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PHYSICAL-MECHANICAL AND MINERALOGICAL-PETROGRAPHICAL CHARACTERISTICS OF THE DIABASES AT THE LOCALITY "KOŠARSKA REKA" (VARDAR ZONE, REPUBLIC MACEDONIA), AS BASIS FOR THE USE OF THE DIABASES FOR CONSTRUCTION STONES

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A b s t r a c t: In this paper will be shown the results from the investigations of physical-mechanical and petrographic-mineralogic characteristics of on diabase Košarska Reka locality (Vardar zone, Republic of Macedonia) as a basis for application of construction stones. The analyses and the laboratory tests have been performed on samples of diabases that were taken from the surface layers. The results from their physical and mechanical analyses showed that these rocks meet the requirements for their utilization as construction stone suitable for all fractions of asphalt – concrete, concrete aggregate, tampon material, stone dust and other application in the civil engineering related to the traffic infrastructure. Additionally, the quality of the stone is higher in the deeper parts of the terrain, where the external influences have little effect.

Key words: diabasse; Košarska River; construction stone; mineralogical-petrographic structure; structural-texture characteristics; chemical characteristics; physical-mechanical characteristics

INTRODUCTION

"Košarska Reka" (Košarska River) area is located in eastern Macedonia, 22 km north–west of Valandovo and 5 km south–east of Demir Kapija (Fig. 1).

Fig. 1. Map of the R. Macedonia with position |the KošarskaReka locality

The immediate surroundings of the research area in the past has been explored by many researchers for different purposes and uses. To preserve the primacy of geological research in chronological order, data of individual researchers who have worked directly on the said terrain will be present.

Cvijić (1906) was the first researcher who found and gave the main features of the Vardar depression or central Balkan Plain as he called it. Especially important is the work of Kosmat (1924) in which he gives a complete overview of the geology of Macedonia. He first made it different Vardar zone as a separate tectonic unit between the Serbian-Macedonian mass and Pelagonia massif. Tajder (1939) provides data on physiography, chemical composition and genesis of gabbroide massive Dren–Boula. Tuchan (1940) has made several routes and concluded that on the investigated area are present granite, gabbro, diabase, melafires and other types of rocks. Izmajlov (1948) conducting surveys in the village of Iberli vicinity and provides information on the geology of the nearby environment. Meyer (1960) gaves details for mineralogical-petrographic characteristics of some rocks from the vicinity of Udovo. Stračkov (1963, 1966) provides detailed data on the geological evolution of the southern part of the Vardar zone and tectonical composition of the Gradeška mountain and its immediate surroundings.

In the period 1962–1974, the immediate vicinity of the research area was studied in details by a number of researchers in the preparation of the OGK of SFRY in scale 1:100 000 sheets of Kavadarci, Kožuf and Gevgelia.

From metalogenetic aspect Vardar zone is the best studied by Ivanov (1966).

Within the plate – tectonic interpretation in the last few decades new views about the nature and significance of the Vardar zone have been indicated by Karamata (1974), Dimitrijević (1974), Aleksić and others (1974), Arsovski and others (1984).

Ivanov, Dumurdžanov and others (1987) provide the latest detailed information on petrological and chemical characteristics of gabbro-basaltic massive Demir Kapija–Gevgelija.

Dumurdžanov and Petrov (1992) give many details for lithostratigraphic and chemical characteristics of the Vardar oceanic crust in the territory of the Republic of Macedonia.

Latest data on the mineralogical-petrographic, chemical and geochemical characteristics of gabbros and diabases from the immediate surrounddings of the investigated area can be found in the works of Spasovski (2001, 2012).

METHODOLOGY

The mineralogic-petrographic research have been done on the Faculty of Natural and Technical Sciences in Štip by the author of this paper, while the chemical content of the granodiorite is determined in the chemical laboratory in Železarnica in Skopje.

The research of the physical-mehamical characteristics was performed in the laboratory at the Civil Engineering Institute in Skopje. The examinations were performed during 2011. Because the rock masses are not well disposed, the samples were taken from the surface of the terrain. As a consequence in the samples themselves there are some cracks which is a result from the great influence of the atmosphere. However the examinations of the samples have shown credible values of their physical-mechanical characteristics. It is certain that the samples from the greater depths would give much better results.

GEOLOGICAL FEATURES

The geological structure of the Kosovska River locality includes the following types of rocks: diabase and spilite and alluvial sediments (Fig. 2).

The diabases are characterized with green and grey-green color, homogenous and massive texture (Fig. 3). They are small-grained and the dimensions of the grains do not exceed 1 cm. They are quite solid and stern. Frequently, they are crossed with calcite and epidotic sinews. At some places, the diabases have mostly parallelepiped, and sometimes sphere excretion. The diabases having parallelepiped excretion are compact and solid. There also have multidirectional fissures.

The following modal structure is provided for the diabases by integrating: plagioclases from 45–74%, pyroxenes from 35–45% and magnetite from 5–15%.

Among the diabases there is a certain number of samples with a presence of phenocrystals, thus they can be named as porphyrin diabases. The phenocrystals are grains of pyroxenes and plagioclases, which are usually 3–4 cm large and rare, and the basis is subophitic and ophitic, as at the normal diabases. It is very rarely noticed at the diabases and quartz, thus they turn in quartz-diabases.

