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INTRUSIVE IGNEOUS ROCKS DEPOSITS FROM THE SOUTH-WESTERN OF ROMANIA, USEFUL FOR CONSTRUCTIONS

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Abstract: Igneous rocks have resulted from the cooling of magma or silicate melts of the lithophile elements. If an eruption occurred cooling was rapid and fined – grained, volcanic rocks resulted. Among the plutonic rock, granites and granodiorites are combined. Igneous rocks vary in texture from massive to ash. The deposit is a geological body or a natural concentration of useful substances which can be economic exploited. The exploitation consists in an assembly of mining works in order to extraction useful mineral substances from deposit. Igneous rocks are of considerable importance in the constructions, in numerous industrial domain civil constructions, dwelling building, roads, building materials, heavy and chemical industries. Rock samples were prepared as their section for mineralogical analysis, and as eprouvettes in order to determine rheological properties. The location of the igneous rocks deposits in the western part of Romania can be concluded from the geological map. The values of the resistances to tearing of compression lies between 2200 – 2800 daN/cm2, for the resistance to shock (impact) between 30 - 65 daN/cm2, the resistance to wear at 0.01 - 0.02 g/cm2, the coefficient of strength 22 – 28, the volume weight 2800 – 3200 kg/m3, with small porosity of 0.2 - 1 %, and the water absorption is practically zero. The scientific results have been obtained during a few decades. The main objectives of the scientific researches, effectuated in the south-western of Romania, have been proposed to identify the magmatic rocks deposits and its reserves, and to determine the physic and mechanic characteristics, like strength coefficient, resistance to compression, strength under shock, to breaking, to freezing and to impact, resistance to shear, and the mineral composition, in order to use as construction materials for roads, railways or buildings and other structures.

Keywords: deposit, granite, diorite, gabbro, stock

1. INTRODUCTION

Rocks are units or associations of more natural minerals, frequent crystallized, defined through structure, texture and mode of formation.

Earth's 4.57 – billion - year history can be reconstructed from the shreds and patches of rock that adorn its crust, for here, layer by sedimentary layer. Plate tectonics theory suggests that Earth's thin crust or lithosphere floats on the mantle and is broken into 15 or more plates. Each plate is free to move and interaction with its neighbors convergent or divergent and forms rocks [8].

The Earth's crust consists of 80 elements that make up the majority of the rocks, distributed in about two thousand characteristic compounds or minerals [4].

Igneous rocks have resulted from the cooling of magma or silicate melts of the lithophile elements. If an eruption occurred cooling was rapid and fined – grained, volcanic rocks resulted. Among the plutonic rock, granites and granodiorites are combined. Among volcanic rocks, basalt and basic andesites predominate.

Igneous rocks vary in texture from massive to ash. The minerals of high melting point crystallize first, yielding large and crystals termed ***phenocrysts***. At the other extreme, when cooling of volcanic extrusive has been very rapid, crystallization of minerals is prevented and ***glassez*** results [8]

The ***ore*** is a geological product forms from one mineral species or by a mineral association from which can be extracted metallic substances (Fe, Cu, U, Pb, Zn, Au, Ag etc.) [7]

A geological body is a volume of rock, delimited in order to study. The field geological works must elaborate a field map and the initial state of equilibrium.

The ***deposit*** is a geological body or a natural concentration of useful substances which can be economic exploited [6].

A geological investigation presumes a geological survey followed by geological prospecting, exploration and exploitation.

The prospecting consists of an assembly of field geological methods, geophysical, geochemical and radiometric, in order to make obvious the mineral deposits [1].

The exploration pursues estimation and evaluation the industrial reserves of mineral substances, the quantity and quality of ores, and to establish the efficiency of exploitation.

The exploitation consists in an assembly of mining works in order to extraction useful mineral substances from deposit.

For the purpose of draw up geological mapping, in the field phase of geologic survey it is necessary to establish the data relative to geological profiles, the contact between the geological formations, the layers position, the unconformities and tectonic style, and the ratio between orogeny and hydrograph. In the end it is necessary to realize an entirely characterization

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of the mineral useful deposits, and to establish the mineral reserves from the territory in order to exploitation in the future [3].

Igneous rocks are of considerable importance in the constructions, but also in numerous industrial domain crude or processed state. Such domains are civil constructions, dwelling building, roads, building materials, heavy and chemical industries, the processing industry [5].

2. MATERIAL AND METHODS

The igneous rock deposits surveyed are placed in the western region of Romania, rather in the counties Arad, Timiș, and Caraș–Severin.

The analytical data and the physical – mechanical characteristics of the rocks from deposits have been realized by sampling.

