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About an identification of geodynamic processes of Greater Caucasus formation with a use of a factor analysis of parameters of its folded structure

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Geodynamic processes of folded formation and uplifted mountain structure can reveal itself in some quantified parameters. As processes can have different intensity in different parts of the structure, the statistical research of the corresponding parameters for a set of objects can give an information on these processes.
The folded structure of Greater Caucasus (GC) characterized by 24 detailed cross-sections with a total length about 500 km. Sections were divided into 505 “domains” with the homogeneous folds morphology. Key parameters (an inclination of folds axial surface, a fold interlimb angle, domain width) measured in all domains. An approximation of parameters by a strain ellipsoid allowed restoring a pre-folded state and a width of each domain. The presumed model of GC structure development consisted of three stages: (I) post-sedimentation, pre-folded; (II) post-folded; (III) post-uplifted. All domains were aggregated into 78 “structural cells”; cells widths at stages (I) and (III) allowed to calculate a shortening value. For "cells", six parameters were measured (*) or were calculated. There are (1) depth of a basement top (DBT) at a stage (I) (b1*); (2) shortening value (Sh*); (3) DBT at a stage (II) after shortening (b2); (4) DBT at a stage III after uplift of mountains (b3); (5) amplitudes of a neotectonic uplift (b3-b2*); (6) a difference of depths of the basement (b3–b1) between stages (I) and (III). The received structure of GC in 78 cells is balanced on volume of a sedimentary cover and on shortening values.
Statistic investigation of six parameters of cells has had two stages – simple statistics and factor analysis. The mean value of parameter (6) is close to zero in spite of the fact that on some sections it deviated from +7 to – 15 km. It indicates specific action of an isostasy during the development of GC structure. Pair coefficients of correlation showed several high values, which have a possible genetic sense, for example, (R(2/5) = 0.818; R(1/4) = 0.708; R(2/6) = -0.461).
Action of several processes can be incorporated in each pair correlation. The factor analysis can distinguish their shares. The “Varimax” method showed existence of two factors, loadings of parameters (1-6) in which for 78 “cells” have next distributions. F1 = 0.790; –0.195; 0.665; 0.982; 0.050; 0.853, with total weight 60%. F2 = 0.022; 0.938; –0.736; –0.158; 0.957; –0.219; 27%. In F1, the depth of basement top (stage I) is main, on which the modern depth (stage III) depends. The shortening (stage II) plays key role in F2; the uplift amplitude is dependent. The isostasy, which seeks to keep the basement top depth, is a source of the first factor. The shortening process (external?) connects to the second factor. For realization of the isostasy action, it is necessary to allow changes of density of crust and mantle rocks in a wide range. Two processes explain 87% of distribution of parameters of GC structure and they are a necessary and sufficient set of mechanisms for an explanation of the structure formation.