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Lithosphere dynamics within Vrancea zone (Romania), as inferred from space geodesy and gravity data

L. Besutiu (1), D. Ghitau (2), D. Zugravescu (1)

(1) Institute of Geodynamics of the Romanian Academy, (2) Low Danube University (Contact Email: besutiu@geodin.ro)

Despite many efforts, the active seismic zone in Vrancea (Romania) still stands as a challenge to geo-scientists worldwide. Intermediate seismicity in full continental environment is rare, and the size and geometry of the Vrancea seismic zone made it difficult to interpret kinematics of subduction and continental collision in the area. Consequently, various models were used on purpose, but all of them assume that intermediate seismicity within Vrancea zone is connected to the presence of a sinking lithosphere fragment in the upper mantle. Weather or not the above mentioned fragment is still attached to the crust bottom represents an open question. Several GPS campaigns, conducted under the CERGOP program umbrella, revealed a general upwelling of the crust in the bending area of East Carpathians, that could be interpreted as an elastic rebound of the bottom of the crust, following denudation and erosion of the mountain chain. However, it should be mentioned that the highest vertical velocity is not located at the ridge, but on the SE slope of the mountains, towards the Carpathians foredeep. The apparent miscorrelation suggests the presence of some additional tectonic factors actively involved in the lithosphere dynamics. In an attempt to approach the issue, a special gravity campaign was conducted in the area. Several stations of the national gravity reference network, located in the bending region of East Carpathians, previously measured about twenty years ago, were re-occupied and observed with the LaCoste and Romberg D-1141 gravity meter. New gravity values were obtained by referring to the datum provided by UNIGRACE network, and compared to the previous ones. Non-tidal changes as a general decrease of gravity have been thus pointed out for the geodynamic area, in apparent agreement with the general upwelling of the crust. The intricately aspect was that the lowest gravity low did not occur in the region of the highest crust deformation, but in an area were anomalous

lower velocity values are exhibited. There is a good correlation between areas of the lowermost gravity with relative lower velocity crust upwelling, and the location of the intermediate earthquakes. Therefore, the gravity change has been interpreted in terms of crust vertical “stretching” (due to its both differentiate top upwelling and, partly bottom lowering). It has been assumed that this complex phenomenon should reflect the presence of an elastic coupling between the crust bottom and the sinking relict of lithosphere.