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The Deep Structure and 3D Thermo-geodynamics of the Caucasus by Geophysical Data.

T. Chelidze, G. Gugunava, N. Gamkrelidze, P. Mindeli, J. Kiria, S. Ghonghadze, and O. Janovskaya

M.Nodia Institute of Geophysics, Ivane Javakhishvili Tbilisi State University, Seismology and Experimental Geophysics, Tbilisi, Georgia (tamaz.chelidze@gmail.com, (+99532)233-28-67)

The Caucasus is a continental collision zone, representing a connecting link between the Western and Eastern parts of the Alpine-Himalayan Belt. The structure and geodynamics have been studied rather well in both of the above mentioned segments of Alpine-Himalayan Belt, but remained problematic on the Caucasus.
Compilation of detailed digital geophysical data bases and their numerical interpretation by modern methods are needed for the quantitative solution of the problem of structure and tectonics of the Caucasus. The first steps in these directions are made in this paper.
The Caucasus is crossed by deep seismic sounding profiles “Gali-Safaraliev” (from the West of East) and “Bakuriani-Stepnoe” (from The North to South). Besides, there are the measurements of gravitational and magnetic fields at different heights along these lines. Integrated interpretation of the set of these geophysical fields by modern geophysical technique supplemented by the existing geological data allows approaching closely the solution of problems, related to structure and evolution of Caucasus.
Three-dimensional stationary and non-stationary geothermal and thermo-elastic models of the Caucasus and the Black and Caspian seas areas are developed and their geological interpretation is given. The temperature field has been defined for the period 410 Ma on the basis of the stationary model of the investigated region. The thermo-elastic equations were solved and both horizontal and vertical thermo-elastic displacements have been calculated on the basis of the thermal field using Hook’s rheology.
These models revealed a number of interesting features in the geodynamics of the region. Nevertheless, they did not give us an opportunity to consider the dynamics of models, taking into account the process of sedimentation. That is why afterwards, computations were carried out on the basis of a non-stationary thermal model beginning from the period of the sedimentary cover formation. Such approach allows the construction of three-dimensional non-stationary geothermal and thermo-elastic models of the Caucasus and the Black and the Caspian seas water areas proposed by the authors of this paper. Paleo-reconstruction schemes of development of sedimentary cover of the Caucasus (Sholpo, 1978) and the Black sea area (Kasmin at al. 2000) and a lot of other data regarding the Caspian sea area have been used for the construction of three-dimensional non-stationary models of investigated region. Numerical modeling of thermal and thermo-elastic processes allows revealing the temporal distribution of a number of thermo-geodynamic events including the formation of some deep faults and active seismic zones.
The above preliminary results on 3D structure and temperature fields in Caucasus were compared to recent publication on 3D crust structure and thermal model of Western and Central Europe (Tesauro, Kaban, and Cloetingh, 2010) and quite satisfactory agreement with our results was found for matching areas (North Turley, Black Sea, Crimea) of considered regions.