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Unveiling density and magnetic structure of the Călimani Caldera by geophysical means

Lucian Besutiu and Luminita Zlagnean
Institute of Geodynamics of the Romanian Academy, Solid Earth Dynamics Dept., Bucharest, Romania (besutiu@geodin.ro)

RATIONALE
Study area is located in the northernmost part of the Călimani-Gurghiu-Harghita (CGH) Pliocene to Quaternary volcanic range of the East Carpathians, Romania. CGH hosts the latest volcanic events within the Carpathian-Pannonian region. Systematic succession of the eruptions was evidenced along the CGH chain, with Călimani Mountains as the oldest and largest developed term.

DATA ACQUISITION AND PROCESSING
The paper aims at presenting some preliminary results of a relatively recent gravity survey conducted in the area of the Călimani Caldera and its neighbouring Rusca-Tihu Volcano, the most important volcanic forms within Călimani Mountains. Geomagnetic data gathered during a previously conducted regional airborne survey, to which some ground total intensity observations were added during the gravity campaign, have been also used. Various filters were applied to data (e.g., upward continuation to a horizontal plan at an altitude immediately above the highest topography, reduced to the pole geomagnetic anomaly, vertical and horizontal derivatives, analytical signal, or power spectra).

MODELLING AND INTERPRETATION
Quantitative interpretation was based on the 2D and 3D inversion of the gravity and geomagnetic data under constraints provided by rock physics determinations. The software employed includes the GM SYS and Geosoft VOXI Earth Modelling™ technology available through the Oasis montaj desktop application.
As the modelling voxel did not exceed 10000 m in depth (due to the limited extent of the study area) the input data were firstly detrended by removing a planar field in order to enhance the signal to noise ratio by mitigating the effect of deep located sources. Results were validated by comparing the observed anomalies with fields predicted by density and magnetisation models obtained.
Examination of the results helped revealing some hidden peculiarities of the caldera in depth structure.

CONCLUDING REMARKS
Although there is an overall agreement between the gravity and geomagnetic results, a higher resolution was offered by the geomagnetic field, very likely due to the better data coverage and petrography discrimination based on magnetic properties, vs. limited possibilities offered by the smaller changes in density. Among major results it should be mentioned:
- main source of the anomalies are the shallow intrusions located in the inner part of caldera: the assumption is supported by rock physics;
- complex structure and the asymmetry of the caldera, with a sharp vertical eastern slope, and a gradually developed western flank;
- in-depth development of the caldera structure down to about 2000 m bellow the sea level;
- intricate structure of the feeder system with several vertical channels, and sills;
- possible location the main magma chamber in the upper crust at about 4000 m bellow the sea level, well outlined by geomagnetic data;
- apparent larger development of the basalts on the eastern flank is not supported by geophysical evidence: lavas seem to consist of thin flows only.

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