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### Abstract

### Full Text

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### Geophysics

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# Principal Features of the Structure of the Earth' s Crust of the Greater Caucasus According to Gravimetric Data

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To study the structure of the Earth' s crust of the Greater Caucasus—a part of the Alpine geosynclinal belt—we have used mainly data on the anomaly of the force of gravity in local topographic reduction (the Bouguer anomaly with a correction for the influence of relief, the deviation of the geoid from the spheroid, and the masses located between these two reference surfaces), as well as the results of other geophysical and geological investigations.

The anomalous gravitational field of the territory under study is strongly disturbed. The largest minimum of the gravity anomaly, observed around the summit of Elbrus, is elongated along the Main Range within its central part. At the same time, in the eastern direction it is smoothed out very gradually, while also splitting into separate, widely distributed negative anomalous centers with a moderate horizontal gradient; in the western direction it changes most sharply, and the gravity anomaly assumes positive values with a zonal distribution parallel to the seacoast.

For a quantitative interpretation of these gravimetric data, 12 profiles have been run across the Greater Caucasus approximately across the strike of the isoanomalies, and curves of $\Delta g$ have been constructed along them. The interpretation of the latter was carried out according to the method proposed by B. K. Balavadze ([1]), taking into account seismic ([2,3]), geological ([4–8]), and densimetric ([1,9]) data, as well as the results of seismo-gravimetric investigations in the Transcaucasian Lowland along the line $A$—$A$ ([10]), which we adopted as the baseline. In this procedure the following assumptions served as the initial ones: the gravity anomaly here is caused mainly by the heterogeneous structure of the sedimentary complex and by changes in the depth of occurrence of the surfaces of the Paleozoic folded basement (the granite layer), the basalt layer, and the subcrustal substratum (the Moho surface).

The results of this interpretation, generalized for the individual surfaces of the boundaries of the main layers of the Earth' s crust and apparently reflecting the most probable picture, are presented in Figs. 1 and 2 as depth isolines.

Fig. 1 schematically illustrates the depth of occurrence of the surface of the Paleozoic folded basement. The basement, which comes to the surface in the central zone of the Greater Caucasus, plunges beneath sedimentary formations in all directions away from it and, as is evident from the diagram, lies in the zone of the Fore-Caucasus at a depth of 1-8 km, in the regions of the Taman and Apsheron peninsulas at 6–8 km and 14–16 km, respectively, and in the Riono-Kura depression at a depth of 0–14 km.

The surface of the basalt layer, in contrast to the basement surface, is characterized by the greatest subsidence in the central and eastern parts of the Greater Caucasus, approximately to a depth of 32 km, and -

**Fig. 1.** Diagram of the depth of occurrence of the surface of the Paleozoic crystalline basement in the Greater Caucasus region. **1** –isolines of the basement surface; **2** –areas where the basement reaches the present-day surface; **3** – borehole with bottom in Pg at a depth of 2.5 km; **4** –borehole with bottom in the basement; **5** –depth to the basement surface according to DSS or CMPV data; **6** –depth to the basement surface according to earthquake data; **7** – gravimetric profile.

**Fig. 2.** Diagram of the depth of occurrence of the surface of the subcrustal substrate (Moho surface) in the Greater Caucasus region. **1** –depth isolines of the Moho surface; **2** –depth of the Moho surface according to DSS data; **3** – depth of the Moho surface according to earthquake data; **4** –gravimetric profile.

down to the peripheries to a depth on the order of 20 km. It should be noted that the Kazbek transverse zone, which is less subsided (to 28 km), separates the two indicated regions of intense subsidence.

The surface of the subcrustal substratum, shown in Fig. 2, basically repeats the pattern of the surface of the basalt layer, with the difference that the Moho surface beneath the central part of the Greater Caucasus is depressed more deeply (to 64 km) than beneath the eastern part (to 56 km).

Thus, the thickness of the Earth' s crust of the Greater Caucasus increases markedly from the periphery toward its central zone; this results from an increase in the same direction in the thickness of the granite layer and from the subsidence beneath it of the basalt layer, which here also becomes somewhat thicker. Against the background of this general subsidence, in the central and eastern parts of the Greater Caucasus two roots each of the granite and basalt layers are outlined, whereas the high-mountain region of Kazbek situated between them does not have this feature.

These results are in full agreement with the conclusions of geophysical studies that the greatest thickness of the Earth' s crust, varying within the range from 50 to 70 km, characterizes regions of Alpine folding, and that the above-noted thickening in these regions may be due to an increase in the thickness chiefly of either the granite or the basalt layer ([1,3,11–14]).

Along with this, a certain regularity is also observed: the general features of the structure of the Earth' s crust of the Greater Caucasus described above correlate with the external geomorphological appearance of this region: the more extensive areas of high-mountain relief (the Elbrus regions and the eastern part of the Greater Caucasus) correspond to a greater thickening of the Earth' s crust in comparison with its narrowed region (the Kazbek region).

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*Note: Figure translations are in progress. See original paper for figures.*