Building stone resources of Dnipropetrovsk region

N B Panteleeva¹, M J Syvyj², O O Kalinichenko¹ and O Volik³

¹ Kryvyi Rih State Pedagogical University, 54, Gagarina Ave., Kryvyi Rih, 50086, Ukraine
² Ternopil Volodymyr Hnatiuk National Pedagogical University, 2, Maxyma Kryvonosa str., Ternopil, 46027, Ukraine
³ University of Waterloo, Department of Geography and Environmental Management, Ontario, Canada

E-mail: panteleeva4y@gmail.com, syvyjm@ukr.net, olgakalinichenko6@gmail.com, volik.olina@gmail.com

Abstract. The article deals with the analysis of building stone resources of Dnipropetrovsk region that are used and can be used in order to provide construction needs. Dnipropetrovsk region is one of the most economically developed Ukrainian regions due to mineral and raw material resources being located on its territory. A part of regional mineral raw extraction comes up to almost 50% of mineral deposit balance reserves and the provision exceeds three times the national rate. Crystalline Pre-Cambrian rocks of East European platform fundament as gneiss, granites, quartzites, migmatites, granodiorites, amphibolites and sedimentary apron rocks – malmrocks – are natural construction material in the region. 42 building stone deposits are located on the territory of the region among them 19 deposits are developed also refer to big and middle and 24 are not developed. The biggest amount of developed deposits is located in the Dnipro, Kryvyi Rih, Kamianske and Nikopol districts. Building stone extraction is equal to approximately 14% from national quantity. Deposit exploitation is performed by commercial structures and state corporation enterprises. The conclusions are made about the ways of expanding capacities of building stone extraction due to complex iron ore deposit development and the opportunity of building stone reserve increase in the region.

1. Problem setting

Comparing to other Ukrainian regions Dnipropetrovsk region owns thick mineral and raw material base the significant part of which has complex forming character. Almost 50% of all Ukrainian mineral resource reserves are situated on the territory of the region including building stones. Pit gravel, gravel and granitic subsoil, which are used as brick aggregate and in road construction, are manufactured from the most of extracted stones. A few publications in national scientific literature are devoted to the research of the geography of mineral resource used in construction. As a rule, they are connected with the construction raw material of specific districts. Thus, Ye. Ivanov researched Opillia [1], V. Burka devoted his research to the Carpathian economical district [2], [3] and M. Svyyi investigated Podillia district [4], [5]. Few special publications, in particular S. Sakhno and others [6], are known concerning Dnipropetrovsk region building stone as well as its extraction and processing. The minerals of the region are generally characterized in monographs by M. Svyyi, I. Paranko, Ye. Ivanov [5], V. Mykhailov, H. Vynohradov, M. Kurylo [7] some articles are also published by V. Maniuk [8], [9] and I. Pihulevskyi [10] concerning the geology structure issues. A peculiar quantity of publications are related to the ecological problems connected with raw material extraction and efficient
resource management in the region, also opportunities of the use of open and partially productive layer of iron ore deposits as building stone are characterized in particular V. Yevtekhov, I. Paranko, Ye. Yevtekhov [11]. Thus, we consider that nowadays there is a high need in conducting complex constructive and geographical analysis of building stone, therefore, that will give an opportunity to evaluate its existing raw material base, the level of regional provision, also to offer possible ways of increasing reserve and extraction amount of highly needed building raw material in our industrial region.

2. Tasks of the research

The main aim of the research is to conduct constructive and geographical analysis of building stone raw materials of the Dnipropetrovsk region, in particular, to highlight briefly qualitative characteristics of rock, to characterize component and territory structure of building stone deposits, their balance reserves, to evaluate building stone provision of regional administrative districts, to analyse raw material extraction during recent years, to study deposit departmental identity, to make conclusions about opportunities of optimization of regional raw building material structure and functioning.