The spilites appear in the southern and southwestern areas and they cover small surface. They usually appear as a pillow-lavas (Fig. 4) and naturally they represent submarine irruptions. They are dark green, dark purple and often fully black rocks with numerous minuscule and massive mandolesi 3–8 cm, filled with secondary minerals such as: calcite, epidote, chlorite. The amount of the mandolesi varies and according to the integrated samples reaches up to 34%. These minerals are sometimes scour at the surface and therefore they gain hollow, cinder-like texture. The orb-like excretion is present within the largest part of the spilite. The orb sizes are not equivalent and they vary from 0.20 to 1 m. The orbs are separated by dilapidated translucent matter.

The spilites are also comprised of acicular plagioclases, which according to the refraction index represent albite or acidic oligoclases. Rarely there are pyroxenes in small amounts. In most of the cases the plagioclases and pyroxenes are modified or fully destroyed. The spilites structure is mandolesi–like and the basic matter is sub-ophitic.

The contemporary alluvial layers are tightly connected with the riverbed of the Airan river. They are represented mostly with gravel and sand whose structure is tightly linked with the structure of the rocks developed in the upper flows of the above-mentioned river. Taking this into consideration, downstream Airan river, there are mostly gabbro diabases. These layers are mutually mixed, but they are characterized with the feature to have rough material at the upper flow, and more processed and gravel material in the lower flow.

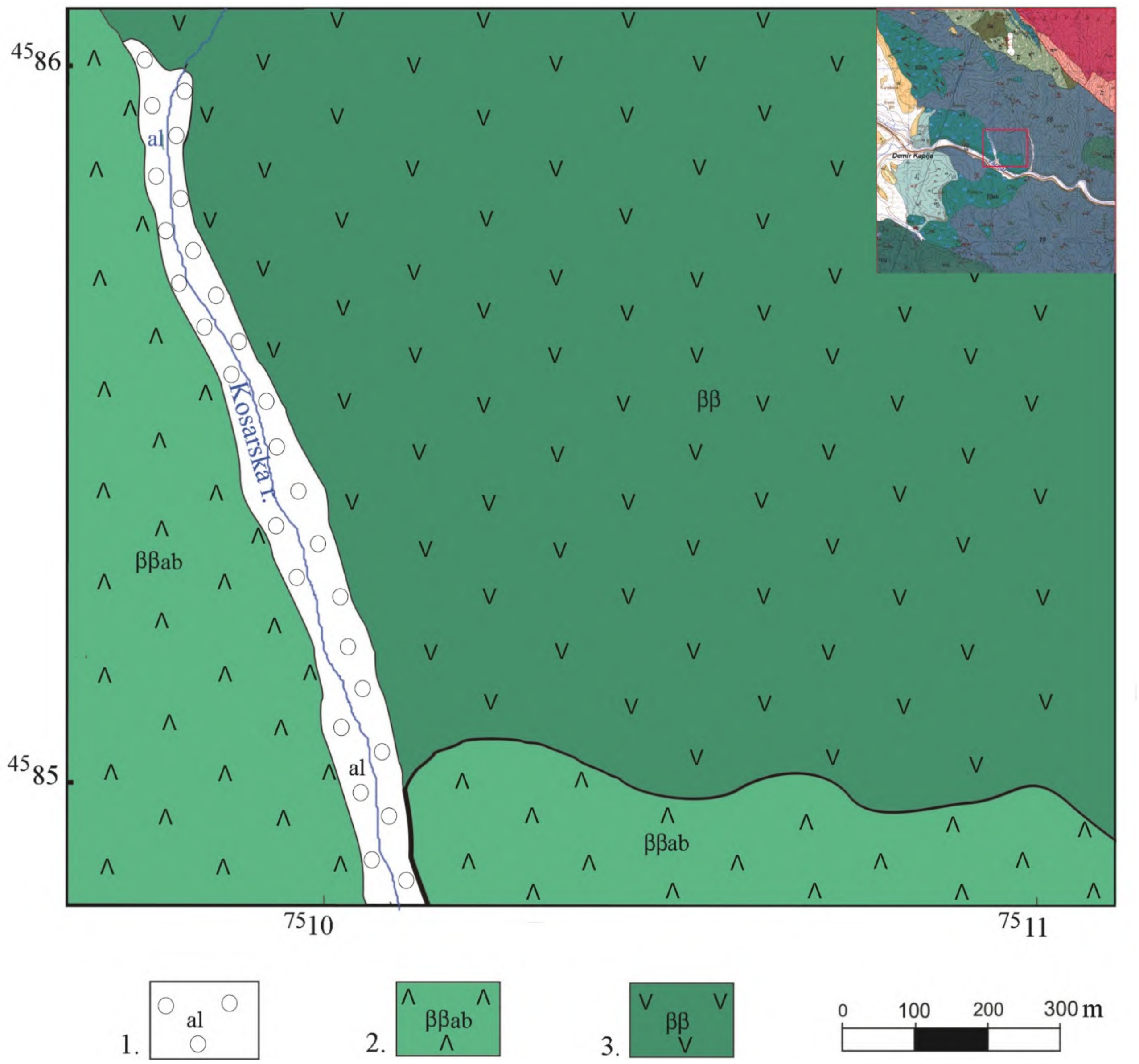

Fig. 2. Geological map of the locality "Košarska Reka" (Spasovski, 2011)
1. Alluvial sediments. 2. Spilite. 3. Diabase

Fig. 3. Dark green diabase

Fig. 4. Spilite with pillo-like excretion

PETROGRAPHIC-MINERALOGIC CHARACTERISTICS

There were some representative samples from the locality Košarska River selected for the mineralogic-petrographic examinations. Six petrographic slides were made which were examined with a polarized microscope with transmitted light brand Leitz, Wetzlar, Germany. The mineralogic-petrographic examinations were performed at the Faculty of Natural and Technical Sciences at the Institute for Geology by the author of the paper.

