

## SECTION 4

### LATEST ACHIEVEMENTS IN CONSTRUCTION, ECOLOGY AND ARCHITECTURE

#### RESEARCH OF BASALTOIDS PETROPHYSICAL PARAMETERS IN A CARBON DIOXIDE ATMOSPHERE

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In order to determine the physical properties of the basalt composition rock samples at the Vyhorlat-Hutinsky range (Transcarpathian region of Ukraine), a complex of petrographic and experimental petrophysical laboratory reseaches has been performed. A brief analysis of the results of these reseaches is given in this work.

The most common natural association within the Vygolrat-Hutyn range are rocks of andesite-basalt composition. However, the formed collection of rocks was in such a way as to describe the maximum possible petrographic variety of rocks from this region. Thus, the researched collection includes almost all petrographic groups of most volcanic centers of the VHP: andesites, andesitobasalts, andesitodacites, dacites, rhyolithodacites, rhyolites and pearlites (rhyolite composition). In this connection, generalized microscopic descriptions of the main petrographic differences are given. Changes in porosity cause variations in the volume density of dry extracted rock samples ranging from 1193 kg/m<sup>3</sup> to 2809 kg/m<sup>3</sup> (average value – 2404 kg/m<sup>3</sup>). The bulk density of the studied rocks saturated with the formation water model (NaCl solution) varies from 1716 kg/m<sup>3</sup> to 2818 kg/m<sup>3</sup> (the average value is 2498 kg/m<sup>3</sup>). The apparent mineralogical density of the rocks varies from 2390 kg/m<sup>3</sup> to 2834 kg/m<sup>3</sup> (the average value is 2634 kg/m<sup>3</sup>).

The coefficient of open porosity of rocks in atmospheric conditions determined by the gas volumetric method varies from 0.007 to 0.522 (average value – 0.108), and by the method of saturation with the reservoir water model – from 0.001 to 0.511 (average value – 0.094). The coefficient of residual water saturation of rocks varies from 0.53 to 0.90 (the average value is 0.824). The coefficient of effective porosity of rocks varies from 0.0005 to 0.179 (the average value is 0.018).

According to the results of our lab capillarometric studies by the centrifugation method, it has been established that the structure of the capillary space of the studied rocks has the following character: the content of supracapillary

pores varies from 3% to 42% (average value 9%); the content of capillary pores is from 3% to 23% (average value - 8%); and the content of subcapillary pores is from 53% to 90% (average value - 82%).

The analysis of the obtained data on the hollow space of the investigated rocks shows their diversity. Basalt rocks such as rhyolites and dacites (some samples) can serve as reservoirs for CO<sub>2</sub> burial. The coefficient of absolute permeability of rocks varies from 0.002 fm<sup>2</sup> to 2.079 fm<sup>2</sup> (the average value is 0.153 fm<sup>2</sup>).

After the analysis of the research results under the physical modeling of reservoir conditions, it is established that the permeability coefficient, when water is squeezed through samples with residual water saturation varies from 0.0001 fm<sup>2</sup> to 0.1365 fm<sup>2</sup> (average value 0.0138 fm<sup>2</sup>), the permeability coefficient when CO<sub>2</sub> is squeezed through completely the water-saturated sample varies from 0.00001 fm<sup>2</sup> to 0.0771 fm<sup>2</sup> (mean 0.0059 fm<sup>2</sup>). For that matter, it should be noted that the structure of the hollow space causes, in general, low filtration properties of the studied rocks, with the exception of some samples. Therefore, when CO<sub>2</sub> is buried in such structures, appropriate preparation of layers is required to increase their permeability.

The relative electrical resistance of the investigated rocks in atmospheric conditions varies from 3.4 to 3990 (average value 671). The porosity parameter in formation conditions has a range of changes from 2.6 to 2608.5 (average value 594.2). Based on the materials of electrometric measurements during centrifugation, the coefficient of increase in electrical resistance (saturation parameter) of rocks was determined, which varies from 1 to 2.261 (average value 1.387).

To sum up, as a result of the analysis of the performed lab studies (including electrometric ones), a number of correlation dependencies are constructed. Based on numerous experimental studies from the literature, it was established that the dissolution of basaltic rocks in CO<sub>2</sub>-enriched water is incongruent with the general composition of water and secondary mineralogy and pH. Changes in water chemistry are described as an increase in silicon, calcium, magnesium, and sodium over time and a decrease in aluminum, iron, and CO<sub>2</sub>. This created prerequisites for the interpretation of the results of the lab experiment on the saturation of samples of VHP volcanites with an aqueous solution saturated with CO<sub>2</sub>. Indeed, the exposure of rhyolite samples in an aqueous solution saturated with CO<sub>2</sub> indicates preservation or even an increase in their permeability, as they have high primary porosity, and the newly formed minerals do not deteriorate the structure of the pore and fracture space. On the contrary, samples of medium-composition volcanics (dacites) are characterized by a decrease in porosity and permeability, as a response to the deposition of carbonate minerals and clay. Pearlites do not form statistically significant changes in permeability against the background of a decrease in porosity. The reaction of VHP volcanics to the interaction with an

aqueous solution saturated with CO<sub>2</sub> is expected to reduce the density and, according to literature data, the velocity properties.

#### References:

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## THE ECONOMIC EFFICIENCY OF LAND USE OF THE RURAL SETTLEMENTS

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Rural settlements of Ukraine are small administrative units which differ from other settlements by their function. Rural settlement is a basic territory for management of agriculture. At first, the people, who live in rural settlements are the workers of agriculture. Secondly, the production assets and management of agricultural processes are concentrated in them. Thirdly, the industrial zones with cattle-breeding and recycling branches are frequently located in these settlements.

There have been many various types of settlements in Ukraine in the course of historical development. Rural settlements in the modern sense of the term appeared after the emergence of cities. Two main forms of the land use managing can be named: private and collective. But the main function of the rural settlement has always been providing the population with the foodstuff and clothes.

Recently, village is separated to a certain extent territorially and administratively from industrial agricultural lands. First of all, it is the place of residence for people and providing of social and other services for them.

In Europe rural settlements can successfully compete with cities in the level of social and economic development, therefore, the division of settlements into categories is frequently purely functional. The social and economic indices of rural settlements in our country are cons in settlements than in cities. It can be explained by a poorly developed infrastructure in villages, such as roads, engineering communications, consumer service facilities and other social objects.