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ON THE MATERIAL OF THE CROMLECH-CREPIDOMA STONE BLOCKS OF THE NOVOOLEKSANDRIVKA KURGAN

Purpose. Determination of the rocks used for the building of the 4th millennium BCE megalithic construction in Novooleksandrivka (Dnipropetrovsk Oblast, Ukraine) as well as establishing the places of their probable provenance.

Methodology. The study was performed using the method of comparative mineralogical and petrographic analysis in thin sections of the building stone and the rocks from the outcrops in the valleys of the rivers Mokra Sura and Dnipro. The chemical composition of the petrographically identical rocks was also compared using X-ray fluorescence analysis.

Findings. Nine specimens of rocks that represent all the species of granitoids used for the cromlech-crepidoma construction of the Novooleksandrivka kurgan “Sura-Oba” were analyzed. As a result of the conducted research, it was ascertained that they are represented by plagiogranites (trondhjemites), tonalites, granite gneisses, migmatites and pegmatites. Besides, some granitoids comprise small xenoliths of biotite gneiss. All the indicated rocks are characteristic for the occurrences of the Surskyi and Dnipropetrovskiy plagiogranitoid complexes, widespread in the valley of the river Morka Sura – the right tributary of the river Dnipro, where the monument is directly located. Granitoids with the massive structure were most likely to be delivered from the occurrences located upstream of the river Mokra Sura in the village of Sursko-Lytovske. Migmatites and gneiss-like granites occur both downstream and upstream of the river from the village of Novooleksandrivka.

Originality. For the first time, the building stone of the megalithic construction, discovered during the excavations of the “Sura-Oba” kurgan in the village of Novooleksandrivka (Dnipropetrovsk Oblast, Ukraine) has been studied using mineralogical and petrographic analysis; in addition, the probable places of its extraction were determined.

Practical value. The results obtained can be used in conducting research on history and archaeology, as well as in popular science works and excursion activities.

Keywords: *building stone, petrography, cromlech, kurgan, Eneolithic, village of Novooleksandrivka, Ukraine*

Introduction. The Middle Dnipro Area is a region rich in stone raw materials, which are currently being developed on an industrial scale. The history of local stone use as a building material dates back more than five thousand years ago. It was in the Eneolithic Age, in the 4th millennium BCE, when the active extraction of stone blocks began, which resulted from the tradition of cult construction. The most famous megalithic monument in the world of that time is Stonehenge in Great Britain. However, megalithic constructions were built throughout the area of settlement of pre-Indo-Europeans, including the territory of Ukraine, from where, particularly, these peoples came to Western Europe.

The question that has always been interesting for archaeologists is determination of the material from which megalithic constructions were built, as well as establishing its provenance. The latter, in turn, makes it possible to discover ancient places of extraction of stone raw materials, which is important for studying the history of mining. Mineralogical and petrographic analysis, which is widely used in the study on ancient monuments, allows such research.

One of the most interesting archaeological finds of recent times in Ukraine is a megalithic construction discovered in the village of Novooleksandrivka near the city of Dnipro (Fig. 1). The monument was discovered during excavations of the Eneolithic-Bronze Age kurgan No. 6048/1 “Sura-Oba”. The

mound, 6.08 m high at the time of excavations and 55 m in diameter was built in the Eneolithic-Early Bronze Age by the representatives of the Kvitianska/Post-Mariupol, Yamna and Catacomb archaeological cultures. Around the central burial No. 27, which by analogies and finds of pottery fragments on the ancient day surface dates to the middle 4th millennium BCE, a cromlech-crepidoma with a diameter of 18 m was built from 70 vertically installed stone blocks. 64 of them survived in situ. A truncated-conical structure, which leaned on the cromlech stones by its slopes, was built of sod and clay blocks, chernozem rollers, and other materials above the burial during several construction stages. An Eneolithic burial No. 21 was later lowered into the mound from its top. The adding of chernozem to the mound connected with this burial covered the megalithic structure. As of the beginning of the 3rd millennium BCE, all except three stones in the southwestern sector were buried under a layer of soil.

The article is devoted to the petrographic study on stone blocks that were used for the building of the megalithic construction in the village of Novooleksandrivka and determining their provenance.

