

Shape of magmatic intrusions outlined by geophysics

¹ AMEGLIO, L. and ² VIGNERESSE J.L. ¹ Rhodes University, Grahamstown, South Africa ; ² University of Poincaré, Vandoeuvre, France.

The problem of the accomodation of granitic intrusions in the Earth's Crust cannot be addressed by geological studies as these are generally restricted to surface observation. To infer deeper geological features, geophysical studies are needed. Amongst the wide variety of geophysical tools, gravimetry is the best suited to describe the morphology of the granitic plutons at depth. 3D gravity data inversion appears to be well adapted to this, and has a precision on calculated depth of 10-15 %. The 3D models derived therefrom also benefit from structural measurements, mainly using the Anisotropy of Magnetic Susceptibility (ASM). Deep parts of the pluton floor correlate in plan view with vertical lineations and characterise magma feeder zones, which may also correspond to mapped regions of late intrusive sub-types.

Combined gravity and structural surveys of various granite intrusions allow two main types of pluton to be defined. The first type are flat-floored plutons, rather thin (≤ 3 km in depth) and form horizontal sheets a few kilometres in diameter, with several feeder zones. They are emplaced as sills in the upper crust, or within rather ductile environments in extensional tectonic regimes. These contrast with the second type, which are thick (≥ 10 kilometres thick) wedge-shaped plutons, that extend laterally in one direction with a few root zones. These are V-shaped in transverse-section and correspond to the infilling of dilatant volumes of the brittle crust during transcurrent tectonics.

In the broader sense, gravity modelling of granites is essential to understanding the overall crustal structure in orogens. Granites may represent a sufficient volume to influence rheological behaviour of the crust. Also, different orogens could display characteristic granitic pluton shapes. Finally, it helps to provide better understanding of granites and associated ore deposits in different metallogenic provinces.