On the question of the influence of elastic-anisotropic parameters of solid media on their geometric shape on the example of pebbles in the of Zavalishina Bay area (experimental data)

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On the northern coast of the Kola Peninsula, washed by the Barents Sea, there are white-stone beaches with unique egg-shaped pebbles. They are especially common in the area from Maly Oleniy Island to Maly Zelenetsky Island, where there are about 70 stone beaches at a distance of 40 km.

This article presents the first experimental studies of the elastic-anisotropic properties of rocks that make up egg-shaped formations on the coast of the Barents Sea, in order to establish the presence or absence of a relationship between these properties and the pebble morphology.

To determine the relationship between the morphology of pebbles and the elastic-anisotropic properties of the constituent rocks, 10 rock samples were taken from the samples in the form of a cube with an edge 2.1-2.6 cm in size. The mineral composition of the rocks was determined, which is represented by quartz diorites and plagiogranites. The rock density was determined by the Archimedes method. Acoustic polarigrams of the samples were constructed using the acoustic polarization method. Based on the data of acoustic polarigrams, the directions in which the propagation velocities of longitudinal (VPR) and transverse (VSR) waves were calculated were determined. Velocity data are presented as a quasi-velocity matrix. The anisotropy indices for longitudinal and transverse waves are determined.

An analysis of the results of determining the propagation velocity of longitudinal and transverse waves shows that each of the velocity characteristics of rocks contains a certain (deterministic) and some random (fluctuation) components. The average value of rock density is 2.68±0.08 g/cm3. Average longitudinal wave velocity (VPR) - 5.24±0.06 km/s, transverse (VSR) - 3.18±0.07 km/s. Analysis of the elasticity coefficients does not show significant values, which allows us to conclude that the rocks are composed fairly homogeneously and mechanical stresses in them in different directions are preserved.

The analysis of acoustopolarigrams together with the analysis of velocity relationships makes it possible to attribute all samples to the orthorhombic type of elastic symmetry. As is known, this type of symmetry consists of a system of two mutually perpendicular planes of symmetry. In the plane of stronger anisotropy, the maximum values of VPR are observed, while the VSR of weaker anisotropy is the minimum. Moreover, if a polymineral rock is formed in a field of compressive stresses, then, according to the works (Belikov, Kozhevnikov, Robin), the maximum orientation of the compressive force corresponds to the minimum values of the velocity VPR or the elasticity constant C. To determine the orientation of the stress components, Young's moduli (E) were calculated separately for each rocks in three directions of a cubic sample. From the results obtained, it can be seen that the stress field in the rocks was formed in the same way in two directions, and large values were determined in one direction. Geometrically, this is an ellipse. Such conditions of the formed stresses correspond to the formation of an egg-shaped pebble.

This work shows the presence of a connection between the elastic-anisotropic properties of the constituent substance and morphology.