Literature review. Today, petrographic methods are actively used in the study on megalithic constructions in different countries. For example, a series of new studies on building stone used in the construction of Stonehenge in the United Kingdom have been conducted in recent years. A group of researchers has clarified the origin of imported “blue stone”,



Fig. 1. General view of the megalithic construction in the village of Novooleksandrivka after excavations

mainly represented by porphyry dolerites found in Southwestern Wales [1]. There are continuing studies aimed to find the source of the altar stone of the complex, made of fine-grained mica sandstone with carbonate cement, the origin of which is imported and currently remains controversial. The available data suggest that the altar stone has a different origin than the “blue stone” and was most likely collected in Eastern Wales [2, 3]. There was also carried out an in-depth petrographic study on sarsen stone, the main building material of Stonehenge, which is represented by local quartz sandstone with quartz regenerative cement. The closest occurrences of these sandstones are recorded in the area of West Woods, which is located about 20 km north of the monument [4].

A group of Portuguese researchers recently conducted a petrographic study on nine Neolithic dolmens from Freixo-Redondo (Alentejo Province). Granodiorites, quartz diorites, granites, gneisses, migmatites, crystalline schists, mica schists, gabbro-diorites and phyllites, whose outcrops are present in the area of the monuments, were determined to be used for their construction [5].

One of the authors of this article conducted petrographic study on the material of stone blocks and stelae of megalithic constructions from Poltava Oblast, which were mostly discovered as a result of excavations near the town of Horishni Plavni. The main material for their construction was plagiogranite (trondhjemite) of the Saksahanskyi complex, common in this area. Also, among the studied samples, there were pegmatoid, essentially microcline granites that intersect local plagiogranites [6]. Thus, today it is known that in the construction of megalithic complexes in the Middle Dnipro Area during the Eneolithic, local rocks were used, primarily plagiogranites, which are the most common in the region.

Topicality. The megalithic structure found in the village of Novooleksandrivka is one of the largest in Ukraine and is of great importance for archaeological science. After the excavations, the study on its materials continues with the use of a full range of methods of natural sciences, one of which is a petrographic analysis. Research on the materials of stone blocks will give a complete understanding of the way it was built. Also, the petroarchaeological study on the cromlech-crepidoma from Novooleksandrivka will supplement the history of the use of stone raw materials of the Middle Dnipro Area and ancient mining with new data.

Purpose. The purpose of this study is to determine the full range of rocks that were used in the construction of the cromlech-crepidoma found in the village of Novooleksandrivka, as well as to define the places of their probable provenance.

Methods. To carry out petrographic research, the specimens from 9 macroscopically different rocks out of 64 stone blocks of the complex were sampled. One of the main goals of sampling was to minimize damage to the studied units. Most often, the fragments that broke off from the plates as a result of exogenous processes were selected. The size of the samples taken was minimally sufficient for the production of transparent petrographic thin sections. The study was performed using a polarizing microscope LOMO POLAM R-312. Geological reports, literature sources, and data obtained from the study on natural granitoid outcrops in the Mokra Sura and Dnipro valleys were used to determine the provenance of the samples. X-ray fluorescence analysis (XRF) was used to compare petrographically similar rock samples and confirm their identity. Determination of chemical composition was carried out in powder using ElvaX Plus stationary spectrometer (analyst – Ye. S. Perkov) in the Analytical Research Laboratory of Dnipro University of Technology.

Results. As a result of the petrographic study on nine specimens of rocks, their mineral composition and structural features were determined. All the studied samples, for convenience, can be divided into several groups: massive plagiogranites (trondhjemites), massive tonalites, banded tonalite (granite gneiss), migmatite, pegmatoid granite, biotite gneiss (xenolith).

Massive plagiogranites (trondhjemites). Samples 2, 3 and 9 were assigned to this group. All of them are represented by medium-grained massive rocks of light grey colour with a pink tinge. Plagioclase forms about 60 % of their volume. The potassium feldspar, represented by microcline, accounts for several per cent, being most often represented by antiperthitic inclusions. Quartz is contained in an amount of 25–35 %. Biotite content is from 3 % – in specimen 2, to 7 % – in specimen 7. The latter mineral is slightly replaced by chlorite. Sample 2 also contains less than one per cent of muscovite. All the rocks were subjected to the process of epidotization. The highest volume of epidote (5 %) is found in specimen 9, in which this mineral was mainly formed as a result of biotite alteration. Also, among secondary minerals, all the specimens contain sericite, which slightly and moderately replaces the crystals of plagioclase. The ore mineral is present in the volume of 1 %. The texture of all the rocks is hypidiomorphic-granular. It should also be mentioned that there are sectors of the allotriomorphic microstructure of plagioclase and the aggregates of recrystallized, granulated quartz in sample 2 (Fig. 2).

