IMPACT OF GRM: NEW EVIDENCE FROM THE SOVIET UNION

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Gravity information recently released by the Soviet Union allows us to make some quantitative assessment of how the GRM mission might affect our ability to use global gravity data for continental tectonic interpretation. The information released is of the form of isostatic response spectra for eight individual tectonic units in the USSR calculated by M.G. Kogan of the Institute of Physics of the Earth in Moscow. The regions examined include the Carpathians, Caucasus, Urals, Pamirs, Tien-Shan, Altai, Chersky Ridge, and East Siberian Platform. The $1^{\circ} \times 1^{\circ}$ gravity data used to calculate the admittances remain classified by the Soviet government. To date, the admittances have been used in two different sorts of tectonic studies of mountain belts in the USSR.

In the first study, McNutt and Kogan (1985) attempted to directly interpret the isostatic responses in terms of plate models of compensation for mountainous terrain. Using geologic information concerning time of the orogeny, lithospheric plates involved, and polarity of subduction in collision zones, they convert the best-fitting flexural rigidity to an elastic plate thickness for the lithospheric plate inferred to underlie the mountains. Combining the new results from the Soviet Union with rigidity estimates for other continental plates, McNutt and Kogan (1985) confirm a trend noted by Karner and Watts (1983) for older plates to yield larger values of elastic plate thickness. This observation is consistent with thermal control for lithospheric strength. Furthermore, McNutt and Kogan (1985) also found that even very old, archean plates in some cases display low elastic thickness values, particularly when the curvature of the fold/thrust belt is high. If, as in the oceanic analogue, highly arcuate belts correlate with steeply dipping slabs, this observation implies that even old continental lithosphere appears elastically thin when sharply bent. The reduction in elastic thickness with increase in plate curvature could help constrain models of finite yield strength for continental crust and mantle. However, McNutt and Kogan's (1985) conclusions remain extremely tentative since they are based on a few noisy spectra from gravity and topography data sets with low coherence. Forward modeling of actual gravity and topography data is vitally needed.

The second study using the isostatic admittance functions is an attempt to directly model gravity and topography data for a few select regions in the Soviet Union. Artemjev has published several grey-toned isostatic anomaly maps for several areas of the USSR (e.g.

Artemjev and Dosymov, 1974; Artemjev and Balavadze, 1973) assuming Airy compensation. Although his maps have no coordinates and no scale, thus appearing useless for quantitative analysis, because the compensation as indicated by the admittances is more regional than the assumed Airy mechanism, Artemjev's isostatic residuals are strongly correlated with topography. Knowing the value of the expected correlation between topography and gravity from the admittances, we can calibrate Artemjev's map in mountainous areas, and convert the maps back to Bouguer gravity. This procedure has been applied to the Caucasus and southern Urals. We are presently in the process of modeling the gravity data.

References

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