The investigated diabase samples are distinguished by miniscule granular structure, firm, massive and compact texture. They are greyish-green, and on the surface sporadically there are tiny calcitic ledges 0.5 mm thick. The rock has holocrystal porphyric, ophitic-subophitic structure represented with rode crystals on the plagioclase with length of 1 mm (Figs. 5 and 6). The primary materials which comprise the rock are: plagioclase, pyroxene, chlorite, calcite and ore material. The secondary materials are sphene, leucosen with fine granular aggregates. The plagioclase is presumably oligoclase and it appears like desultorily dispositioned, rod crystals (Figs. 7 and 8). It also appears in thicker rectangular shapes earthed with neutral plagioclase andesine.

The pyroxene appears in the plagioclases interspace, mostly in the shape of miniscule granular aggregate or short-slate sections. The pyroxene also appears sporadically in thin rod crystals, crunched along with the plagioclase structure comprising spherolitical structrure. The chlorite is often included as a secondary mineral, appearing in irregular shapes and fine granulated aggregates, and occasionally in bundle-like shapes.

The ore mineral is microgranular with irregular grains, splashed on the surface, rarely occurring in more massive crystals. The calcite in ledges which intersects the rock, familiar as microcrystal calcite, appears regularly and is 2 mm thick.

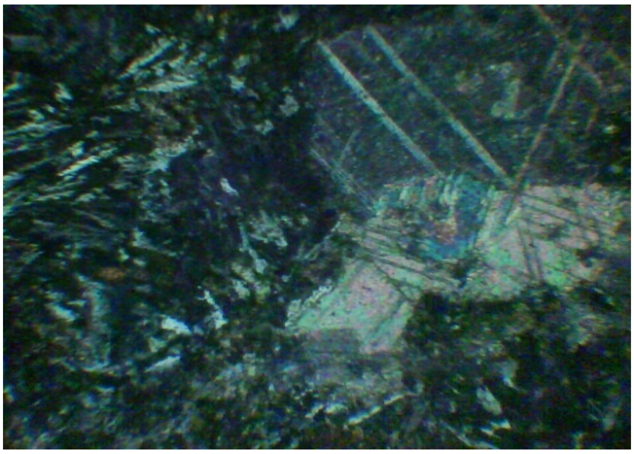

Fig. 5. Holocrystal porphyric, ophitic-subophitic diabase structure (N^+)

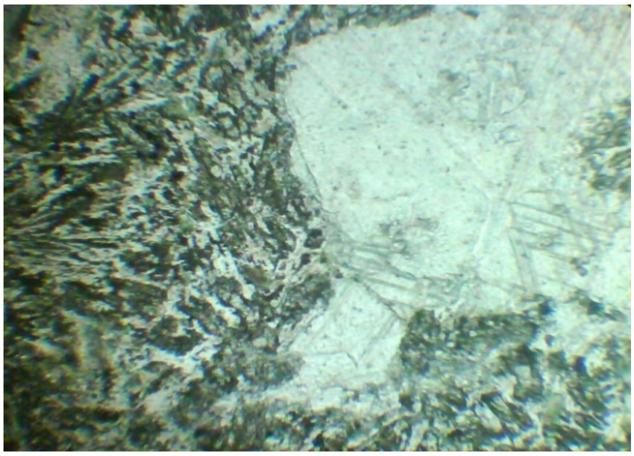

Fig. 6. Holocrystal porphyric, ophitic-subophitic diabase structure (N^-)

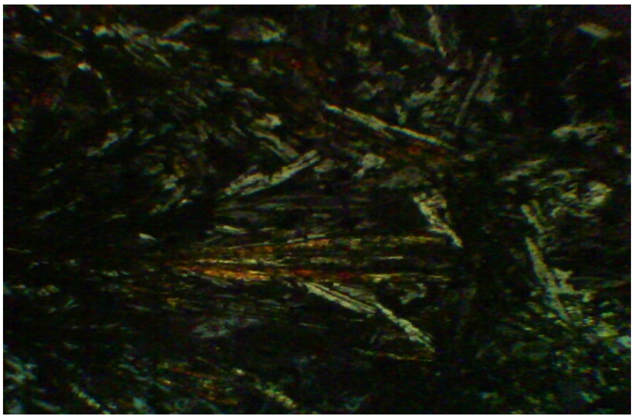

Fig. 7. Thin rod-plagioclase crystals with desultory disposition (N^+)

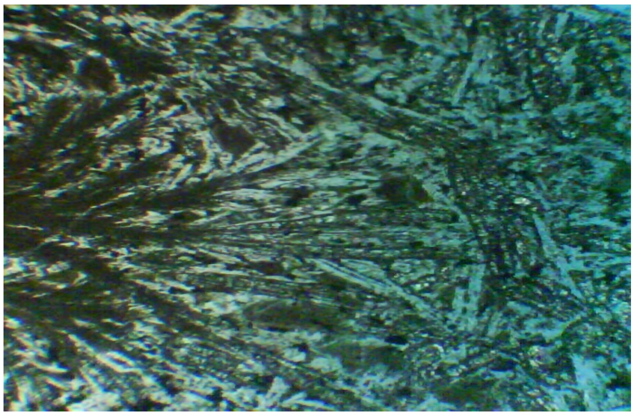

Fig. 8. Thin rod-plagioclase crystals with desultory disposition (N^-)