Massive tonalites. Specimens 5 and 8 were assigned to this group. They are represented by more basic granitoids that do

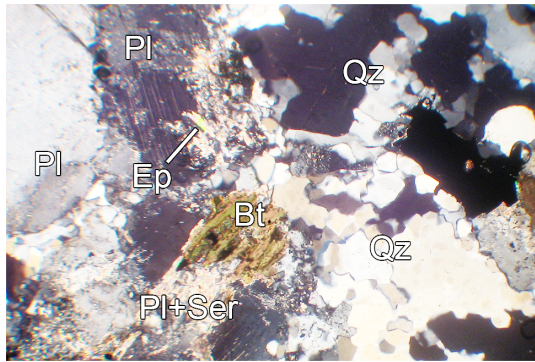


Fig. 2. Biotite plagiogranite (2):

Pl – plagioclase; Qz – quartz; Bt – biotite; Ep – epidote; Ser – sericite. Transmitted light, nicols (+), zoom 47x

not have a banded structure. Both rocks contain plagioclase in the amount of about 65 %. The content of quartz in the specimens differs. Sample 5 contains 17 % of this mineral and in specimen 8, its content is as high as 22 %. Biotite is present in both rocks, where it makes up 15 % in sample 5 and 7 % in sample 8, respectively. However, in addition to the content of main minerals, rocks also differ in the alteration degree. Sample 8 was identified as altered tonalite. Plagioclase is intensively sericitized and epidotized there. The epidote also forms big crystals. In addition to sericite, plagioclase is replaced by muscovite. Chlorite moderately replaces biotite. Also, the sample comprises orthite, represented by brown grains that are almost completely decomposed. It occurs together with biotite aggregates and has a halo of secondary epidote. Sample 5 is less altered. Among the secondary minerals, it contains epidote and sericite, which slightly replace plagioclase. Also, less than 1 % of muscovite and single sphene crystals are present in the rock.

Banded tonalite (granite gneiss). Sample 1 was assigned to this group. The rock has a grey colour and a clear gneissose structure, because of which it can be defined as granite gneiss. Feldspar in the rock is almost entirely represented by plagioclase, which occupies about 70 % of its volume. The microcline is present mainly in the form of antiperthite inclusions and makes up only about 1 % of the rock volume. Mica is represented by biotite and muscovite, the former of which predominates. The rock contains myrmekite intergrowths of quartz and feldspar, the volume of which does not exceed one per cent. The secondary epidote that alters plagioclase and biotite is a little more than one per cent. The texture of the rock is hypidiomorphic-granular, which is defined by the greater idiomorphism of plagioclase relative to quartz grains (Fig. 3).

Migmatite. Sample 4 was identified as a migmatite. The rock has a banded structure consisting of leucosome and melanosome. The composition of the leucosome, which was represented by pink granite, was of the greatest interest. As a result of the analysis, it was found that this rock is a two-feldspar granite. The microcline occupies 37 % of its volume. The mineral forms crystals of euhedral shape, which have a well-defined crosshatched crystal twinning. There is a little less plagioclase in the rock – 34 %. It is represented by less idiomorphic isometric crystals, in most of which weakly expressed polysynthetic twins are manifested. The mineral is slightly replaced by secondary sericite. Quartz makes up more than 25 % of the rock volume and is represented by irregularly shaped grains with wavy extinction. Mica occupies about 3 % of the rock volume. Biotite is 3 % and muscovite is 1 %, respectively. Granite also contains about one per cent of epidote and less than one per cent of ore mineral. The structure of the rock is hypidiomorphic-granular, medium-grained.

