



Structural interpretation of upper crust of the Khibiny area on the complex of geological and geophysical data and the results of 3D seismic and density modeling

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The area considered is located in the central part of the Kola Peninsula and represents a part of tectonically compound terrane, consisting of the AR, PR and PZ geological structures of the East of Fennoscandian shield (NW Russia). The Khibiny massif (PZ) intrudes the Archean complexes (the northern contact) and the Paleoproterozoic volcanogenic-sedimentary Imandra-Varzuga complex (southern and SW-contacts). Moreover this district includes several PGE-bearing layered mafic-ultramafic intrusions, which are related with Neo Archaean ÷ Paleoproterozoic rifting and plume activity (LIP).

According to the previous conceptions the shape of the Khibiny multiphase pluton is close to the asymmetrical lopolit, characterized by the steep eastern and northern contacts and the gentler south and west contacts.

The results of the 3D seismic and density modelling showed two correlated local high-velocity and high-density anomalies with dimensions of 5 x 10 km approximately in central part of the Khibiny massif (1) and close to contact with Imandra-Varzuga sedimentary-volcanic complex (2).

The first anomaly cannot be explained by "substance" factor only (titanomagnetite-apatite ore bodies), as it has a structural disconformity to general structure of the pluton. According to the numerous instrumental measurements the actual values of stress are significantly greater than values calculated by weight of rocks. It is important the main normal axis of compressive stress has usually quasi-horizontal position. Thus, the zone of abnormally high tectonic stress is the best explanation for this anomaly. The quick isostatic uplift of the massif after the digression of the last glacier, during which the rocks did not have time to unload, can be a source of the increased horizontal stress.

Based on the properties of typical rocks and geological structure of the region the second anomaly is well interpreted by large layered intrusion of Fedorova-Pana type, subsurface of which is cut by Khibiny massif.

The upper part of one, taking into account the current level of erosion, occurs at 2 ± 0.5 km from surface. The lower boundary is defined on the basis of loss of contrast in the density and velocity models in the range of 7÷9 km of about surface. Anomaly has angle of dip about 30-40° to the south. These boundaries well corresponds to regional features of localization of the layered intrusions of Fedorovo-Pana type, which are always agreed with the northern and north-eastern tectonic boundary of the Imandra-Varzuga paleorift and have the fall to the south at different angles in the range of 15° to 70°. Thus we forecast big "blind" (not outcropping) PGE-bearing layered intrusion, the upper part of which was cut during the magma intrusion of the Khibiny pluton.

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