Volcanology

The Late Pliensbachian - Early Toarcian Volcanic Complex of the Shaly Zone of the Greater Caucasus Southern Slope as Raw Material for Ornamental Stone (the Kvachadala Deposit)

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(Presented by Academy Member D. Shengelia)

ABSTRACT. Three levels of volcanism are known in the shaly series of the southern slope of the Greater Caucasus. The most widespread are Late Pliensbachian-Early Toarcian subalkaline basalts, evidenced as separate outcrops all over the territory of Georgia – from the upper reaches of the river Bzybi up to the border between Georgia and Azerbaijan. The author investigated analogous basaltoids, revealed in the upper reaches of the river Alazani, in the Kvachadala segment, presenting the results in this paper. Considering the data, the mentioned complex has been found to absolutely satisfy all the technical and technological requirements, it has fine external texture and is perfect raw material for manufacturing ornamental stone decorative tiles. Besides, according to the stable homogeneity of the basaltic complex within the limits of its spread, the author assumes it to be prospective as raw material for manufacturing ornamental stone blocks and tiles and recommends to carry out geological studies in this direction.

Key words: texture, structure, aggregate, microlitite, lava, plate.

By the present time within the limits of spreading of Lower-Middle Jurassic shaly deposits of the southern slope of the Greater Caucasus three stratigraphic levels of effusive magmatism manifestation have been confidently established: Sinemurian-Early Pliensbachian and, Late Pliensbachian-Early Toarcian volcanites are most widespread in Georgia [1]. They are attested as isolated outcrops in the upper reaches of the Bzybi [1] and Rioni rivers [2], in Khevi-Khevsureti [3] and on the territory of Trans-Alazanian Kakheti [4].

At the headwaters of the right tributaries of the Alazani - the Kvachadala and Lamazuri rivers outcrops of volcanogenic-sedimentary series have been revealed. According to the data of their geological-petrological study, the volcanites, constituting the series, have been attributed to the complex of Late Pliensbachian-Early Toarcian subalkaline basaltoids [5, 6].

The basaltic complex in the upper reaches of the rivers Kvachadala and Lamazuri is distinguished for its variegated coloration-combination of gray, green and bluish-green and its massive structure; thus they may be used in manufacturing decorative stone blocks and tiles. In this connection the author carried out special geological researches in the Kvachadala segment and proved that these volcanic rocks may be qualified as raw material of ornamental stone.

The segment is located in the upper reaches of the Kvachadala and Lamazuri rivers, 10-12 km north-east of the Khadori Hydro Electric Power Plant. The volcanogenic-sedimentary rock mass under consideration constitutes the limb of the syncline structure.
It crops out in the Lamazuri river bed at a height of 2050-2180 m. Volcanites occupy the upper part of the aleuropelitic thickness. They are represented by three sheets (50, 12 and 15 m thick).

The first, lowermost, 50 m sheet concondantly interlies laminated black aleuropelitic shales with small pyrite concretions. At the sole of the body the shale members have lighter colour and are turned into adinole (10-12 cm); at the roof the shales are quite fresh. At the lower part the sheet is represented by light green brecciated rocks (0.8 -1.2 m thick). The debris constitutes 35-37% of the rock. The outlines of derbis are fused, 1x3 cm or more in dimensions. There are distinguished breccias of light green and dark colours.

Light-green breccias are represented by aleuropelitic formations of sedimentary origin whereas dark green breccias are of volcanogenic genesis and relict microlitic and ophytic textures are established in them. Lava, taking the role of cementing material, has been recrystallized and turned into granular-scale aggregate of albite-chlorite-epidote composition. The author considers the rock to be tuff breccia.

The quantity of sedimentary breccia gradually decreases and simultaneously tuff breccia turns into lava-breccias (with 1.0-4.0 m interval) and nearer to the roof the latter becomes massive, having relict dolerite texture. Plagioclase has turned into saussurite and pyroxene into a chloride-epidote aggregate. The changed dolerites occupy the central part of the roof (5.0-30.0 m) and the body is completed (30.0-50.0 m) by pillow basalts. Large pillow formations have ellipsoid structure and the smaller ones spheric structure.