Pegmatoid granite. Pegmatoid pink granites are present in contact with many grey granitoids from which stone blocks were made, indicating the same source of both rocks. We studied a stone block made entirely of pegmatite-like granite (sample 7). The main minerals of the rock were microcline, quartz, and plagioclase. Potassium feldspar predominates in the granite, accounting for 57 % of its volume. Plagioclase is present in a volume of only 7 %. The mineral is intensively replaced by secondary sericite, as well as some large scales of muscovite. The rock has a high content of quartz, which is about 35 %. This mineral is represented by aggregates of irregularly shaped grains. The size of individual grains of quartz is up to 4 mm, and their aggregates – up to 6 mm. The rock is leucocratic, dark-coloured minerals are almost absent. Biotite is represented only by single scales. Muscovite by its volume outreaches biotite, but its content is still less than one per cent. In addition, the rock contains single aggregates of micropegmatite. The texture of the rock is hypidiomorphic-granular, coarse-grained, and medium-grained. Only microcline crystals have a coarse-grained size of more than 5 mm. At the same time, smaller crystals of this mineral are present. Plagioclase is represented by crystals up to 2 mm in size (Fig. 4).

Biotite gneiss. Specimen 6, a rock that makes up the xenolith in the granitoid, was identified as a biotite epidotized gneiss. The rock consists of plagioclase, biotite, quartz, and epidote. Apatite is found as an accessory mineral. Plagioclase occupies more than half of the rock volume. Biotite and the epidote that replaces it form aggregates composed of large scales and crystals, respectively. Probably, these minerals were formed as a result of amphibole alteration. The texture of the rock, considering its metamorphic genesis, was defined as lepidogranoblastic.

Provenance of studied specimens. The area where the excavations took place belongs to the zone of occurrence of Dnipropetrovskiy and Surskiy granitoid complexes as well as the rocks of the Konkaska series that form the Surska greenstone structure represented mainly by amphibolites and schists [7]. All the studied samples belong to the rocks found in the gran-

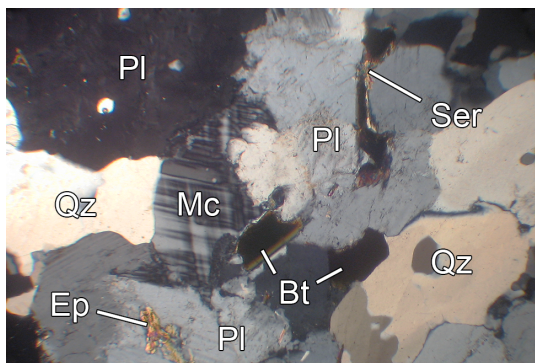


Fig. 3. Biotite tonalite (1):

Pl – plagioclase; Qz – quartz; Mc – microcline; Bt – biotite; Ep – epidote; Ser – sericite. Transmitted light, nicols (+), zoom 47x

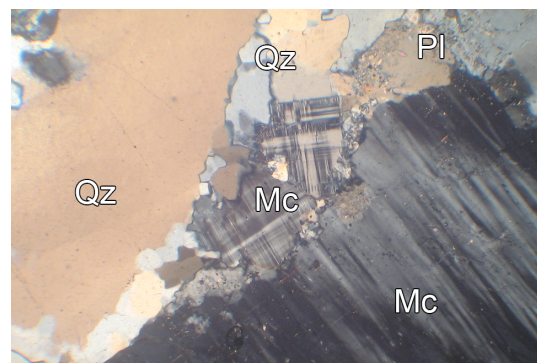


Fig. 4. Pegmatoid granite (7):

Pl – plagioclase; Qz – quartz; Mc – microcline. Transmitted light, nicols (+), zoom 47x

itoid complexes. The rocks of the Dnipropetrovskiyi complex are mainly represented by banded granite gneisses of tonalite-trondhjemite composition with transitions to granodiorites and quartz diorites. Tonalites and trondhjemites predominate in the complex [8]. Macroscopically, plagiogranitoids of the Dnipropetrovskiyi complex have a colour from light grey to dark grey. The rocks are slightly schistose and cataclased, the structure is banded, gneiss-like and massive, the texture is mainly hypidiomorphic-granular. Their main minerals are plagioclase and quartz, occasionally containing microcline. Granite also contains biotite, epidote, muscovite, and magnetite. Accessory minerals are zircon, apatite, sphene and orthite. The Dnipropetrovskiyi complex includes migmatites, whose melanosome is represented by highly altered remnants of the Paleoproterozoic Aulksa series [9].

