EGU21-14613
https://doi.org/10.5194/egusphere-egu21-14613
EGU General Assembly 2021

Constraints on the pre-eruption thermal and fO_2 conditions in the magma reservoir of Ciomadul (SE Carpathians, Romania) based on Fe-Ti oxide geochemistry

Máté Szemerédi[1,2], Katalin Mészáros[1], Réka Lukács[1], Zoltán Kovács[1], and Szabolcs Harangi[1,3]

[1]MTA-ELTE Volcanology Research Group, Budapest, Hungary (szemeredi.mate@gmail.com)
[2]University of Szeged, Department of Mineralogy, Geochemistry and Petrology, 'Vulcano' Petrology and Geochemistry Research Group, Szeged, Hungary
[3]Eötvös Loránd University, Department of Petrology and Geochemistry, Budapest, Hungary

Ciomadul is the southernmost eruptive centre of the post-collisional Călimani-Gurghiu-Harghita andesitic-dacitic volcanic chain (SE Carpathians, Romania) and represents the latest manifestation of the Neogene to Quaternary volcanism in the Carpathian-Pannonian Region. Ciomadul consists of older, peripheral shoshonitic to dacitic lava domes formed episodically between 1 Ma and 300 ka and a voluminous, central volcanic complex developed within the last 200 ka. Although several lines of evidence (based on petrology, geophysics and gas monitoring) suggest a long-lived magmatic plumbing system holding a potentially active magma storage ("PAMS" volcano) beneath Ciomadul, the pre-eruptive conditions of the upper crustal magma reservoir (including temperature, oxygen fugacity and TiO_2 activity) are not completely explored so far. In this study 23 rock samples, representing the whole volcanic activity of Ciomadul in time, were involved. Fe-Ti oxide (magnetite-ilmenite) grains were selected from magnetic heavy minerals, but only a few of the samples contained both magnetite and ilmenite crystals. Equilibrium between Ti-magnetite and ilmenite was tested by their chemical composition (Mg/Mn ratios).

Various geothermobarometer calibrations, including Andersen and Lindsley (1985, 1988) as well as Ghiorso and Evans (2008), were applied to calculate temperature and oxygen fugacity from Fe-Ti oxide compositions. Our results show that, in case of dacitic pyroclastic rocks, temperature values gained by the method of Ghiorso and Evans are significantly lower (640–780 °C) than those obtained by the geothermometers of Andersen and Lindsley (1985, 1988), showing 750–830 and 710–790°C temperatures, respectively. On the other hand, andesitic lava dome rocks of Dealul Mare show higher, 800–900 °C temperature according to all of these methods. The obtained temperature was compared with amphibole-plagioclase thermometry results and this shows a better agreement with the values yielded by the Andersen and Lindsley (1985) Fe-Ti oxide thermometry, particularly for the pumice samples.

In case of oxygen fugacity, the Ghiorso and Evans (2008) and Andersen and Lindsley (1985) methods showed fairly similar values (fO_2=0.9–1.8) whereas the Andersen and Lindsley (1988) calculations gave higher oxygen fugacity (fO_2=1.1–2.5). Nevertheless, these results, irrespective the

applied calculation methods, suggest relatively oxidized conditions (ΔNNO>1) what is comparable with many other andesitic to dacitic volcanic systems (e.g. Mount St. Helens, Mount Unzen, Santorini). Values of TiO_2 activity was calculated and obtained a range between 0.76 and 0.98 what is consistent with the common presence of titanite.

This study was financed by NKFIH K135179 project.

Andersen, D.J. & Lindsley, D.H. (1985). EOS Transactions of the American Geophysical Union, 66, 416.

Andersen, D.J. & Lindsley, D.H. (1988). Amer Miner 73:714–726.

Ghiorso, M.S. & Evans, B.W. (2008). Amer J Sci 308:957–1039.