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Abstract

Full Text

GEOPHYSICS

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FEATURES OF THE STRUCTURE OF THE EARTH' S CRUST IN WESTERN CENTRAL ASIA

The deep structure of the Earth' s crust is regularly connected with the structure of its surface layers and with the distribution within them of deposits of mineral resources (2, 3, 5, 11–13, 18).

In the present work we examine a scheme of the relief of the surface of the subcrustal layer (the Mohorovičić surface), compiled for the territory of Central Asia on the basis of materials from deep seismic sounding, seismology, and the results of quantitative interpretation of gravity-survey data. The scheme covers the territory of the Turkmen SSR, the Bukhara-Khiva region of Uzbekistan, the Fergana intermontane depression and the adjoining Pritashkent region to the west and the Golodnaya Steppe depression, and, to the south, the Tajik depression and the Pamir-Alai regions. In geological terms, the area studied lies within the ep Hercynian platform and the Alpine folded structures of the Kopet-Dag and Pamir-Alai that frame it on the south and southeast.

The most precise data on the structure of the Earth' s crust were obtained as a result of seismic soundings carried out by various organizations in the territory of the Pamir-Alai, the Fergana intermontane depression, the Bukhara-Khiva region, southeastern Turkmenia, individual districts of western Turkmenia, and the northern part of the Caspian Sea water area (6–10). Deep seismic sounding was conducted both according to complete continuous systems of observations (VNII Geofizika), which make it possible to obtain more precise and detailed data on the structure of the Earth' s crust, and according to incomplete systems of observations (Institute of Physics of the Earth, Academy of Sciences of the USSR; Complex Southern Geological Expedition, Academy of Sciences of the USSR). Along with the results of deep seismic sounding, materials from seismological investigations (1, 14, 16), carried out over a considerable part of the territory under study, were widely used in compiling the scheme.

Thus, the compilation of the scheme of the surface of the subcrustal layer was carried out on the basis of the integrated use of data from seismic and seismological investigations, which were extrapolated to the adjoining territory in accordance with the established regular relationships between the anomalous

gravitational field (in the Bouguer reduction) and the character of variation in the thickness of the Earth' s crust (⁴).

When considering the scheme of the relief of the surface of the subcrustal layer (Fig. 1), a general increase in the thickness of the Earth' s crust is noted in the southern and western directions—from 30–35 km in the region of the Kara-Bogaz-Gol Bay and the Central Karakum Desert to 50 km and more in the zone of the mountain structures of the Kopet-Dag, and from about 40 km in the Pritashkent region to 60 km and more in the Pamir-Alai zone. Thus, the limits of variation in the depth of occurrence of the surface of the subcrustal layer already make it possible to distinguish, within the territory under consideration, two different zones: a western zone, extending as far as the meridian of the city of Tashkent, and an eastern zone, encompassing the region of the Fergana intermontane depression and the Pamir-Alai. The distinguished zones also differ in the character of the relief of the surface of the subcrustal layer. The western zone has a comparatively simple structure, while the eastern one is considerably more complex.

[Map figure]

Fig. 1. Map of the isobaths of the surface of the subcrustal layer (Mohorovičić boundary) in the western regions of Central Asia, according to DSS data (Yu. N. Godin, I. P. Kosminskaya, B. S. Volvovskii, I. S. Volvovskii, V. Z. Ryaboi, and others), seismology (I. L. Nersesov, S. S. Andreev, E. M. Butovskaya, N. K. Bulin, Yu. I. Sytin, and others), and quantitative interpretation of gravity-survey data (Yu. N. Godin, I. S. Volvovskii, V. Z. Ryaboi, V. I. Shraibman). 1 – isobaths of the surface of the subcrustal layer: *a* –according to seismological data and *b* –inferred; 2 –regional deep faults: 1 –Fergana-Talas, 2 –East Kyzylkum, 3 –Bukhara, 4 –Mangyshlak-Central Ustyurt, 5 –East Kara-Bogaz-Gol, 6 –Sub-Kopetdag.

The complexity of the relief structure of the surface of the subcrustal layer of the eastern zone apparently indicates the state of an intensive tectonic regime in this region. The Fergana intermontane depression corresponds to a deep down-warp along the Mohorovičić surface. The mountain ranges framing the Fergana depression correspond to reduced thicknesses of the Earth' s crust. Conversely, for the mountain structures of the Alpine folded region of the Pamir-Alai, a subsidence of the surface of the subcrustal layer is noted.

In the western zone, against the background of a comparatively calm southward subsidence of the Mohorovičić surface, areas of relatively uplifted occurrence of the subcrustal layer are distinguished, corresponding to: 1) Kara-Bogaz-Gol, 2) the region of the Central Karakum, and 3) the Hungry Steppe.

The noted uplifts, especially the first two, have a clearly expressed northwestern extent and are separated by zones of deep faults, quite clearly traceable from aeromagnetic survey data; the Kara-Bogaz-Gol and Central Karakum uplifts of the surface of the subcrustal layer correspond to anticlinal uplifts of the

surface of the folded basement; the Bukhara-Khiva oil-and-gas-bearing province corresponds to a region of relative increase in the thickness of the Earth' s crust.

Toward the Alpine folded zone of Kopet-Dag the thickness of the Earth' s crust increases considerably. Within the Caspian Sea the increase in the thickness of the Earth' s crust occurs toward the pre-Alpine foredeep.

Thus, it may be concluded that on approaching the regions of mountain structures of Alpine folding (Kopet-Dag, Pamir-Alai), the depth of occurrence of the Mohorovičić surface increases considerably, whereas the Epihercynian mountain structures (the Nuratau, Fergana, Turkestan, and Kuramin ranges) correspond to a decrease in the thickness of the Earth' s crust. In other words, in the first case an inverse relationship is observed between the relief of the land surface and the level of occurrence of the surface of the subcrustal layer, and in the second—a direct one.

It should also be noted that the thickness of the crystalline mass of the Earth' s crust (after subtracting the thickness of the sedimentary cover) remains approximately constant within the platform. This fact apparently indicates that, in geologically homogeneous regions, the Earth' s crust does not undergo any special restructuring in the process of tectonic movements, and that the cause of the movements lies in physicochemical processes occurring in the subcrustal matter.

The presented scheme of the relief of the surface of the subcrustal layer is the first attempt to generalize the accumulated factual material on the study of the Earth' s crust in Central Asia.

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