Rock samples were prepared as their section for mineralogical analysis, and as eprouvettes in order to determine rheological properties.

The thin section has been analyzed with polarizing microscope for light minerals, heavy minerals and opaque minerals.

Rheological characteristics were determined by trial laboratory and were: resistance to compression, shearing strength wear hardness, tearing – strength test, frost cleftness test, mechanical shock resistance.

Geological investigations made inside the deposits allowed to determine some characteristics such as the declivity and the position of geological stratum, the presence of discontinuities and fissures, the volume of reserves.

For some of rocks have been made total elemental analysis.

3. RESULTS AND DISCUSSIONS

The location of the igneous rocks deposits in the western part of Romania can be concluded from the geological map, presented of scale 1:1000000, figure 1.

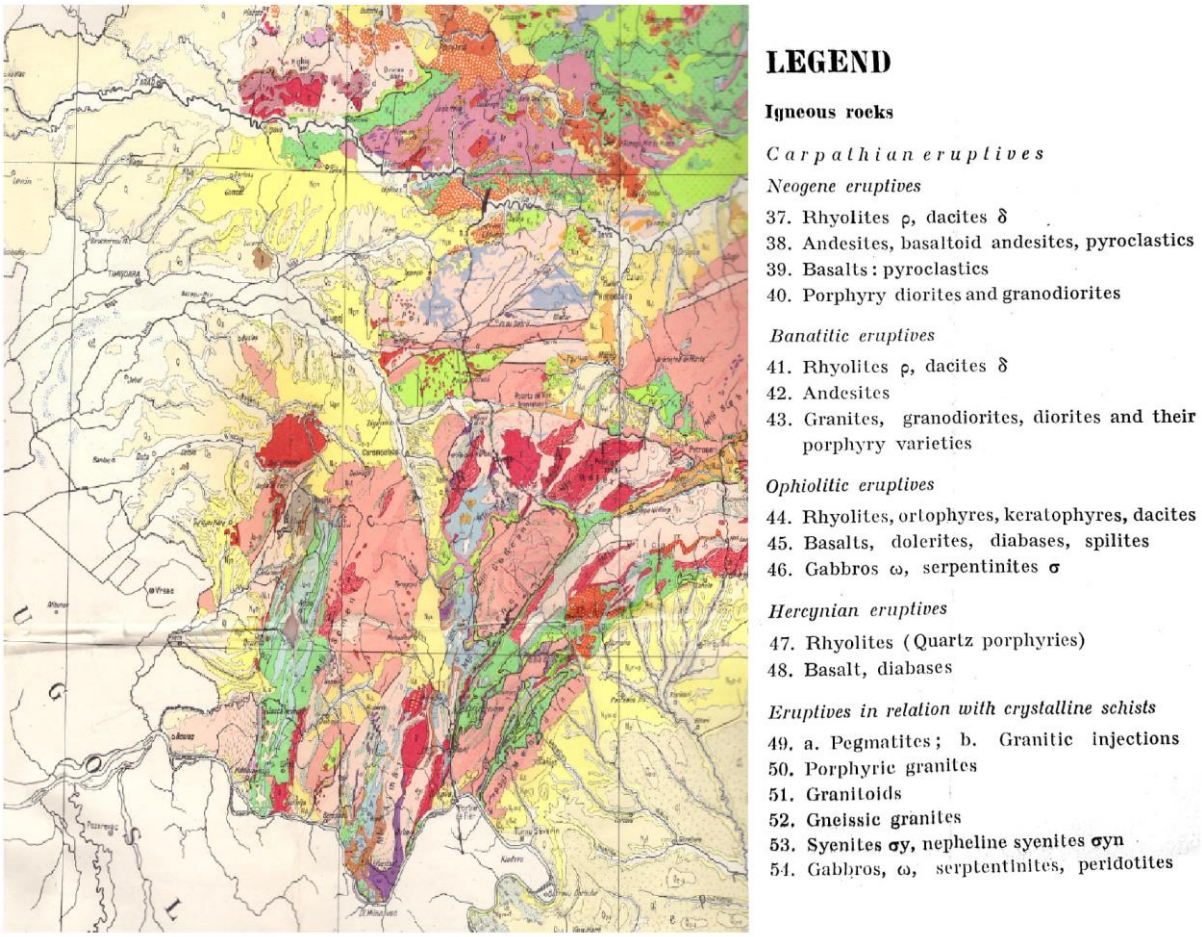

Figure 1. Geological map of the western part from Romania [10]

The association of minerals in these rocks results from the fractional crystallization sequences (figure 2):