Granitoids of the Surskiy complex have rock composition similar to the Dnipropetrovskiyi one. They are also mainly represented by tonalites and trondhjemites, as well as quartz diorites, granodiorites, and low-alkaline granites. The main minerals of the plagiogranitoids of the Surskiy complex are plagioclase and quartz, among the secondary minerals there are biotite, epidote, and muscovite. Also, the rocks can contain microcline. The accessory minerals are represented by apatite, zircon, orthite, and magnetite [9]. Surskiy complex granitoids are more homogeneous than those of the Dnipropetrovskiyi complex; they are mostly characterized by a massive structure, but at the same time, they contain xenoliths, which are represented by both metavolcanic rocks of greenstone structures and plagiomigmatites of the Dnipropetrovskiyi complex. Also, vein pegmatoid granites, which intersect the granitoids of all the complexes, are found everywhere in the Middle Dnipro Area. Today these rocks are not regarded as a separate complex, whereas earlier they were identified as Dniprovskiyi and Dniprovsko-Tokivskiyi granites [8].

The closest to the excavation site massif of the Surskiy complex granitoids is the Sursko-Lyтовskiyi one that crops out on both banks of the river Mokra Sura between the villages of Novomykolaivka and Sursko-Lyтовske [8]. Granitic rocks that form natural exposures downstream of the Mokra Sura River from the village of Novooleksandrivka belong to the Dnipropetrovskiyi complex. In the lower reaches of the river, on the left bank, they are found between the villages of Kamiianka and Dniprove (Yamburg), and on the right bank – between the villages of Chervonyi Sadok and Voloske (Fig. 5). The zone of the Dnipropetrovskiyi complex granitoids, which is located to the south from the city of Dnipro up to the village of Dniprove (Yamburg), is distinguished as Lotskamianskiy or Yamburzkiy massif [9]. But also, except for typical granite gneisses of the Dnipropetrovskiyi complex, the massive species of intrusive-magmatic genesis plagiogranitoids are present here, which I. B. Shcherbakov proposed to refer to as the Saksahanskiy

complex [8]. Since V.V. Sukach proposes to unite the Saksahanskiy and Surskiy complexes because of their similarity [9], massive granitoids from other occurrences in the valley of the Mokra Sura River can be considered as analogues of the Sursko-Lyтовskiyi massif Surskiy complex rocks, which break through the plagiomigmatite strata of the Dnipropetrovskiyi complex.

Among the studied samples, massive plagiogranites (2, 3, 9) and tonalites (5, 8), most likely, belong to the rocks of the Surskiy complex. It should be noted that sample 8 has clear analogues among biotite orthite-containing tonalites of the Surskiy complex [8]. The banded tonalite (1) and migmatite (4) can belong to the Dnipropetrovskiyi complex. Since contacts with pegmatite have been preserved on many blocks of massive granite, sample 7 is most likely represented by a vein that intersected plagiogranitoids. Biotite gneiss, in which biotite is intensively replaced by epidote (6), could be formed by retrograde changes of primary amphibole rocks, which form xenoliths in plagiogranitoids in the area.

Thus, all the studied samples most likely originate from the valley of the Mokra Sura River. Since there are no natural granite outcrops near the village of Novooleksandrivka, the stone blocks could have been delivered either from the upstream occurrences or from the lower reaches of the Mokra Sura River. To determine the most probable place for the stone blocks extraction, we conducted a survey of granite outcrops in the river valley. Since today this area is significantly built up, many occurrences are inaccessible or not preserved, we also used the materials of the primary geological survey of the area, conducted in the middle of the 20th century (Zaytsev A. A., Kiktenko V. F., Bondar B. I., 1963). It should be noted that during the geological survey in 1963, the Dnipropetrovskiyi and Surskiy complexes were not distinguished and were considered as rocks of one formation. According to the descriptions of natural outcrops, upstream from the village of Novooleksandrivka along the Mokra Sura River mostly pinkish grey, slightly pinkish grey and grey granites cropped out, aplite-pegmatoid granites, as well as light grey, greenish dark grey and pinkish grey migmatites were less common. In particular, both banded and massive migmatites with xenoliths of amphibole plagiogneisses and amphibolites were noted. In addition, the authors of the report mentioned the so-called polymigmatites with the layered intrusions of pink aplite-like granites. In the lower reaches of the river, according to the survey, mostly grey plagiogranites and migmatites were exposed. Pinkish grey granites with a purple tinge, greenish pinkish grey and pinkish grey aplite-pegmatoid granites were less common in this area. Migmatites belong to the massive and banded plagioclase species, as well as the above-mentioned polymigmatites. Also, cataclases were found in outcrops, and amphibolite xenoliths were observed in granitoids.