The research has been conducted based on materials of SRDE “Geoinform Ukraine” and Summary balance of mineral deposits of Ukraine. The methods of analytical treatment of statistical information and cartography model construction using Data Graft, Map Info are used in the work. The algorithm of constructive and geographical research of mineral and raw material resources, worked out by the authors in the previous article, has been used.

3. Presentation of the main material of the study

Crystalline Pre-Cambrian rocks of East European platform fundament such as granites and migmatites and also their attendant rocks as granodiorite, quartz diorite, gneiss, amphibolites and quartzites are mainly used as natural construction material in Dnipropetrovsk region. Nowadays sedimentary apron rocks such as limestone, sandstone, which are spread on the North East and South of the region, are not mainly used as building stone. Minor reserves of small deposits of limestone and sandstone, which were processed for local needs last century, left.

Crystalline Pre-Cambrian rocks covered with less thick Cainozoic sediment are spread within south-eastern part of Ukrainian crystalline formations which covers central and south-western part of the region. In the northern and eastern parts Ukrainian crystalline formations border on Don-Dnipro aulacogen (DDA) where Pre-Cambrian crystalline rocks are covered with layers of Paleozoic and Mesozoic sediments total thickness of which arises to 1600 m. A border between these structures goes a bit further south of the settlement line Petrykyivka – Novomoskovsk – Pavlohrad – Mezhova. In the north-west of the region crystalline rocks of Ukrainian crystalline formations gradually immerse in the direction of Black Sea Lowland.

Within Ukrainian crystalline formations on the territory of the region Middle Prydniprovia megablock and in the further east Horikhovo-Pavlohrad suture zone are located. These structures are separate with Horikhovo-Pavlohrad abyssal fracture. Among DDA structures within the region the junction zone of Dniprovo-Donetsk lowland with Donetsk cover-folded area.

43 deposits of raw material are thoroughly developed and taken to balance in Dnipropetrovsk region in order to extract gravel and quarystone with total reserve of more than 526276,23 thousand $m^3$ (table 1). Among them 19 deposits are with the reserves of more than 614201 thousand $m^3$ and they are exploited [12]. Raw material is mainly presented with the deposits of granitoids, in the composition of which there are gneisses, migmatites, also granodiorites, quartz diorites, tonalites. The deposit of monomineralic quarzites is developed and exploited in Horikhovo-Pavlohrad suture zone.
Pre-Cambrian structures open in the Dnipro valley, its flowings and hollows as rock outshorts, quaquaversal upwell or sometimes continuous extended outcrop. Mostly they are covered with less thick layers of quaternary and Neogene sediments.

The most widespread rocks on the territory of the region are plagiogranitoid of Dnipropetrovsk complex \((AR_1)_{dn}\) which open along the banks of the Dnipro river, in the interstream area of the Bazavluk river and the Kamianka river, river bottoms of the Mokra Sura river, the Tatarka river, the Voronyi river, the Ploska Osokorivka river, the Nyzhnia Tersa river and Serednia Tersa river covering the area of 1500 km\(^2\). Among complex rocks the leading role goes to plagiogranites and plagiomigmatites, the less spread connected with them are quartz diorites, granodiorites and tonalites.

Plagiogranite biotite, amphibole-biotite are the rocks that are of light grey, grey colour, medium-grained, more seldom porphyroblastic structure, massive, often gneiss similar composition.

Plagiomigmatites are grey rocks with thin-striped, indistinctly-banded, knotty composition, granoblastic structure with the elements of porphyroblastic and lepidoblastic structure connected with mutual transition with plagiogranites.

Granodiorites biotite, amphibole-biotite occur alongside with plagiogranites and plagiomigmatites in common array being dominant at specific areas. They have grey, dark grey or sometimes green-and-grey colour, medium-grained structure, massive, knotty, gneiss similar composition.

Tonalites are rocks similar to granodiorites, differ with less quantity of quartz, dark minerals, absence or a small quantity of potash feldspar, are of grey colour, medium-grained structure massive composition.