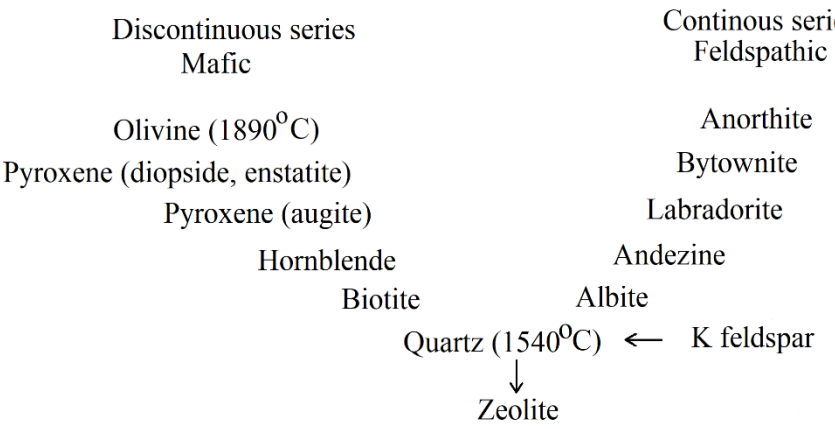

Figure 2. Crystallization sequences [2]

1. Granites deposits

The granite denomination originates from Latin – granum, and the rock is granular. The structure is holocrystalline, namely the principal minerals can be seen with the naked eye (phaneritic structure).

The granites contain quartz, as a rule over 20 %, alkaline feldspars (microcline, potassium feldspar) and plagioclase feldspar (albite). As mafic minerals are hornblende, pyroxenes and biotite. According to the quantity of mafic minerals, the granites can be grey, yellowish, pink, reddish or even bluish.

Some of the granites contain in abundance zircon, thorite, fluorite.

The physical and mechanical characteristics are dependent on the structure and mineralogical composition. As, for example, a great content in mafic minerals have a negative influence on the rheological properties, like compression resistance, wear hardness, strength under shock.

The values of the resistances to tearing of compression lies between 2200 – 2800 daN/cm^2, for the resistance to shock (impact) between 30 - 65 daN/cm^2, the resistance to wear at 0.01 - 0.02 g/cm^2, the coefficient of strength 22 – 28, the volume weight 2800 – 3200 kg/m^3, with small porosity of 0.2 - 1 %, and the water absorption is practically zero.

The granites are used for a various construction works, masonry works, public works, building, maintenance works, for roads, concrete units, decorative works, socle for monuments. It is estimates that in the future, the granites will became ores for metals extractions. A hundred tons of granites contain: 8 t Al, 80 t Mg, 14 kg V, 5 t Fe, 540 kg Ti, 80 kg Cr, 18 kg Ni, 4.5 kg W, 9 kg Cu, 1.8 kg Pb, and also a content of thorium (Th) and uranium (U) energy equivalent to 50 t coal.

The main deposits studied are: Barațca, Cladova, Galșa, Radna, Săvârșin, Ogradena, Șoimoș, Nădrag, Brădișor, Surduc, Forotic, Iuți.

Barațca deposit

There are considerable reserves of grey granite detached in reefs and blocks with different dimensions, situated at 300 m to the north of settlement Barațca, next to the river Mureș. The rock is used as building stone, raw or cut, for roads, and ballast for railway.

Cladova deposit

It is situated on the Cladova hill and at the Cladova valley. It can be found as reins or even as granitic massive but also as quartz – granodiorite and quartz – diorite. It is recommended to use as raw or polished stone for dams, bridges, viaducts, supporting – wall, pavements.

Galșa deposit – Vineyard hill

Near by the highroad Arad – Ineu, the deposit is formed of alkaline granite, fissured and grey. Raw stone, can be polished and used decorative. The reserves are great.

Radna deposit

This deposit belong to acid granites from the mountains Highiș – Drocea, but gneissic facies. Gneissic granite of Radna appear on the slope named Popilor, to the north of the Radna town, at 400 m.

The main parameters determined for this deposits are: ρ_a = 2.63 g/cm^3; c = 97 %; δ_{rcu} = 1800 – 1950 daN/cm^2; K = 65-70 daN·cm/cm^3.

The use is: ballast for railway and roads, kerb and paving stone, varied building.

Săvârșin deposit

The deposit is situated on the valley Corbului, at 2.5 km to the north of Săvârșin. The granite is rich in biotite and has a blackness color, sometimes pink. The deposit has good conditions for exploitation, with great reserves.