Fig. 5. Scheme of granitoid outcrops prevalence in the valley of the river Mokra Sura

As we can see, the rock composition of the two sections of the Mokra Sura River valley was almost identical and varied only in the predominance of certain macroscopically different species of rocks on the total number of outcrops. The main difference between these areas is the greater prevalence of massive grey granites with a pink tinge upstream, which today belong to the Surskyi complex. We studied the outcrops of these rocks on the left bank of the Mokra Sura River in the village of Sursko-Lytovske (Fig. 6), adjacent from the west to the village of Novooleksandrivka.

These rocks, despite the massiveness, often have a platy parting, which would allow obtaining flat blocks, similar to those used in the construction of cromlech-crepidoma. Macroscopically, these granites are identical to samples 2, 3 and 9. These are the same medium-grained species with visible biotite scales and red feldspar. Microscopically, the rocks are also similar (Fig. 7), having the same mineral composition and structural features. In particular, both for these samples and for rocks from the outcrops the sericitization of plagioclase, chloritization of biotite and the presence of epidote are characteristic.

The XRF analysis was also applied to compare massive plagiogranites from the cromlech-crepidoma materials and



Fig. 6. Natural outcrop of the Surskyi complex granites in the village of Sursko-Lytovske

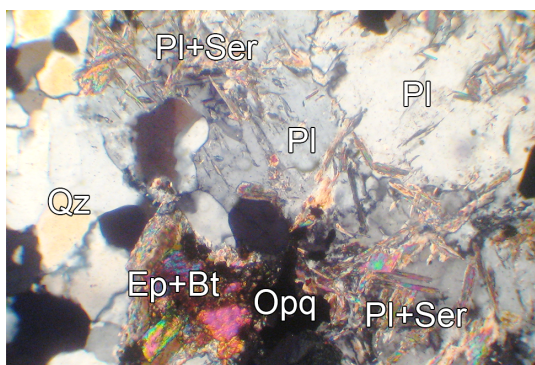


Fig. 7. Biotite plagiogranite (Sursko-Lytovske):

Pl – plagioclase; Qz – quartz; Bt – biotite; Ep – epidote; Ser – sericite; Opq – ore mineral. Transmitted light, nicols (+), zoom 90x

similar rocks from the outcrops of the Surskyi complex granites in the village of Sursko-Lytovske. The results of the chemical examination of the samples are shown in the Table. As it is seen, the chemical characteristics of the rocks are very close. High calcium content in both samples can be explained by the fact that they were taken from the surface and were weathered.

In the granitoid outcrops that we studied in the lower reaches of the Mokra Sura River, located on the left bank opposite the village of Rakshivka, grey and dark grey plagiogranites interbedded with tonalites were found. The rocks hardly have any gneissose structure but have a platy parting. Among the features of tonalites, in addition to biotite content, the presence of hornblende crystals, which were not observed in the samples of tonalite from the cromlech materials, should be noted. Morphologically similar xenoliths to sample 6 were studied by us in the lower reaches of the Mokra Sura River in the village of Voloske. However, these rocks were represented by amphibolites rather than biotite gneisses. It should be noted that according to the report on the geological survey, gneisses, as xenoliths, were observed very rarely.

Unfortunately, the real estate development of the banks of the Mokra Sura River, as well as the gullies that flow into it, did not allow for a full comparative analysis. But, using the data of primary geological surveys and the results of our own observations, it can be asserted that at least some of the studied blocks represented by massive granitoids have analogues among the rocks of the Surskyi complex, found within the Sursko-Lytovskiy massif upstream from the excavation site. Though, it is not possible to draw an unambiguous conclusion about the origin of migmatites and gneiss-like granitoids, as these rocks were found both downstream and upstream of the Mokra Sura River.