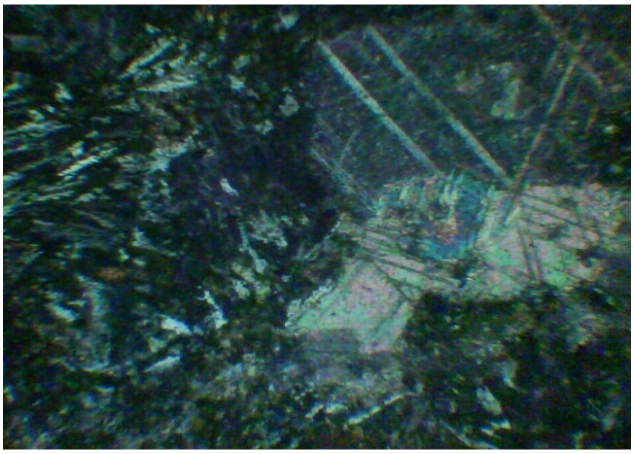

Fig. 5. Holocrystal porphyric, ophitic-subophitic diabase structure (N^+)

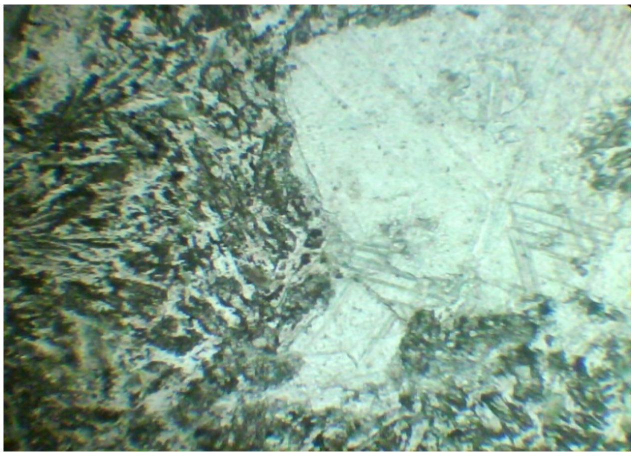

Fig. 6. Holocrystal porphyric, ophitic-subophitic diabase structure (N^-)

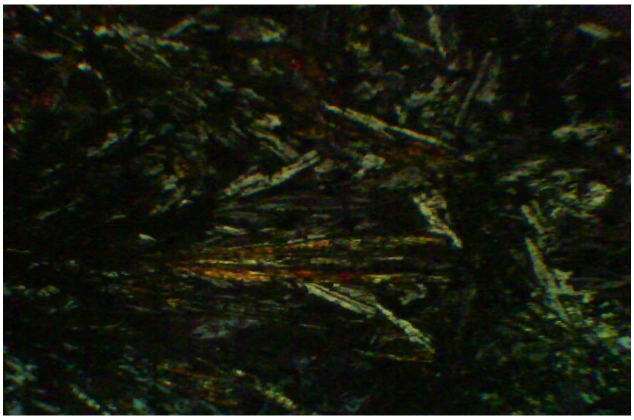

Fig. 7. Thin rod-plagioclase crystals with desultory disposition (N^+)

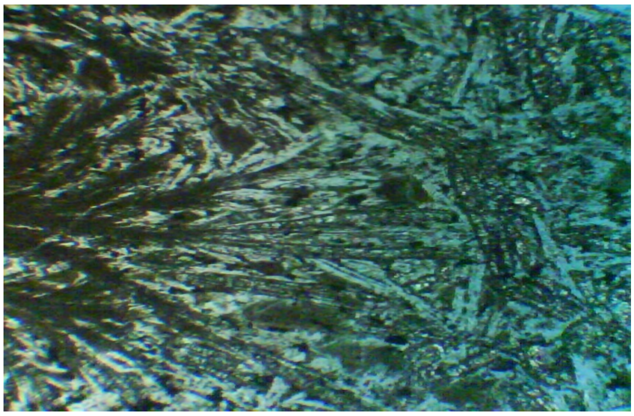

Fig. 8. Thin rod-plagioclase crystals with desultory disposition (N^-)

The rock has hollocrystal porphyric structure–microphyric (Fig. 9, 10). The phenocrystals appear as plagioclase rode crystals with desultory disposition. It represent an acid plagioclase, oligoclase with grains 1 mm thick. Alongside the plagioclase, the chlorite, calcite and ore material appear as primary materials too. The calcite appears, sporadically in irregular shapes as hypidiomorph, and occasionally in miniscule lentils and thin ledges. The chlorite appears as mandolesi, having radial chlorite bundles in the middle, and fine granular brownish pigmented matter along the mandolesi edges (Fig. 11, 12). There is a microcrystal feldspatization and microcrystal siliphication.

