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STUDY OF "SARALSK" DEPOSIT FOR PRACTICAL APPLICATIONS IN CONSTRUCTION

In article the results of research of structural features and technical properties of andesite - basalt stone rock of the "Saralsk" deposit are given. The material is estimated by its mineral - petrographic composition, and the cuts/refinements of stone materials have been made for the microscopic study of mineral-petrographic composition. Researches are conducted according to requirements of acting standards and as a result, it became clear, that the rock consists basically of minerals opacitized hornblende and plagioclase, it doesn't contain any no secondary minerals such as hydroxides of iron, chlorites, epidote, quartz, saricite, etc. Petrographic researches have allowed to determine the species of stone rock. The density, strength, water resistance and frost resistance of stone rock are studied. The suitability of the material for practical application in construction, including for external works, is revealed.

Keywords: structure, texture, density, strength, water resistance, frost resistance.

Introduction

The main features by which a natural stone species can be determined are, as is known, position, structure, mineral and chemical compositions. The Geological phenomena to which rocks owe their origin define: being in nature; position and its association with other rocks; mineral and chemical compositions; structure and texture of the material [1].

The article contains the results of petrographic and technological research of stone rock of the "Saralsk" deposit. Preliminary the material is visually defined as a rock belonging to andesite - basalts. The differentiation of basalts and andesites is the important problem of systematizing igneous rock, as both these groups of rocks are closely connected by continuous transitions between themselves. The difficulty of defining the boundaries between them is that it is difficult to determine the exact quantitative mineral composition. As, they contain an uncrystallized base mass of glass and its devitrification or decomposition products, which makes it absolutely impossible to accurately define the composition under a microscope. Therefore at establishing boundaries the chemical analysis of rock is necessary.

For successful application of natural stone, as an architectural-construction product especially in external works, experimental study of its main qualitative indicators is necessary, among which, research aimed at detection of resistance of material to various external influences is most significant.

Materials and methods

The stone rock of the "Saralsk" deposit for the purpose of establishment of suitability of the material for external application in the form of architectural-construction products is investigated.

According to the technical requirements of the relevant standards, the material is estimated by its mineral - petrographic composition, and also resistance to environmental influence, mainly water and frost resistance. For microscopic study of mineral-petrographic composition, sections of stone material have been made; based on analysis of powder from crushed rock, chemical composition of stone is revealed; density, strength, water and frost resistance are studied on samples-cubes with a rib size of 100 mm.

Researches are spent according to requirements of operating standards [2].

Literary review

The questions of geological-tectonic, petroleum-chemical and geochemical features of the magmatism of the tectonic zone of the Alevyrdy ore area of Armenia, where the "Saralsk" deposit is located, are dealt with by numerous researches, on which quaternary emissions of pyroclastic material have a type of areal or multi-outlet eruptions. On relatively strong areas of earth crust of the Debed's rock sets arose faults from which the basalt lava streamed. Numerous crossed cracks were weak places, especially in crossing places where the message with the magmatic pocket was established, and arose craters of volcanoes. Craters of volcanoes existed short time. After eruption the fault cicatrised, at further revival of volcanic activity on the same crack or in new crossing of cracks there was a new center of propagation of basalt lavas, in some cases changing during volcanic history its composition. Basalt and andesite lavas of this region of Armenia, streaming on the surface of the earth and cooling in the form of streams and covers, mainly formed a blocky crust. The upper solidifying layer was broken off on angular blocks with sharp ribs and stretched crosspieces between them. With the lapse of time, these crosspieces were broken off, creating an original completed blocky surface. In the quaternary lavas of the Armenian volcanoes, owing to weathering and frost action, the blocky lavas were subjected to disintegration, creating scatterings of blocks of the andesite-basalt, which has already lost the characteristic features of the real blocky lavas [3].

Many petrographs consider basalt magma to be the "parent" primary, from which all other eruptive rocks could occur by differentiation and also by contamination the more silicate-rich material of earth crust. Together with basalts, andesites, as is known, are the most widespread stone rocks. Basalts consist approximately equally of plagioclase and iron-magnesian minerals. Basalt structure is often zonal or sand-glass, medium and macro-crystalline and porphyritic. The microstructure of base mass is most often intersertal, microdoleritic is also quite common, ophitic is less common, and little-crystallized types with hyalopilitic and hyaloophytic structure are less extended.

Andesites are characterized by a macroscopically aphanitic base mass essentially consisting of lime-sodium plagioclase together with subordinated amount of pyroxene and some amount of glass. Such a base mass sometimes entirely builds up the whole rock, but is more often the base mass containing phenocrystals of lime-sodium plagioclase. More acidic plagioclases are characteristic for corniferous and mica andesites, more basic - for augitic. Phenocrystals, as a rule, are with the developed zonal structure and have common tablitic appearance. The zonal structure of plagioclase for andesites is characteristically more than for basalts [4].