It should also be noted that we registered the presence of granitoid blocks that were disintegrated as a result of exogenous processes at natural outcrops, similar to those used in the construction of the megalithic complex. Considering that only a few such blocks could be obtained at each outcrop without significant effort and providing open cast mining, it can be assumed that the ancient mound builders developed not one but many occurrences of granitoids. This fully explains the diversity of rocks among the material of the blocks of the complex

Table

Chemical analyses comparison of the granites of sample 9 from the cromlech-crepidoma materials and a specimen from the outcrop in Sursko-Lytovske

Element	Sample 9, %	Sursko-Lytovske, %
SiO ₂	71.719	71.554
Al ₂ O ₃	11.124	11.683
CaO	7.667	7.404
K ₂ O	2.417	4.747
Fe	1.711	2.036
TiO ₂	0.621	0.835
Cl	0.207	0.390
BaO	0.083	0.247
P ₂ O ₅	0.059	0.073
MnO	0.055	0.057
V ₂ O ₅	0.041	0.040
S	0.022	0.022
CuO	0.012	0.019
NiO	0.005	0.008
Cr ₂ O ₃	0.004	0.008
ZnO	0.004	0.002

but does not allow localizing the place of extraction by a definite site.

Thus, the studied monument is a petrographically confirmed evidence of the beginning of the use of plagiogranitoids of the Middle Dnipro Area as a block stone for megalithic construction and large stone sculpture, which lasted until the Middle Ages [10]. The extraction of these rocks as building stones continues today.

Conclusions. As a result of the study, it was ascertained that the blocks used in the construction of the cromlech-crepidoma in the village of Novooleksandrivka are represented by plagiogranites (trondhjemites), tonalites, granite gneisses, migmatites and pegmatites. Some granitoids also contain small xenoliths of biotite gneiss. All these rocks are characteristic of plagiogranitoid complexes common in the valley of the Mokra Sura River – the right tributary of the Dnipro River. Plagiogranitoids in this area are represented by intrusive-magmatic Surskyi and ultrametamorphic Dnipropetrovskiy complexes of the Archean age. Among the blocks of the megalithic complex, there are both gneiss-like granitoids and migmatites, characteristic for the Dnipropetrovskiy complex, and homogeneous massive granites and tonalites, characteristic for the Surskyi complex. The massive granitoids used in the construction of the cromlech-crepidoma were most likely brought from the occurrences located upstream of the Mokra Sura River in the area of the village of Sursko-Lytovske. Migmatites and gneiss-like granitoids are common both upstream and downstream from the excavation site. In any case, the material of all stone blocks can be unambiguously defined as local.

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Про матеріал кам'яних блоків кромлеха-крепиди Новоолександрівського кургану

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Мета. Визначення гірських порід, що були використані при побудові мегалітичної споруди середини IV тис. до н.е. в с. Новоолександрівка (Дніпропетровська область, Україна), а також встановлення місць їх імовірного походження.

Методика. Дослідження було виконане методом порівняльного мінералого-петрографічного аналізу у шліфах будівельного каміння й гірських порід із відслонень у долинах річок Мокра Сура та Дніпро. Хімічний склад петрографічно ідентичних порід також був порівняний за допомогою рентгенофлуоресцентного аналізу.

Результати. Було досліджено 9 зразків будівельного каміння, що представляли всі відміни гранітоїдів, використаних при спорудженні кромлеха-крепиди Новоолександрівського кургану «Сура-Оба». У результаті проведеного дослідження було встановлено, що вони представлені плагіогранітами (тронд'ємітами), тоналітами, гранітогнейсами, мігматитами й пегматитами. Також у деяких гранітоїдах містяться невеликі ксеноліти біотитового гнейсу. Усі зазначені породи характерні для проявів сурського та дніпропетровського комплексів плагіогранітоїдів, поширених у долині р. Мокра Сура – правої притоки р. Дніпро, де безпосередньо розташована пам'ятка. Гранітоїди з масивною текстурою, найімовірніше, були доставлені із проявів, що знаходяться вище за течією р. Мокра Сура в районі с. Сурсько-Литовське. Мігматити та гнейсоподібні граніти проявлені як нижче, так і вище за течією ріки від с. Новоолександрівка.

Наукова новизна. Уперше за допомогою мінералого-петрографічного аналізу було досліджено будівельне каміння мегалітичної споруди, виявленої при розкопках кургану «Сура-Оба» в с. Новоолександрівка (Дніпропетровська область, Україна), а також встановлені ймовірні місця його видобутку.

Практична значимість. Отримані результати можуть бути використані при проведенні наукових досліджень з історії та археології, а також у науково-популярних працях й екскурсійній діяльності.

Ключові слова: будівельне каміння, петрографія, кромлех, курган, енеоліт, с. Новоолександрівка, Україна

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