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Theoretical models for gravity anomalies caused by thermo-elastic deformations in the vicinity of magmatic bodies

Brimich, L.¹, Vajda, P.¹, Kohut, I.¹

¹Earth Science Institute SAS, Dubravská cesta 9, Bratislava, geofbrim@savba.sk

Abstract:

Theoretical formulae for the calculation of the steady state thermo-elastic deformations field due to magmatic bodies approximated by a three dimensional prism embedded in an elastic half-space are presented. The formulae for the gravity anomaly due to non-uniform extension connected with thermo-elastic deformation is derived as well. A set of figures presents the results of the pertinent numerical calculations. The results have shown that the main part of the negative gravity anomaly is due to the vertical elevation (doming) of the surface about the magmatic body. The free-air and Bouguer anomaly are of the order of $10^{-6} m.s^{-2}$, while the part due to extensional changes of the density is 3 orders less. The upward pressure around the magmatic body is approximated by the point- concentrated body force applied at the centre of the upper face of the prism by using Mindlin's solution from elasticity theory. The negative anomaly due to this pressure effect is of the order of $10^{-6} m.s^{-2}$.