Quartz diorites are green-and-grey, dark grey rocks with medium-grained or less frequent coarse-grained structures, massive, knotty or less frequent knotty-and-striped composition. They create separate bodies with the area of the first km\(^2\) up to tens of km\(^2\) in the Dnipro river valley and along Horikhovo-Pavlohrad abyssal fracture.

Plagiogranitoids of Dnipropetrovsk complex as final products of anatexis of the rocks of aul series, often they contain xenolith of metamorphic rock.

Within Pryazovia megablock a similar role is played by plagiogranitoids of Remivskyi complex \((AR_1)_{rm}\) which are also represented with the association of interconnected plagiogranites and plagiomigmatites. Among the previous mentioned plagiomigmatites biotite sometimes with amphibole, pyroxene, garnet have the principal spread. The rocks are grey, green-and-grey sometimes with rosy shade, not coarse or medium-grained striped and gneiss similar composition. Biotite plagiogranites differ with light grey colour, medium-grained structure and massive composition.

In the west and south of the region Mesoarchean granitoid rocks of Inhulets, Demuryne and Tokivske complexes are more widespread, and they open in the valleys of the Inhulets river, the Saksahan river, the Bazavluk river and the Kamianka river.

Plagiogranites and plagiomigmatites biotite, amphibole-biotite of the Saksahan complex create dome shaped massives. The rocks are of grey colour, medium-not coarse structure and massive composition. Plagiomigmatites of similar consistence differ with striped and knotty composition. In the periphery of massives hybrid rocks as diores, granodiorites and migmatites of the same consistence are locally developed. Granitoids of the Inhulets complex open in the valley of the Inhulets river and its flowings – the Zhovta river and the Zelena river. Plagiogranites and plagiomigmatites biotite, amphibole-biotite of grey colour and grained structure prevail in the complex composition. Microcline plagioclase granites and migmatites of grained, sometimes inhomogeneously grained structure, grey, rosy-and-grey colour, massive (granites), striped and knotty composition (migmatites) occur in the subsidiary quantity. Rocks of these complexes are similar between each other and are considered to have been formed in the
result of ultrametamorphic processing more ancients granitoids of the Dnipropetrovsk complex and basaltoid rocks of Sura suit, more homogeneous in their composition and contain less patch of metamorphic rocks.

Microcline plagioclase granitoids of the Demuryno complex create dome shaped massives among the rocks of the mentioned complexes, more often are related to fracture structures. Their genesis is connected with potassic metasomatosis of plagiogranitoids. They differ with their Microcline plagioclase with bigger grains of rosy microcline. Rosy, rosy-and-grey medium and coarse-grained biotite granites and migmaites as well as homogeneously grained – gneiss similar being associated with granodiorites are widespread among granitoids.

Granitoids of the Tokivske complex create homonym dome shaped massive of the compound composition in the south-western part of the region. In its central part diorites amphibole and migmaites of diorite composition occur alongside with granites. Granites are massive, microcline plagioclase, having grey-and-rosy, grey-and-red sometimes red colour, medium grained or inhomogeneously grained structure.

Within Horikhovo-Pavlohrad suture zone (Vasyllivske deposit) Vovchansk Paleoarchean layer monomineralic quarzites are extracted as building stones which underlay among gneisses, high-alumina shale rocks, jaspilites, amphibolites. Rocks are inhomogeneous due to composition features, have adulteration of garnet, feldspars, other layers and lenses of composition rocks.

Granitoid rocks including quarzites are capable for producing gravel of different purposes. They meet the functioning standards, in particular, All Union State Standard B V.2.7-75-98 Construction materials. “Pit gravel and gravel solid natural for construction materials, goods, constructions and work. Technical conditions” [13], All Union State Standard B V.2.7-2040:2009 Construction materials. “Pit gravel from natural stone for ballast layer of railway. Technical conditions.,” All Union State Standard B V.2.7-30:2013 “Materials nonmetalliferous for pit gravel and gravel bases and for automobile roads cover. General technical conditions” [13].

