Preliminary estimate of realness of geodynamic models of Greater Caucasus development with different shortening of structure by use of calculations of their theoretical volumes of eroded rocks

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Three geodynamic models of the Greater Caucasus (GC) with different value of shortening are compared in their parameter "volume of eroded rocks". Approximate similarity of volumes of eroded rocks with the volume of the synchronous accumulated sediments in foreland basins surrounding Greater Caucasus since Oligocene was criterion of models verisimilitude.

The neotectonic map was used as first model (of "fixism"). Vertical movements of uplift for 15 million years was shown here according to (Milanovsky, 1968). Fold-related shortening of space in Greater Caucasus ignored; uplift amplitudes were maximum 4-5 km in this model.

The second model had moderate shortening values (about 50%) in 78 structures about 5 km width each, which were studied in some parts of GC. This model is balanced on volume of sedimentary cover and on shortening values (Yakovlev, 2015). Calculated average uplift and erosion amplitudes for 30 million years are about 10, 15, 20 km for some parts of GC.

According to the third model of "accretionary prism" (Dotduyev, 1986), the minimum shortening of 200 km for 50 km width belt (80%) was declared. Data about raisings amplitudes were absent; however, an opinion of 4-5 km erosion is usual, but it is not balanced. Our estimates of balanced increasing of a sedimentary cover thickness (13 km) during of 80% shortening gives about 55 km of erosion in 50-60 km wide belt.

Thicknesses of Oligocene and N-Q terrigenous deposits in foredeeps around Caucasus were counted based on (Neotectonic Map, 1998) and (Milanovsky, 1996). Volumes of the accumulated sediments calculated on polygons 20×30 minutes of these maps, which summed up on next steps. The total amount of the Pg3-Q sediments around the Caucasus was 2610 thousand km3, including 592 thousand km3 for the basin of the Black Sea, which source of sediments is only GC.

The volume of GC mountain building (119 thousand km3) was calculated using a digital relief model. For calculation of an eroded rocks amount, the volume of mountains uplift should decreased on this amount. For the calculation of uplift according to model of "fixism", the technique of a summarizing of volumes on polygons 20×30 minutes of neotectonic map used. The volume of eroded rocks (uplift volume after correction) was 160 thousand km3, including 87 thousand km3 of GC western part (for the Black Sea's basin). It is 15% of actual volume of this part of sediments. For the balanced model, some operations of averaging and interpolations of data of uplift amplitudes were used before calculations of eroded rocks volumes on polygons 20×30 minutes and of their subsequent summarizing. After corrections, volume of erosion for GC was 826 thousand km3, and for the western part - 448 thousand km3 (76% of an actual volume). An estimation of eroded rocks volume for model of 80% shortening gives 2950 thousand km3 as minimum, including 1600 thousand km3 for western part (270% of real volume). It means that only the balanced model of GC structure with 50% shortening is realistic one.