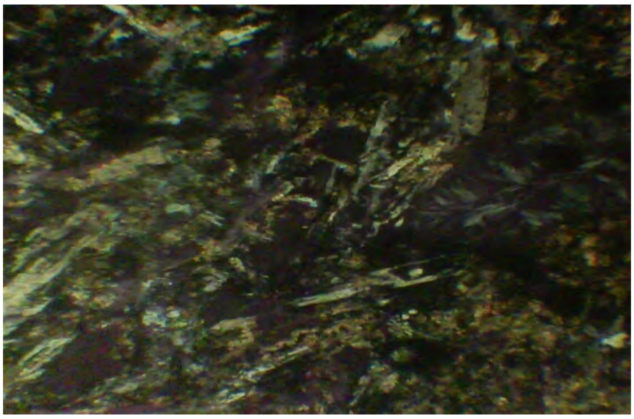

Fig. 9. Microphytical diabase structure with desultory plagioclase disposition (N^+)

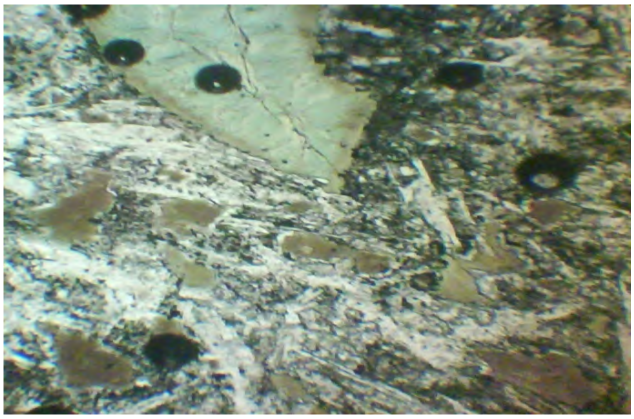

Fig. 10. Microphytical diabase structure with desultory plagioclase disposition (N^-)

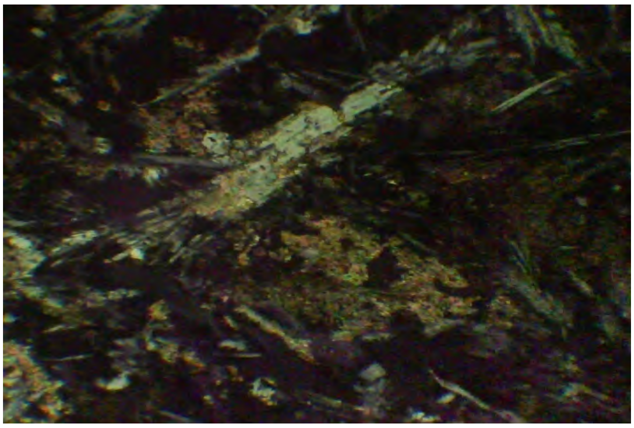

Fig. 11. Chlorite in radial bundles peripherally pigmented with fine granular brownish matter (N^+)

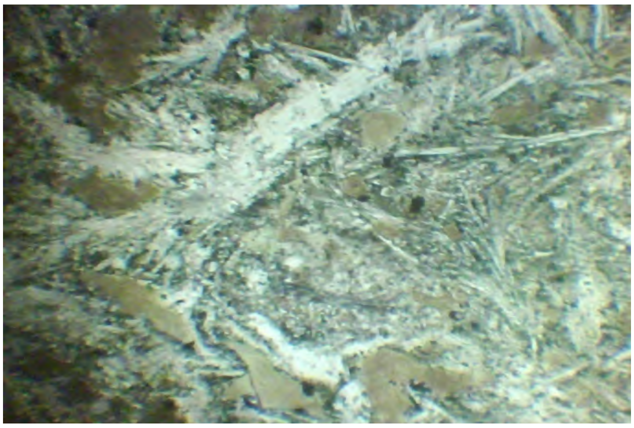

Fig. 12. Chlorite in radial bundles peripherally pigmented with fine granular brownish matter (N^-)

The quartzdiabase with dark grey and light green colour is determined with the mineralogical and petrographical investigations. The rock has miniscule granular structure, firm, massive and compact texture. There are quartz ledges 1 mm thick and calcite ledges. There is also sulphide mineralization represented with grains along the quartz ledges.

The rock has microfitical–microspherolitical structure and massive texture. It is comprised of plagioclase, pyroxene, ore material and quartz. The plagioclase and pyroxene appear like rod-acicular crystals, often fused together. They are spherolitic shapes of acicular pyroxene, metamorphosed in calcite and epidote. The grains of ore material such as: magnetite, ilmenite, sphene and leucosene, appear regularly. Within the interspace of the rod-crystals there are irregular quartz, feldspate and leucosene grains. The quartz mostly appears in thin and irregular ledges, that represent prolonged siliphication that occupies the rock (Fig. 13, 14). Alongside the siliphication, calcitization oftenly occurs.