Results

On the basis of microscopic study of rock sections, it is revealed that the rock consists basically of minerals opacitized hornblende and plagioclase (up to 30% of the rock). The hornblende pleochroes in red-brown tones, from ash-light-green to red-orange and yellow-red and is surrounded by an opacitic edge consisting of opaque small grains of magnetite. This mineral is represented by two generations of elongated narrow prismatic crystals: the first - with the sizes of 1.5... 4.5 mm, the second - less than 1.5 mm. Plagioclases are also represented by two generations, the first of which is porphyritic phenocrystals, in the form of short thick impregnations with the sizes 1.0... 2.0 mm, and the second generation - microlites with the sizes less than 1.0 mm.

The texture of the rock concerns type "massive". The rock structure is microporphyritic and porphyritic with the microlitic structure of the base mass. The relation of fine impregnations and fine-grained base mass is approximately the same and is 48% and 52%, respectively. Visually, the rock has no macrocracks, macrocrosses, and macrocracks are not found by microscopic studies on either opacitized prismatic phenocrystals hornblendec or on the surface of watery-transparent phenocrystals of plagioclase.

There are no secondary minerals in the rock, such as hydroxides of iron, chlorites, epidote, quartz, saricite, etc., xenoliths, xenocrysts and accessory minerals are also not found. There are no impurities of solid and loose minerals, there are no inclusions of quartz, silicon nodules, clay and other harmful rocks.

Table 1 shows the chemical composition of the stone, the content of which components is average value of the analysis of three samples of powder of ground rock.

Table 1. Results of the chemical analysis

The content of components, %							
SiO ₂	Al ₂ O ₃	TiO ₂	Fe ₂ O ₃	CaO	MgO	K ₂ O+Na ₂ O	SO ₃
60.18	17,49	0.61	5.78	5.63	2.55	6.29	0.29

Table 2 shows the results of the study of the main qualitative indicators of stone rock. Average values of density and strength were determined by testing 20 stone samples. Coefficients of water saturation, softening and frost resistance are average values of the corresponding indicators of three tests. In experiments on frost resistance, six control and nine basic cubes were used for each cycle of alternate freezing in the climate chamber and thawing in room conditions.

Table 2. Results of study of the main qualitative indicators of stone rock

Average density, kg/m ³	Average strength at compression, MPa	Coefficient of water saturation	Coefficient of softening, $K_{softening} = R'_{av.}/R_{av.}$	Coefficient of frost resistance at 100 cycles of tests
2192	76.4	0.46	0.869	0.96

Discussion

On the basis of petrographic researches, chemical and mineralogical compositions, structural and textural features of the material are revealed, analysis of which results has allowed to define that the studied stone rock is corniferous andesite.

Corniferous andesites, as is known, are characterised by a combination of the phenocrystals of plagioclase and hornblende, plagioclase with the impregnated biotite. In addition, pyroxen, mainly hyperstene, can be found, and to this sign andesites receive the name corniferous. The corniferous andesite, as a rule, is richer in silicate, that is visible on chemical composition of the material and has affected the microlite structure of the base mass. There are clearly expressed traces of opacitization of the hornblende, which explains the colour of the material. It is necessary to underline, that it is not connected with superficial low-temperature changes, with weathering. The phenomenon of hornblende opacitization can be explained as follows. At contact with air oxygen, the bivalent iron is oxidized to trivalent, the reaction causes the temperature of the andesite lava poured out on the surface to rise. At the same time around phenocrystals of hornblende there is formed opacitic edge, as a result of which green hornblende is painted in orange-red and brown colors.

The analysis of results of technological researches has shown that stone rock has density of 2.200 kg/m³ and strength of 76.4MPa, which corresponds to the rocks of the andesite species. Coefficients of softening (0.869), water resistance (0.46) and frost resistance (0.96) testify to sufficiently high quality of stone rock, that allows to recommend the studied material for wide application in construction practice, including for external works.

Conclusion

The investigated natural stone material of the "Saralsk" deposit on its mineralogical and chemical composition is hornblende andesite. It consists of impregnated hornblende and plagioclase in the form of tablitic porphyritic phenocrystals, smaller sheets and microlites. Rock-forming minerals of andesite are not subject to secondary changes, traces of weathering of the material are absent.

The hornblende andesite has a "massive" texture, the structure of the rock is microporphyritic and porphyritic with the microlite structure of the base mass. In rock are absent macro- and microcracks, are not found out impurities of secondary and harmful minerals.

The revealed basic technical characteristics of a stone testify to high quality of the material and sufficiently resistant to negative influences of environment.

The complex analysis of the results of petrographic and technological researches of stone rock of the "Saralsk" deposit has shown the suitability of hornblende andesite for practical application in construction, including for external works.

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