Due to the size of reserves in the region deposits may be divided into: 4 big granitoid deposits (Novomykolaivske, Nadezhdvivka, Nedaivoda, Novopavlivka) with the reserves more than 30 mln tons and 5 medium size deposits (Rybalske, Komisarivka, Devaldovo, Tokivske) with the reserves of 15-30 mln tons. There is 1 big deposit in every district: Dnipro, Synelnykove, Kryvyi Rih and Nikopol districts. The most part of medium (3) are located in Kryvyi Rih district, 1 in Dnipro district as well as 1 in Kamianske region. 1 quarzite depot is situated in Synelnykove district (Vasyllivske deposit). Other deposits are related to small (10 deposits).

Deposits being not developed (24 deposits) are presented with small deposits with general reserves less then 10000 thousand m³. Zhovtneve and Marianivka migmaites deposits of Kryvyi Rih district and Savrivske migmaites deposit of Kamianske district have been presented and related to medium deposits, nowadays are taken out of operation. Nowadays they serve as drowned open pits and are udes with recreational aim.

The only developed sandstone deposit in Dnipropetrovsk region is known as Andronivske and has general reserve of 60 thousand m³.

The location of building stone deposits within the region is highly inhomogeneous. Deposits are located on the area of three administrative districts: 6 deposits of Dnipro region, 5 deposits in Kryvyi Rih district as well as 5 deposita in Kamianske region and therefore the amount of all developed raw material reserves is almost 88%. There are some being developed deposits of building stone – 2 deposits in Synelnykove district and 1 deposit in Nikopol district. Deposits of building stone are not represented in Novomoskovsk and Pavlohrad districts at all (figure 1).

The figure 2 demonstrates raw material provision of administrative districts and division density through the whole region. The map chart represents the maximum division density of construction raw material in central and south-western districts of the region, i.e. in Kryvyi Rih district (312 m³/km²) and Dnipro district (226 m³/km²). A little lower density indices are distinctive for Nikopol district (187 m³/km²) and significantly differ in Kamianske and
Synelnykove districts 226 m³/km² respectively.

Figure 1. The scheme of location of building stone deposits in Dnipropetrovsk region (source: Geoinform Ukraine) [14].

Deposits being developed: 1. Liubymivka, 2. Liubymivka 1 Section Pershotravneva, 3. Novomykolaiivske, 4. Rybalske, 5. Chaplynka, 6. Petrivske, 7. Balbyshka, 8. Erastivske, 9. Komisarivka, 10. Myshuryno-Rizke, 11. Borodaivska, 12. Vasylivske Section Balka Labzunova, 13. Nadezhdivska, 14. Devladovo, 15. Kolomoivske, 16. Nedawoda, 17. Tokivske, 18. Khrystoforivska Section № 2, 19. Novopavlivske.

Not developed deposits: 20. Andronivske, 21. Havrylivska, 22. Velyka Mykhailivska (Pokrovsk), 23. Velyka Mykhailivska, 24. Vasylivske, 25. Pervomaiske Section North-west, 26. Zvonetske, 27. Kamiano-Zubyivska, 28. Bashmachka, 29. Taromske Section №1, 30. Trytuzne, 31. Olmieske, 32. Kudashivka 3, 33. Chernihivske, 34. Pidstepniavsk, 35 Ust-Kamianska, 36. Mariivska, 37. Marianske, 38. Marianske, 39. Karachuny, 40. Zhovtneve, 41. Marianivka, 42. Savrivske.

Raw material provision (m³/person) demonstrates a bit different picture (figure 3). Synelnykove district (268,8 m³/person) and Nikopol district (257 m³/person) are maximally provided. Kryvyi Rih and Kamianske districts correspondently take medium position with the indices 239 m³/person and 141,9 m³/person. Dnipro district takes the last place due to this index (table 1). Such situation can be explained with population density and territory industrial development.