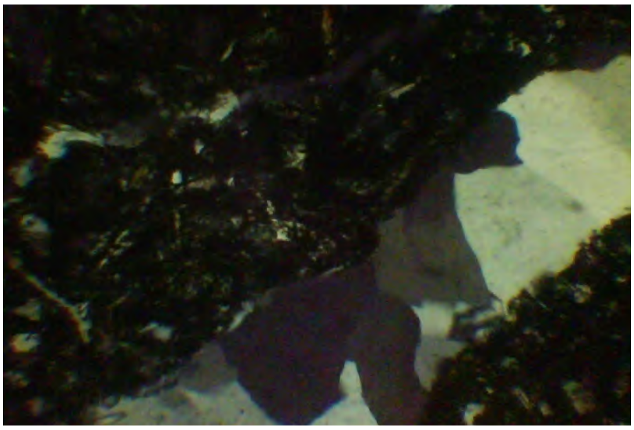

Fig. 13. Thin and irregular quartz ledges subsequently generated (N^+)

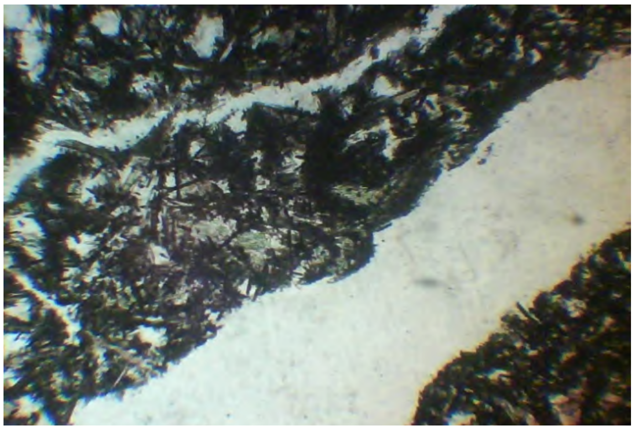

Fig. 14. Thin and irregular quartz ledges subsequently generated (N^-)

CHEMICAL EXAMINATIONS

The chemical characteristics of the basic rocks from the Udovo locality represent a supplement to deepen the cognizance regarding the gabbro-diabase massif Demir Kapija-Gevgelija, which is the biggest discovered relict at the Vardar oceanic crust on the territory of the Rrepublic of Macedonia. This massif is clearly different from the other surrounding rocks in its composition, structural-tectonic characteristics, color and the manner of appearing. On the other hand, the gabbro-diabase massif is does not represent an uniform mass. The core of this gabbro-diabase massif is made of gabbros to which on the SI as differentials the diabases and spilits are added. The border between the gabbro massif and the diabases are characterized with gradual transitions of the gabbro rocks, through gabbro diabases to diabases. Between the gabbros and the diabases there is a thin zone built up of gabbro and diabases with multiple strings of the gabbros in the diabases.

At the geological map, the diabases are separated as homogenous mass characterized with dark green color, great firmness and toughness. A parallelepiped and rarely round excretion can be noticed within the diabases.

The following modal structure has been obtained at the diabases by the method of integrating: plagioclases 45–74%, pyroxenes 35–45%, and magnetite 5–15%.

In order to make more detailed perception of the chemical structure of the diabases, five representative diabase and one quartz keratophyre sample were provided from the Košarska River locality. The results of the performed chemical test are presented on Table 1.

The presented table clearly shows that the analyzed samples are characterized with consistence of the chemical structure which can be perceived in the contents of the SiO_2 ranging from 52.34 to 66.03%. The exception is the second analysis where a significant increase of the Si component can be seen, i.e. it is a rock with emphasized sour character. This rock has been separated as quartz keratophyre, which has been confirmed by the mineralogical-petrographic examinations. Nevertheless, this rock does not make any significant masses and it does not infringe the homogeneousness of the diabase mass. In addition, it is characterized with great firmness.

A small increase of the Al, Ca, Mg and Na can be noticed at the analyzed samples, which is probably due to the additional secondary processes appearing at the analyzed samples.

The trace element distribution in the cumulates of the diabase reflects variations in mineralogical composition. The increase in the absolute abudance of incompatible LIL elements and decrease in proportions of compatible (Ni, Cr, Co) elements as Solidification Index increases are indicative progressive differentation. The geochemical characteristics of the diabase indicate its oceanic (ophiolite) nature, but also a possible contamination of basaltic magma by continental material.

Table 1

Chemical composition of the basic rocks from the "Košarska Reka" locality (%)

	Symbol of the sample					
Components	Kr1	Kr2	Kr3	Kr4	Kr5	Kr6
SiO_2	54.27	53.34	55.20	55.11	66.03	63.11
TiO_2	0.86	0.50	0.52	0.43	0.59	0.48
Al_2O_3	15.48	15.60	12.20	12.80	10.88	10.12
Fe_2O_3	7.32	7.92	6.15	5.16	6.51	6.82
MnO	0.77	0.84	0.17	0.15	0.14	0.14
MgO	3.83	3.62	3.00	3.04	3.15	4.04
CaO	6.67	6.51	7.85	7.93	4.43	5.99
Na_2O	3.95	3.50	5.84	5.54	3.98	4.24
K_2O	2.11	2.15	0.11	0.10	0.10	0.09
P_2O_5	0.15	0.18	0.23	0.25	0.17	0.15
H_2O^+	1.19	0.98	0.80	0.74	0.29	0.21
H_2O^-	0.15	0.23	0.25	0.38	0.86	0.73
LOI	4.15	4.62	6.95	7.73	2.65	3.65
Total	**100.90**	**99.99**	**99.27**	**99.36**	**99.78**	**99.77**
Ba (ppm)	75	58	56	35	48	58
Co(ppm)	32	59	34	37	27	32
Cr(ppm)	299	1047	78	287	43	405
Pb(ppm)	16	6	12	1	2	9
Zn(ppm)	104	71	74	118	71	67
Ga(ppm)	14	11	12	9	16	14
Ni(ppm)	123	376	60	89	19	103
Rb(ppm)	7	7	8	8	7	17
Cu(ppm)	122	30	190	115	13	52

Note: The analyse 1 and 2 are spilit-diabase, 3 and 4 are diabase, while the analyse 5 and 6 are quarzdiabase.

