Geophysical Research Abstracts
Vol. 18, EGU2016-1681-2, 2016
EGU General Assembly 2016

Geomagnetic imprint of the Persani volcanism

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The Persani small volume volcanism is located in the SE corner of the Transylvanian Depression, at the north-western edge of the intra-mountainous Brasov basin.
It represents the south-easternmost segment of the Neogene-Quaternary volcanic chain of the East Carpathians. The alkaline basalt monogenetic volcanic field is partly coeval with the high-K calc-alkaline magmatism south of Harghita Mountains (1–1.6 Ma). Its eruptions post-dated the calc-alkaline volcanism in the Harghita Mountains (5.3–1.6 Ma), but pre-dated the high-K calc-alkaline emissions of Ciomadul volcano (1.0–0.03 Ma).

The major volcanic forms have been mapped in previous geological surveys. Still, due to the small size of the volcanoes and large extent of tephra deposits and recent sediments, the location of some vents or other volcanic structures has been incompletely revealed.
To overcome this problem, the area was subject to several near-surface geophysical investigations, including paleomagnetic research. However, due to their large-scale features, the previous geophysical surveys proved to be an inappropriate approach to the volcanological issues.

Therefore, during the summers of 2014 and 2015, based on the high magnetic contrast between the volcanic rocks and the hosting sedimentary formations, a detailed ground geomagnetic survey has been designed and conducted, within central Persani volcanism area, in order to outline the presence of volcanic structures hidden beneath the overlying deposits. Additionally, information on the rock magnetic properties was also targeted by sampling and analysing several outcrops in the area.

Based on the acquired data, a detailed total intensity scalar geomagnetic anomaly map was constructed by using the recent IGRF12 model. The revealed pattern of the geomagnetic field proved to be fully consistent with the direction of magnetisation previously determined on rock samples.
In order to enhance the signal/noise ratio, the results were further processed by employing various filtering techniques. Thus, the reduction-to-the-pole or pseudo-gravity operators have allowed for an improved source positioning, distorted by the inclination of the geomagnetic vector, while high-order derivatives (e.g. horizontal and vertical gradients) have better outlined the contour of the hidden magnetic bodies.

Overall, the geomagnetic survey has confirmed the assumptions previously inferred by geological field work. Besides, it helped identify several unrevealed buried volcanic forms and their relation to structural elements (e.g. fault aligned vents, and larger circular structures).
In-depth development of the volcanic structures has been studied along several interpretative lines by using inversion and 2D forward modelling of geomagnetic data under rock magnetic properties constraints provided by lab analyses.

Acknowledgements. The research was funded through CNCS – UEFISCDI, project number PN-II-ID-PCE-2012-4-0137.