Building stone extraction also differs in the districts of the region. The maximum indices of extraction are fixed in Dnipro district (471,76 thousands. m³/year), it is almost total building stone extraction of all districts as a whole unit, in particular, Nikopol, Synelnykove, Kryvyi Rih and Kamianske districts (figure 4).

Among six deposits of Dnipro district Liubymivka granite deposit has the extraction maximum index. Basing on the data provided by Geoinform Ukraine in 2017239,8 thousand m³
Figure 2. Density of raw material provision on the territory of districts of Dnipropetrovsk region m³/km² (source: Geoinform Ukraine) [14].

Table 1. The provision with developed building stone reserves of the administrative districts of Dnipropetrovsk region (source: Geoinform Ukraine) [12].

| Administrative district deposits | Balance reserves A+B+C thousands m³ on 1.01.2018y. | In the developed deposits | In the not developed deposits (thousands. m³/year) | extraction with raw material m³/km² | Intension of the territory provision m³/person | Raw material |
|--------------------------------|---------------------------------------------------|---------------------------|-----------------------------------------------|---------------------------------|------------------------------------------|-------------|
| Dnipro                         | 93925,89 (6)                                      | 29577 (6)                 | 471,76                                        | 226                             | 108                                      |
| Kamianske                      | 40052,21 (5)                                      | 20689 (4)                 | 0,188                                         | 94                              | 141,9                                    |
| Synelnykove                    | 50371,41 (2)                                      | 3621 (5)                  | 39,92                                         | 91                              | 268,8                                    |
| Kryvyi Rih                     | 119893,144 (5)                                    | 58810,45 (7)              | 98,934                                        | 312                             | 240                                      |
| Nikopol                        | 62417,69 (1)                                      | 2923 (3)                  | 154,082                                       | 187                             | 257                                      |
| Novomoskovsk                   | 0                                                 | 0                          | 0                                             | -                               | -                                        |
| Pavlohrad                      | 0                                                 | 0                          | 0                                             | -                               | -                                        |
Figure 3. Raw material provision of administrative districts of Dnipropetrovsk region m³/person (source: Geoinform Ukraine) [14].

Figure 4. Building stone extraction in districts of Dnipropetrovsk region in 2017 (source: Geoinform Ukraine) [14].

were extracted here. This deposit is developed by LLC “Liubymivka open pit” that also owns Chaplynka granite deposit with the extraction of 31.4 thousand m³. The enterprise provides
extraction of granite that is not changed and faulted by rotting, therefore, these rocks are capable to be used as raw material for manufacturing pit gravel and ledgestone, rock fines.

Rybal’ske granodiorite and migmatite deposit (183.36 thousand m$^3$) is the second in production capacity and is related to the category of medium. The territory of open pit exhausted space amounts approximately 40 hectares and the maximum depth is up to 120 m. The maximum area of the open pit will become 85.7 hectares by the end of extraction.

Novomykolaiivske granite deposit, although being related to the category of big deposits, has minimum indices among six deposits of Dnipro region, in particular 17.2 thousand m$^3$ with general extraction project capacity 167.9-168.8 thousand m$^3$, i.e. deposit potential is used at 10% nowadays.

The extraction of mineral resources being suitable for producing ledgestone and pit gravel is executed by drilling and blasting using the method of vertical down hole blasts. Deposits and open pits are located nearby settlements with developed infrastructure and do not demand additional investments. Ground mass of building stone reserves in Dnipro district are located on marginal nonarable lands.

Only one granite and migmatite deposit is developed in Nikopol district, that is called Novopavlivske and is related to the category of big deposits. The extraction amounts 154,084 thousand m$^3$ with project capacity 500 thousand m$^3$, (% of use) with the area 109.7 hectares. Granite pit gravel of seven fractures is manufactured from extracted building stone and is used for building and highway, speedway and railway repair. Novopavlivske sandstone and pit gravel mixture is used by asphalt plants during asphalt and flagstone manufacture as well as paperboard and rubberoid plants use it as dusting powder for rubberoid. Ledgestone is used for storage dam and basement construction and building facade finish. Increasing demand on open pit products is explained with its high quality. They meet the first construction group due to the sanitation and radiation characteristics (All Union State Standard referce).