PHYSICAL-MECHANICAL CHARACTERISTICS

In order to determine the basic physical and mechanical characteristics of the rock masses, examinations pursuant the valid standards and recommendations ISRM (International Society for Rock Mechanics) have been performed:

Determination of the index of strength (Is) at rock stone masses. Determination of the uniaxial strength of pressure.

The examinations of the strength characteristics of the monolithic diabase parts from the Košarska River locality have been performed at the Civil Engineering Institute in Skopje, Geotechnics Department.

The samples have been put to a test of strength to pressure, point load, volume weight, water absorption, consistence to ice influence and grinding upon the "Los Angeles" as basic classification parameters.

Fourteen samples have been examined with the test of point load and three samples for strength of pressure in dry, saturated condition and after 25 cycles of freezing and defrosting. In addition, three tests upon the Los Angeles method have been prepared, and the moist absorption during saturation has been measured for 6 test bodies.

The results from the strength index present that the value of the Index of strength is within the following limits:

Value of Is (50) = 8.46 – 12.48 MPa depending on the examined sample.

Results from the strength of pressure in dry and moist condition are presented in Table 2.

The results from the examinations of the strength after 25 cycles of freezing and defrosting are presented in Table 3.

The coefficient of softening and resistance to the influence of ice are presented respectively:

Kom = σpv/σp = 172.43/197.2 = 0.874.

Kom = σpm/σp = 170.5/197.2 = 0.86.

The volume weight of the diabase, depending on the sample, ranges from γ = 26.95 – 29.14 KN/m^3 (average = 27.974 KN/m^3).

The value of Los Angeles, for the three series of samples is presented in Table 4.

All results show that the material is appropriate for utilization of all asphalt fractions – concrete, concrete aggregate, tampon material, stone dust and other usage in the construction engineering related to the traffic infrastructure.

Table 2

Results from the examination of strength of pressure in dry and moist conditions

Sample mark	Dimensions a/b/h (mm)	Strength of pressure σ_p MPa	Absorption of moisture (%)
K_{r1} (dry)	5.05/5.0/5.28	179.6	0.25
K_{r2}(dry)	5.07/5.25/5.30	175.6	0.27
K_{r3}(dry)	5.10/5.25/5.30	236.50	0.054
Average		197.23	0.191
K_{r1} (moist)	5.02/5.05/5.10	172.2	0.15
K_{r2}(moist)	5.07/5.10/5.05	169.50	0.22
K_{r3}(moist)	5.10/5.05/5.10	175.60	0.089
Average		172.43	0.153

Table 3

Results from the examinations of the strength after 25 cycles of freezing and defrosting

Sample mark	Dimensions a/b/h (mm)	Strength of pressure σ_p MPa
K_{r1}	5.06/5.0/5.20	172.8
K_{r2}	5.06/5.15/5.20	171.50
K_{r3}	5.20/5.20/5.05	168.15
Average		170.82

Table 4

Results from examinations regarding attrition upon the Los Angeles method

Sample mark	M_1 – mass of the dry rock before attrition (g)	M_2 – mass of the dry rock after attrition (g)	LA (%)
Sample 1	5000	3940	20.70
Sample 2	5000	4130	17.70
Sample 3	5000	4040	18.90
Average			19.10

CONCLUSION

The samples were taken from the surface parts of the terrain where the influences from the outside are quite intense. In the deeper layers of the ground, the rock mass is found as blocks and less affected by the atmospheric influence which enables a better quality. Based on the results received from the analyses it can be concluded that it can be used as construction stone.

The examined rocks are characterized with dark green color, massive structure and little presence of cracks.

The diabases with their dark green color are mostly prevalent on the examined area and they clearly differ from the other types of rocks.

From the mineralogical point of view, they are silicate rocks structured mostly of plagioclase, pyroxene and rarely amphibole. The samples are determined as small-grained diabase with ophitic to subophitic structure. According to the performed chemical examinations, the diabases have permanent chemical structure with contents of SiO_2 from 50 to 54%.

According to the petrologic, mineralogical-microscopic examinations, physical-mechanical parameters and chemical analyses, the examined diabases may be widely applied in the civil engineering, mostly in traffic civil engineering as construction stone, suitable for utilization at all fractions of asphalt – concrete, concrete aggregate, tampon material, stone dust and other applications in the construction related to the traffic infrastructure.

In addition, it can be used as architectonic stone, depending on the microtechnics, in order of provision of larger blocks.

Pursuant the performed examinations for determination of the physical-mechanical parameters, it is considered that the strength of the diabase is sufficiently high.

The samples that are identified as spilitic diabase, contain a lot of chlorite and calcite, modally around 35 %. The calcitization and chloritization are inauspicious components for the rock's physical-mechanical characteristics which provide it with weaker strength characteristics. The samples determined as quartzdiabases represent firmly siliphied rock that afterwards occurs as irregular ledges which firmly block the fissures. They are dark grey, with miniscule granular structure and massive texture. The sulphidic mineralization represents detrimental component for applying the rock as a concrete aggregate. Therefore it is recommended to avoid the zones with siliphication that causes the sulphic mineralization.

