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Balanced model of the folded sedimentary cover of the Greater Caucasus as a source of information about geodynamic processes on the scale of the lithosphere - statistical approach

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Geodynamic processes of formation of mobile belts operate during entire tectonic cycle since sedimentation up to recent uplift and erosion. In general, we can expect that some quantitative parameters of tectonic events will be associated with such processes, so they can be used to solve the inverse problem of recognizing quantity and nature of geodynamic processes.

The Greater Caucasus is a well-studied Alpine structure, within which the sedimentary cover (total thickness of 10-15 km) has a thin layering, deformed in small and moderate-sized folds. The folded structure was described in 24 detailed profiles with a total length about 500 km. Using a special method of sections balancing, models of the sedimentary cover were compiled, based on the balance of the sediments volume and the shortening values. By the method, profiles were divided into 505 "folded domains", for which their pre-folded states were restored. Then, the pre-folded domains were combined into 78 "structural cells", for which their shortening values were estimated.

For calculations, a three-stage's conditional model of the development of the Greater Caucasus was adopted: 1) sedimentation (Jurassic-Eocene), 2) shortening and folding formation (Oligocene), 3) uplift and erosion (post-Oligocene). Six parameters were digitized in the structural cells: the depth of the basement top for development stages (1, 3, 4), the shortening value (2), the amplitude of uplift and erosion (5), the difference between the depths of the basement top in stages 3 and 1 (6). Obviously, these parameters are directly related to geodynamic processes of the Greater Caucasus formation. The calculation of the correlation matrix showed the presence of such strong correlations between a numbers of parameters, which may have a genetic sense. Factor analysis was used to clarify all these relationships. It showed the presence of two well-defined factors that explain the main dispersion of the six parameters. Factor (process) F1 (named ISOSTASY) has a weight of 46.6%, the loads on parameters 1-6 were 0.790, -0.195, 0.665, 0.982, 0.005 and 0.853. Process F1 showed the dependence of the actual depth of the basement top (4) on its first value (1), which is clearly associated with isostasy and necessarily indicates an increase of the density of the crust rocks up to mantle values. The F2 factor (named SHORTENING) has a weight of 40.2%, the loads amounted to 0.022, 0.938, -0.736, -0.158, 0.957, -0.219. Factor (process) F2 indicated the dependence of the uplift amplitude (5) on the shortening value (2), which can also be associated

with isostasy and changes in the density of the crust and mantle rocks.

The calculation of the crust layer thicknesses for a part of the structure during the development, in which it has an isostatic equilibrium, showed its gradual degradation from 40 km (before a sedimentation) to 14 km after sedimentation and to present 19 km after folding and uplift (9.5 km without shortening influence).

Yakovlev F.L., Gorbatov E.S., 2018. On using the factor analysis to study the geodynamic processes of formation of the Greater Caucasus. *Geodynamics & Tectonophysics* 9 (3), 909–926.