

The role of exogenous geodynamic processes in the formation of the stressed state of intracontinental orogens

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The report discusses the mechanism of stress generation of increased horizontal compression in the crust of intracontinental orogens. It is generally assumed that the increased level of horizontal compression stresses existing here is due to the movements of lithospheric plates, for example, the Altai stresses are caused by pressure from the Indian Plate located at a distance of several thousand kilometers. These archaic views are based on long-formulated ideas on the genesis of the forces that determine the movement of lithospheric plates. But modern seismological, geophysical and tectonophysical data contradict these views.

In particular, it was found that the pressure from the ocean spreading zone is not the leading force of the movement of the ocean plate. Its immersion under the continental or subcontinental plate is caused by the action of gravity from the side of the submerged and weighted as a result of metamorphism of its part. Because of this, a horizontal stretching regime takes place in the lithosphere of the ocean plate, and at the same time, the stress of the least compression acts orthogonally to the trough stretch. The results of tectonophysical reconstruction of stresses show that in the crust of the island arc (for example, the Japanese Islands) or the continental lithosphere under conditions of horizontal compression, the level of these stresses is higher than the lithostatic pressure by 30-50 bar, which is very small. It is precisely because of this low level of horizontal compression that the stress state inversion occurred in the upper part of the crust in the focal area of the Tohoku earthquake (M=9.1, 2011).

On the other hand, the tectonophysical inversion of natural stresses, performed from seismological data in the Altai-and Sayan orogens, showed that horizontal compression here exceeds vertical by an average of 300-500 bar, which is much more than in subduction zones.

Our research shows that exogenous processes are the source of high-intensity horizontal compression stresses in the crust of Alpine-type orogens. According to the fission-track analysis of rock samples, the rocks that are now on the slopes of the ridges several million years ago were at a depth of 3-5 km or more. Under the conditions of these depths, the rock is in a supercritical state and here, as a result of fractured vertical compaction, horizontal compression is several times higher than the level of horizontal compression stresses of the purely elastic state. After this rock is gradually brought to the surface as a result of erosion of the slopes, a partial unloading of horizontal compression occurs. In addition, the compression that occurred in the supercritical state is preserved. This leads to the fact that a state of horizontal compression occurs in the upper part of the crust and at the same time a horizontal expansion of the rock is observed near the surface.

The report will show that the processes of formation of the stress field of intracontinental orogens are associated with the tectonics and deep geodynamics of these regions, and not with long-range processes.