REFERENCES

[1] Aleksić, V., Kalenić, V., Pantić, N., and Hadzi, E., 1974: *Historical geology of the evolution of continental, transitional–oceanic lithosphere in Serbia and surrounding areas*. Matallogeny and concepts of the geotectonic development of Yugoslavia, Belgrade, pp. 229 – 274.

[2] Arsovski, M., Dumurdžanov, N., 1984: Recent findings of the structure of Pelagonian horst anticlinorium and its relation with Rhodopen and Serbian–Macedonian masses. *Geologica Macedonica*, **1,** pp. 3–24.

[3] Dimitriević, M., 1974: *The Dinarides: A model based on the new global tectonics*. *Metallogeny and concepts of the geotectonic development of Yugoslavia*, Belgrade, pp. 147–178.

[4] Думурџанов, Н., Петров, Г., 1992: Литостратиграфски карактеристики на офиолитскиот комплекс Демир Капија–Гевгелија (Македонија). *Geologica Macedonica*. Т. **6**, св. 1, Штип.

[5] Иванов, Т., 1966: *Металогенија Вардарске зоне*. Реферат VI Саветовања геолога СФРЈ, Охрид.

[6] Ivanov. T. et. al., 1987: The Demir Kapija–Gevgelija ophiolite massif Macedonia, Yugoslavia. *Ofioliti*, **12** (3) 457–478, Italia.

[7] Karamata, S., 1974: The geological evolution of the area of Yugoslavia: the nature and movements of plates and the importance of these properties and processes for metallogeny. *Metallogeny and concepts of the geotectonic development of Yugoslavia*, Belgrade, pp. 109–118.

[8] Kossmat, F., 1924: *Geologie der zentralen Balkan Halbinsel*. Die Kriegsschauplatze 1914–1919 geologische dargestellung. Berlin.

[9] Tajder, M., 1939: *Fiziografija, kemiski sastav i geneza gabroidnog masiva Dren–Boula u Južnoj Srbiji*. Rad Jugoslavenske akademije znanosti i umjetnosti, 263, pp. 1–54.

[10] Ракичевиќ, Т., Пенџерковски, Ј., 1963: *Толкувач за ОГК на СФРЈ 1 : 100 000 за листот Кожуф*. Фонд на Геолошкиот завод, Скопје.

[11] Ракичевиќ, Т., Пенџерковски, Ј., 1963: *Основна геолошка карта на СФРЈ 1 : 100 000 за листот Кожуф*. Фонд на Геолошкиот завод, Скопје.

[12] Спасовски, О., 2001: *Типогенетски карактеристики на титаномагнетитите во Република Македонија*. Докторска дисертација, Штип (318 стр).

[13] Spasovski, O., 2012: Posibilities use the diabases from the Udovo locality (Vardar zone, of the Republic of Macedonia) as construction stones. *Geologica Macedonica,* Vol. **26**, No 1, pp. 99–107.

[14] Страчков, М., 1963: *Тектонска градба на Градешките Планини и блискатa околина*. Трудови на Геолошкиот завод, Скопје, Св. 10.

[15] Страчков, М., Ивановски, Т., Пенџерковски, Ј., Ракичевиќ, Т., Христов, С., 1966: *Тектоника на Вардарската зона во пределите на СР Македонија и некои општи прашања во врска со нејзината градба.* Реферат VI саветовање геолога СФРЈ, Охрид.

[16] Христов, С., Карајовановиќ, М., Страчков, М., 1965: *Толкувач за ОГК на СФРЈ 1:100 000 за листот Кавадарци*. Фонд на Геолошкиот завод, Скопје.

[17] Христов, С., Карајовановиќ, М., Страчков, М., 1965: *Основна геолошка карта на СФРЈ 1 : 100 000 за листот Кавадарци.* Фонд на Геолошкиот завод, Скопје.

[18] Цвијић, Ј., 1906: *Основе за географију и геологију Македоније и Старе Србије*, Београд.

Р е з и м е

ФИЗИЧКО-МЕХАНИЧКИТЕ И МИНЕРАЛОШКО-ПЕТРОГРАФСКИТЕ КАРАКТЕРИСТИКИ НА ДИЈАБАЗИТЕ ОД ЛОКАЛИТЕТОТ КОШАРСКА РЕКА (ВАРАДРСКА ЗОНА, РЕПУБЛИКА МАКЕДОНИЈА) КАКО ОСНОВА ЗА ПРИМЕНА НА ДИЈАБАЗИТЕ КАКО ГРАДЕЖЕН КАМЕН

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Клучни зборови: дијабаз; Кошарска Река; градежен камен:, минералошко-петрографски состав; структурно-текстурни карактеристики; хемиски карактеристики; физичко-механички карактеристики

Во трудот се прикажани резултатите од извршените испитувања на физичко-механичките и минералошко-петрографските карактеристики на дијабазите од локалитетот Кошарска Река (Вардарска зона, Република Македонија) како основа за нивна примена како градежен камен. Самите анализирања, како и лабораториските испитувања беа извршени на примероци од дијабази земени од површинските делови. Резултатите од нивните физичко-механички испитувања покажаа дека овие карпи ги исполнуваат сите барања за употреба како градежен камен погоден за користење на сите фракции за асфалт – бетон, агрегат за бетон, тампонски материјал, камено брашно како и за други намени во градежништвото поврзани со сообраќајната инфраструктура.