The space between pillows is filled with siliceous, epidote-carbonate or chloride-carbonate material. The pillow bodies have hardening crust represented by devitrificated glass. Towards the center the rock assumes intersticial structure, built of curved, bifurcated and elongated laths of albite and chlorite and further, intersticial-ophiolitic ones. Sometimes large pillows are of relict-ophitic structure turning into lepidoblastic. The rocks are rich in amygdaloid cavities, filled with epidote, chlorite and carbonate.

The second sheet, as a whole is massive and only in the sole (0.20-0.80 m) there occur brecciated formations – tuff lavas. Greyish dark grey breccias of aleuropelitic structure represent cement-recrystallized glass of basaltic composition. The massive part of the body is light green, has relict intersticial-ophitic structure, primary minerals being preserved only as primary contours. Plagioclase has turned into saussurite-carbonate aggregate and pyroxene – into uralite-chloritic laths. The body is concordant in laminated aleuropelitic memb.
### Table 1

Results of Chemical Analyses of the Late Pliensbakhian-Early Toarcian Volcanic Rocks

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<th>Order</th>
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<th>FeO</th>
<th>Fe₂O₃</th>
<th>MgO</th>
<th>CaO</th>
<th>Na₂O</th>
<th>K₂O</th>
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<th>Heating pass</th>
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Kvachadala-Lamazuri basin

Stori-Mazimchai Interfluve

Khevsureti

Mountainous Abkhazeti
The Late Pliensbachian - Early Toarcian Volcanic Complex of the Shaly Zone...

the same chemical (Table 1) and mineral compositions and physical-mechanical and technologic properties.

The main primary rock forming minerals of the complex are basic plagioclase and pyroxene. Comparatively fresher ones are found only in holocrystalline varieties of the complex. In the other textural varieties the principal minerals rarely preserve their primary appearance. Plagioclases are albitizated or turned into saussurites. Pyroxene turns into chlorite and lamellar or needle actinolite rarely develops over it. Volcanic glass has turned into epidote-zoisite, epidote-carbonate or albite-chlorite-carbonate granular scarry mass.

All the investigated principal kinds of volcanites satisfy the requirements of the State Standard Committee 9679-84 according to the reduced (111 samp.) and broadened (10 samp.) program. The results of investigations according to the broadened program are given in Table 2.

As the analyses of the received results show, all the investigated varieties of rocks completely meet the requirements set to ornamental stones. They belong to the group of more resistant rocks and thus may be used for lining, facing and floor and stairs boarding where the maximal volume of traffic is 100 men per hour or even more. As for radioactivity, the rocks belong to the first class and are allowed to be used in great quantity.

The reserves of C\textsubscript{1}+C\textsubscript{2} category and the predicted resources of the deposit have been calculated. On the basis of the author’s recommendation, in 2007 the Ministry of Natural Resources and Protection of Environment gave a licence for commercial mining of the Kvachadala deposit.

Thus, multi-year investigations of Late-Pliensbachian-Early Toarcian basaltoids from the shaly zone of the Southern Slope of the Greater Caucasus, have demonstrated that sheets at full length preserve sufficiently stable homogeneity of chemical composition and textural-structural properties as well as of mineral composition and character of variation.

Study of the volcanogenic complex, revealed at the Kvachadala deposit, proved the availability of high-quality raw material for manufacturing blocks and tiles with various surface texture for lining and facing walls of buildings and structures.

Considering the results, the author assumes that there may exist analogous deposits at full length of outcrops of the Southern Slope of the Greater Caucasus from the headwaters of the river Bzybi to Trans-Alazanian Kakheti inclusive. The author recommends carrying out special geological investigations in this direction.

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Table 2

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<th>Water absorption%</th>
<th>Specific weight gr/cm\textsuperscript{3}</th>
<th>Porosity%</th>
<th>Attrition gr/cm\textsuperscript{2}</th>
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ვულკანობზე

კავკასიის სახელმწიფო ფართობის ვულკანობის ასოციაციის 80-წლების ისტორია

3. უწყებები

о. ქართველი ოზურის სახელმწიფო უნივერსიტეტი

(ქართული რუკა, უნივერსიტეტი: თბილისი)

REFERENCES


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