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# Quasy-3D models of restored folded sedimentary cover of Alpine Greater Caucasus and evidences of isostasy participation in processes of folding formation and of mountain building

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Hinterland of Greater Caucasus (GC) has almost pure folded structure (stripe 1000x50 km) in alpine flysch-like sedimentary cover of 10-15 km thickness. Thin-layered sediments of hinterland formed relatively small folds (0.1-1 km width) and its strain allow to restore the structure in scale of whole sedimentary cover. Material of 24 detailed (1:10000, 1:100000) cross-sections of 510 km total actual length in three regions was used. Domains as 2-5 folds (totally 505) were selected. Strain inside of each domain (as ellipsoid) was described due to three measured parameters of domain geometry. There are value of shortening as interlimb angle, dip of axial plain, dip of envelope plain [1, 2, 3]. Three kinematic operations allow to restore actual domain to pre-folded state (and the same – ellipse to circle): rotation, horizontal simple shear, flattening [1, 2]. Gathering of sequence of domains in its pre-folded states allows to compile pre-folded state of whole sections and of its parts. By aggregation of 5-10 domains, 78 “structural cells” were formed for study of structures in scale of sedimentary cover. Relation of actual and pre-folded lengths of cells gave its shortening values. Value of shortening, initial thickness of cover, its post-folded thickness, also as depth of sedimentary cover bottom and virtual air-position of its top (uplift or amplitude of “erosion”) were found as result of observations, measurements and interpolations of cover thicknesses. Geological history was found as three stages: A) sedimentation (J1 – Pg2), B) pure folding/shortening (during of Pg3), C) pure neotectonic uplift (Miocene2-N2-Q). In regional aspect, results show certain regularities, and it may be used as initial material for study of some aspects of geodynamics.

Three regions of GC were studied: North-Western Caucasus (NWC) [1], Chiaur tectonic zone in South Ossetia (ChZ) and two zones in South-Eastern Caucasus – Tfan zone (TZ) and Shakhdag zone (ShZ) [3]. The shortening values for structural cells were found as 49% in average for ShZ (with deviations 37÷62%), 55% for TZ (36÷67%), 57% for ChZ (46÷67%) and 35% for NWC (0÷15÷67%). Correlations of six parameters of 78 cells were analyzed [4]: 1) value of shortening, 2) initial thickness of a sedimentary cover (stage A), 3) depth of post-folded basement top (stage B, calculation on 1 and 2), 4) actual depth of the basement (stage C, calculation on 3 and 5), 5) "amplitude of a neotectonic uplift", 6) “difference of depths” of basement top (between positions for stages C and A, parameters 2 and 4). For structures of NWC, for full (42 cells) and selected (32) sampling, important correlations of parameters were found: 1/5 R=0.79 (0.59), strong association; 1/6 R = -0.40 (-0.52), moderate; 2/6 R=0.40 (0.54) moderate. The same correlations for structures of TZ, ShZ and ChZ together made values R (1/5, 1/6, 2/6) = 0.63, -0.63, 0.36, and all-78 cells together have R = 0.81, -0.44, 0.39. Genetic interpretation of these three correlations were found as following: the more initial thickness of a sedimentary cover (2) preset the more difference of depths of the basement (6), deeper syn-folding and general subsidence (3 and 6) preset the more the value of shortening (1), and uplift and erosion (5) depends on shortening (1).

Average actual depths of basement top were close to initial thickness of sedimentary cover (parameters 2, 4) in the regions ShZ, TZ, ChZ, NWC [1, 3, 4]: -10 (-10) km, -13 (-12), -15 (-21) km, -13 (-13) km. Stability of this position is confirming by dependence of “uplift” from shortening (5/1) for the same regions: +9.64km/52%, +19.16/55%, +16.0/57%, +8.9km/35%. For NWC, as sequence for 8 sections, average values of “depth difference” (6) have small deviation from “0” (as maximal $\pm$3.5), but inside sections it may be very large (+2.1/-14.6, +7.5/-11, +5.8/-12.9 km). Analyses of stratigraphic column and of geological history of GC together with data about shortening values for tectonic zones (in scale of Earth crust) shows that rocks on level of possible Moho at J1 period (-40 km) now may have position at -100/-110 km for south part of GC [3]. It means that considerable part of crust rocks inevitably got a “mantle” density. Together with above-stated analysis of 1-6 parameters behavior, it means that isostasy take very important participation in processes of folding formation and mountain building.

1. Yakovlev F.L. // Izvestiya, Physics of the Solid Earth. 2009. 45. 11. 1023–1034.
2. Yakovlev F.L. // Comptes Rendus Geoscience. 2012. 344 (3–4). 125–137.
3. Yakovlev F.L. // Bulletin of “KRAESC”. Earth Sciences. 2012. 1 (19). 191-214. (in Russian)
4. Yakovlev F.L. // XLVII Moscow Tectonics Conference Proceedings, 2015, in press (in Russian)