Granite extraction in Kryvyi Rih district is produced on 5 developed deposits, 3 of them are related to the category of medium deposits, in particular Devladovo with the extraction of 20.25 thousand m$^3$, Kolomoivske with 74.2 thousand m$^3$ and Tokivske with 3,866 thousand m$^3$ (grey granites) and 0.618 thousand m$^3$ (red granites). The extraction is temporally stopped in the big deposit Nedaivoda and a small one Khrystoforivka. The reason of extraction stop is caused by the deposit location near conservation area “Inhulets steppe”.

Kamianske district is almost equal to Kryvyi Rih district due to the quantity of deposits but building stone extraction is manufactured only in Boltyshka deposit (0.188 thousand m$^3$). As it was mentioned gneiss and granite deposits can be used for siding goods manufacture. Granites are extracted for producing quarrystone, pit gravel and granitic subsoil in Erastivske, Komisarivka, Mishuryno-Rizke and Borodaivka deposits but the enterprises are marginal. Building stone extraction is either stopped or is produced on not full capacity there. Erastivske open pit, being owned by stock company “Ukrzaliznytsia”, has worked at a loss of 1935 thousand hryvnia during 7 months in 2020 (based on data of “Centre of industry manqgement”), so that the question is arisen about its further functioning.

Two developed building stone deposits are located in Synelnykove district and only one of them is excavated. Vasylkivske quarzite deposit is related to the category of small deposits. In 2017 quarzite extraction amounted 39.92 thousand m$^3$. Besides building pit gravel these rocks are suitable for producing ferro-alloys and silica blocks. The area of Vasylkivske deposit is 36.21 hectares. Nadezhdivka granite deposit (big deposit) is not exploited nowadays.

As it was mentioned above Erastivske granite deposit is exploited by state stock company “Ukrzaliznytsia”, extraction in other deposits are exploited by different commercial structures and as a rule LLC. Due to the statistics of statistics main office of Dnipropetrovsk region the dynamics of granite extraction during 2011-2022 was analyzed (figure 5). The chart demonstrates clear trend in increasing of granite extraction by enterprises of the region according to demand.
increase on goods in the region as well as in the whole country.

Figure 5. Dynamics of granite extraction in Dnipropetrovsk region in 2011-2021 (thousand tons) (based on data of statistics main office in Dnipropetrovsk region) [15].

During next years the increase of building stone extraction is planned due to the increase of construction tempo. The increase of extraction volume can be achieved by the extraction increase in existing building stone deposits (Nadezhdivka, Novomykolaiivske, Novopavlivske etc.). Thus, according to issues about enterprise planned activity which needs to be evaluated in the impact on environment, also prospective technical and economical indices of further industrial development of granites within open pits (provided extraction project annual capacity) demonstrate further provision with granite reserves for 50-60 years with medium project capacity 150-160 thousand m$^3$, however, it may cause fast exhaust of existing reserves.

Extraction increase is possible provided that implementing in exploitation new developed mineral resource areas. Thus, in the end of 2019 a new head of State Service on Geology and Mineral Resources of Ukraine presented “Investment map of mineral resource user” and announced that State GeoMineral resources will follow the direction of maximization of land at auction. In the middle of January the information about 75 land parcels with 26 kinds of mineral resources was published on the website www.geo.gov.ua in order to be sold at auctions. 4 building stone deposits are located on the territory of Dnipropetrovsk region including Ust-Kamianka, land parcel North-Tokivske (bought on 01.02.2022), Kudashivka and Komisarivka (still are the lots). So that big problems do not exist with the choice of objects for investments, but if the new deposit extraction is appropriate as constantly increasing great receiving pits after iron ore extraction and processing. Determined state police being realized on the legal system is necessary to cope with the issues connected with mineral resource complex use and ecological rehabilitation of mining and processing districts [16]. Real actions are not observed in this direction nowadays.

