5 m – see Fig. 3.). In the boreholes that passed through anthropogenic sediments, many new artefacts were found that will be the subject of future archaeological research.

At the part of the area with the anthropogenic sediments, landslides occurred, which were the result of long-term excavations that caused the destabilization of the soil. This is a negative consequence of the geological composition of the terrain and especially unskilled construction and urbanization of the area surrounding the archaeological site. In particular, the intolerable fact must be emphasized that for more than 100 years there was no supervision by experts in geology and geotechnics in the area, which is known as a jewel of the natural, cultural, and historical heritage of Serbia and Europe.

Conclusion

Vinča, a world famous archaeological site of Neolithic culture, is threatened by landslides. For this reason, geological and geotechnical research of the cores of seven exploration boreholes was performed. This resulted in new knowledge concerning the geology of the investigated area.

The base of geological structure consists of Middle Miocene Sarmatian sediments, which were discovered along the right bank of the Danube River and in its riverbed. These Sarmatian strata testify that the Danube River eroded the coast and within its valley there is a fault zone along which the block on the right bank was uplifted with respect to the block on the left bank of the River which subsided.

In all the boreholes, sediments of a previously unknown geological formation. were identified. Lithologically, the formation contains grey alevrites and clay with layers of fine-grained sands. They unconformably overlap the Sarmatian strip marls and make a basis for the Pleistocene loessoid sediments. In genetic terms, the above-mentioned sediments were formed in a marsh-lake environment with a strong river influence. According to superposition, the supposed age of this formation is the Plio-Pleistocene.

Above the right bank of the Danube River, there are steep sections in which Pleistocene swamp loessoid sediments are found. True loess deposits are not present here, but in the hinterland of the coast at higher elevations of the terrain. The loess delluvium was deposited over Pleistocene sediments.

On the right banks of the Danube, below the archaeological site, there are the anthropogenic water-compacted sands that were previously incorrectly shown on geological maps as alluvial fans.

Archaeological layers are found within a swamp loessoid palaeodepression that was partially filled with loess deluvium. A part of the embankment with the archaeological layers was probably destroyed by erosion in the period from the late Neolithic to the present.

A future study of the archaeological site of Vinča should include geological studies that predict the development of deeper wells, and a detailed geological map with structural features.

Redeposited Sarmatian limestone ("pužarac" – a limestone with gastropod dominance) belongs to the younger sections of the Sarmatian, which were not developed near the Vinča archaeological site. Such material was transported by river and periodical flows from the remote hills compared to the current bank of the Danube River.

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Резиме

Нови подаци о геологији на археолошком локалитету Винча (Београд, Србија)

Први пут после 104 године ископавања на археолошком локалитету Винча-Бело брдо, урађена су геолошко-геотехничка истраживања терена и избушено је 7 истражних бушотина у циљу решавања проблема клизишта и одрона. Тим истраживањима је утврђено да су најстарији стратиграфски чланови средњомиоценски, сарматски фино-ламинирани и тракасти лапорци који су откривени дуж десне обале Дунава, као и у самом кориту реке (на котама 74–75 m изнад нивоа мора) око 300 m узводно од археолошког насеља. У њима је идентификована фосилна асоцијација која указује на старије нивое сармата (*Rissoa* слојеви и фораминиферска зона са елфидијумима). У свим бушотинама у дворишту археолошког локалитета и Музеја, као и испод њега, на десној обали Дунава, сарматски седименти нису лоцирани јер се налазе на нешто већим релативним дубинама. Свих 7 бушотина је набушило прашкасте седименте до сада, непознате геолошке формације која лежи дискордантно преко сарматских тракастих лапораца и чини непосредну подлогу плеистоценским лесоидним седиментима (приближно 10 m испод површине терена). Литолошки гледано, то су сиве, алевритске глине и алеврити са прослојцима финозрних пескова. Слабо су водопропусни и садрже остатке барске фауне (представници фамилије *Planorbidae*) и копнене фауне са родовима *Clausilia*, *Succinea* и *Valonia*. У генетском смислу, ови седименти су формирани у барско-језерској средини са јаким утицајем реке. Ове наслаге су присутне на десној обали Дунава. Изнад њих су наталожени седименти лесног делувијума и антропогени талози. Према суперпозицији, старост ове нове стратиграфске јединице би била у интервалу Плиоцен–

–Плеистоцен. Других доказа о ближој старости за сада нема. Изнад десне обале Дунава, постоје стрми одсеци на којима су плеистоценски, мочварни лесоидни седименти такође пронађени. Прави лес није присутан на самом локалитету, али га има даље у залеђу десне обале Дунава. Лесни делувијум је депонован изнад плеистоценских седимената. На десној обали Дунава, испод археолошког налазишта, присутни су антропогени наноси рефулираног песка који је раније погрешно приказан на геолошким картама као алувијални седимент.

Урађена геолошка истраживања указују да сарматски седименти на десној обали Дунава као и у самом кориту реке, припадају једном тектонском блоку који је издигнут у односу на блок(ове) на левој обали Дунава и у Банату. О томе сведоче врло оштри падни углови (преко 70°) и они су све стрмији идући од десне обале ка самом кориту реке. То даље указује на постојање једне разломне структуре дуж садашњег корита Дунава која је и условила различито кретање блокова.

Одсуство значајних алаувијалних наслага и присуство миоценских изданака на десној обали Дунава, указује на ерозију те обале коју врши сама река. Историјски гледано, овај процес је присутан већ дуже време. Врло је вероватно да је, од неолита до данас, Дунав еродовао и однео део обале са археолошким слојевима који су били ближе реци. Ако се зна да је у ширем подручју долина Дунава композитна, река често мења правац и постоје појаве меандрирања, онда је претходна претпоставка још реалнија.

Налазак комада сарматског кречњака (“пужарац”) у бушотини V-5, указује на млађе нивое сармата (средњи сармат) који је овде редепонован локално. Такав материјал је транспортован мањом реком или бујичним токовима из залеђа и удаљенијих виших подручја у односу на археолошки локалитет.