Ogradena deposit

At the north – east of settlement Ogradena, in the southern part of Banat, in the Danube Gorge, on a considerable area, develops a massif of granites, wide crystallized, white, rich in biotite and in the shape of huge blocks. The rheological properties are: ρ = 2.65 g/cm3; ρ_a = 2.62 g/cm^3; c = 98.85 %; δ_{rcu} = 2150 daN/cm^2; δ_{rcg} = 1870 daN/cm^2; K = 68 daN·cm·cm^2. There are very great reserves.

2. Banatites deposits (granodiorite + diorite)

The scientific term “banatite” has been introduced by Cotta B. (1865) for the igneous, rocks, which have a large spread in Banat region along two alignment:

- the former is on the direction Ocna de Fier – Oravița – Sasca – Moldova Nouă, formed by

granodiorites with inclusions of sienodiorites, and aplotes, pegmatites, porphyries.

- the second is on the direction Lindenfeld – Anina – Bozovici – Berzasca and is formed from granodiorites and diorites (with quartz and porphyry).

Șoimoș – Arad deposit

The deposit is situated in the immediate vicinity of the railway station Radna and it is exploited in a quarry of 800 – 900 m long together with granites. The granodiorites are grey – greenish, and the main properties are: ρ_a = 2.78 g/cm^3; c = 98 %; δ_{rcu} = 1600 - 1900 daN/cm^2; K = 85 daN·cm·cm^2.

The stone can be used raw for supporting wall, bridges, roads, railway or carved as cobble stone.

Nădrag – Timiș deposit

Granodiorite strong cracked, grey – greenish, exploited in quarry of 60 m long and 50 m height, situated at about 3 km upstream of the settlement Nădrag. Because is strong altered, the granodiorite has a weak resistance, but can be used for road foundation, ripraps, covering materials.

Brădișorul de Jos deposit, Caraș – Severin

The deposit, exploited in a quarry, is situated in the immediate vicinity of the railway Oravița – Anina. Can be used for building, railway, roads. The rhyolitic properties are: ρ_a = 2.60 g/cm^3; c = 97.42 %; a_1 = 0.57%; δ_{rcu} = 1230 daN/cm^2.

Surduc – Forotic deposit, Caraș – Severin

The deposits are situated in two locations, in close proximity of the railway Berzovia – Oravița: the first quarry is in Surduc, with reserves of granodiorite, and the second in Forotic with diorite.

A half from the quarry Surduc has next to granodiorite a great quantity of gabbro.

Gabbro deposit

Magmatic intrusive rocks, with crystals visible with the unaided eye and massive texture. The name provided from Latin "glabrous" – shiny. The color of the rock is dark – green or black – bluish, with a shiny from the mafic minerals (augite, olivine, dialog, hornblende). There are also other minerals, about 50% from the total, like anorthite, but also chromite, magnetite, amphiboles, garnets.

The strength coefficient is great of 18 – 25, volume weight 3000 – 3200 kg/m^3, the resistance to tearing of compression 1800 – 2500 daN/cm^2, resistance to shock 50 – 62 daN cm·cm^2 resistance to wear 0.5 – 0.77 g/cm^2, and resistance to acids.

Gabbro is rich in Cr, Ni, Co, Cu, Fe, V and Ti.

Iuți deposit, Donau Defile (Banat)

The deposit is situated near the settlement Tișovița, between the rivers Iuți and Tișovița, which make the separation of serpentinite. The color is dark – green and the massif of rocks is fissured in blocks. The resistance to tearing of compression is 1730 daN/cm^2, K = 62 daN cm/cm^2.

Very indicated for monumental works.

4. CONCLUSIONS

A total of eleven rock deposits has been investigated throughout the scientific research, from which six are with granites (Barațca, Cladova, Galșa, Radna, Săvârșin, Ogradena), four with banatites (Șoimoș, Nădrag, Brădișoru de jos, Surduc - Foieni), and one with gabbro (Iuți - Tisivița).

The presence of intrusive igneous deposits in the western part of Romania is a result of the geological structures, which in this region have numerous geological bodies, materialized nearby the Earth's crust.

The access to the quarry is relative easy, because there are roads and railways in the proximity, therefore the exploitation is a lucrative business.

All of the mentioned stonepits have considerable volume of stones, which, according to the analytical data processing obtained by scientific research in situ or in laboratory, will be used as crude – building – cobble – or decorative stone for civil engineering, hydrotechnic, roadwork or some other types of constructions.

Since the magmatic bodies have advanced towards the Earth's crust in the Superior Cretaceous period, polymetallic sulphides were constituted at the contact with limestones, therefore numerous eruptive bodies are rich in ores, which can be exploited for Cu, Zn, Ni, Co, Cr, Ti, W extraction.

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