With significant increase of building stone demand within the region and Ukraine raw material deficiency payment is possible as a result of import from other regions.

While planning increase of building stone extraction volume it is significant to take into account the fact that increase of extraction volume will cause decline of the ecological situation
within the region. As a consequence of open development pollutes air with emissions from drilling and blasting operations, digging off and downloading operations. Potential acoustic impact of planned activity supposes noise and vibration pollution the sources of which are installation and construction works, mining, loading and unloading, crushing machines, automobiles and other additional equipment that is used on the objects. Negative impact on soils is possible due to the air pollution and immediately by taking out land parcels in order to locate and exploit basic, subsidiary and additional enterprise buildings connected with mineral resource use. Besides hydrological and hydroecological regimes of extraction regions also change. The level of subsoil water also changes around open pits that are exploited, consequently, it may cause the decline of surface and subsoil water quality as the most vulnerable components of geological environment, some negative processes can occur as drowning, flooding and bogginess in case of stopping extraction and drowning open pits. Slope processes like erosion, gravitation etc. become active in extraction zones. Such zones require further land restoration and transformation of drowned open pits into recreational areas.

4. Conclusions
Constructive and geographical analysis of building stone raw material of Dnipropetrovsk region has allowed to find out the following:

1. Granites, quarzites and migmatites that are used as a raw material for producing pit gravel and ledgestone are extracted in 19 deposits that are developed as building stones.

2. The list of deposits that are not developed (24 deposits) is perspective for increase of building stone extraction and therefore should be overviewed as some deposits are out of exploitation and extraction cannot be renewed (Zhovtneve and Marianivka deposits of Kryvyi Rih district and Savrivske migmatite deposit of Kamianske district).

3. Building stone deposits are located on the territory of Dnipro, Kryvyi Rih, Kamianske, Synelnykove and Nikopol districts, moreover 88% of developed reserves are concentrated in first three mentioned deposits. 2 districts of the region – Pavlohrad and Novomoskovsk building stone deposits have not been explored out yet.

4. Density indices of construction raw material provision are the highest in Kryvyi Rih, Dnipro and Nikopol districts and twice more prevails corresponding indices of Synelnykove and Kamianske districts.

5. Population provision with general construction raw material reserves differs from indices of raw material density division. The best provided are Synelnykove (268.8 m$^3$/person), Nikopol and Kryvyi Rih districts that is explained by peculiar indices depending on population density and industrial exploration of the territory.

6. The extension of building stone extraction is possible due to the increase of increase of extraction at the exploited open pits and exploitation start of new sections the amount of which arises almost to 20 in the region but they are related to the category of small deposits. Exploitation start of new sections and significant increase of building stone extraction may cause decline of the ecological situation in the region.

7. The capacity of some parts of enterprises are used unreasonable. A need in investment or changing their owners is arisen. Open pits work not on the full capacity although tendency of increasing raw material extraction is observed during last 5 years because of demand increase on building stones.

8. It is demanded to study the problem of using parts of great amount of accumulated mining and industrial waste of iron ore and other raw material extraction in the district as construction material. Moreover, part of them meet All Union State Standard B V.2.7-34-2001 Construction material. “Pit gravel for building from clift rocks and waste of dry
magnetic concentration of ferruginous quartzites at ore dressing integrated works and mines of Ukraine. Technical requirements”.

ORCID iDs
N B Panteleeva https://orcid.org/0000-0001-6787-2266
M J Syvyj https://orcid.org/0000-0002-3150-4848
O O Kalinichenko https://orcid.org/0000-0002-7057-2675
O Volik https://orcid.org/0000-0003-4949-1974

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