Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.12507

From mush to eruption: an amphibole perspective study for the 56–30 ka explosive volcanism of Ciomadul, eastern-central Europe

BARBARA CSERÉP, PHD[1,2], MÁTÉ SZEMERÉDI[2,3], SASKIA ERDMANN[4], RÉKA LUKÁCS[2,5], IOAN SEGHEDI[6], OLIVIER BACHMANN[7], ZOLTÁN KOVÁCS[2] AND SZABOLCS HARANGI[1,2]

[1]Department of Petrology and Geochemistry, Eötvös Loránd University
[2]MTA-ELTE Volcanology Research Group
[3]Department of Mineralogy, Geochemistry and Petrology, 'Vulcano' Petrology and Geochemistry Research Group, University of Szeged
[4]Institut des Sciences de la Terre d'Orléans
[5]Institute for Geological and Geochemical Research Research Center for Astronomy and Earth Sciences, ELKH
[6]Institute of Geodynamics Bucharest
[7]ETH Zürich

Presenting Author: cserep.barbara@gmail.com

Constraining pre-eruptive conditions plays a crucial role in better understanding the nature and structure of volcanic plumbing systems and assessing hazard potential and hazard types in case of active or potentially active volcanoes. Ciomadul is the youngest volcano in eastern-central Europe, where the last eruption occurred at 30 ka. Geophysical studies suggest that a melt-bearing magma reservoir still exists in the crust. Thermal modeling and zircon geochronology indicate that crystal-dominated magma storage has been continuous throughout the lifetime of the volcanic activity since 1.3 Ma. The eruptive phases were intersected by long (several 10's of thousands of years) quiescent periods. The latest, 56–30 ka eruptive period was dominantly explosive in contrast to previous, lava dome building eruptive phases. Ciomadul's eruptive products are relatively homogeneous K-rich dacites containing plagioclase, amphibole, and biotite phenocrysts. Amphibole crystals show great diversity in chemistry and texture and were used to constrain the pre-eruptive physicochemical parameters along with plagioclase, Fe-Ti oxides, titanite and zircon.

We use here the composition of amphibole phenocrysts to define magmatic environments (MEs) and crystal stratigraphy. Six distinct MEs can be distinguished based on major- and trace-element signatures of amphibole for pumice from three explosive eruption events. Two of the MEs are inferred to comprise strongly hydrous (H_2O>6 wt%) mafic magma batches, where high-Mg amphibole crystallized (>900 °C). They resided in the lower crustal hot zone of the plumbing system, recharging the shallow, mushy magma reservoir leading to eruptions. Low-Al-Mg amphibole represents the ME of the long-lived, felsic crystal mush, which resides at 680–750 °C. Beneath it, a slightly hotter (750–800 °C) crystal mush occurred, where amphibole with intermediate Al and Mg content crystallized. Following magma recharge, mixing of amphibole crystals resulted in complex core and core-rim zoning patterns, and a relatively uniform amphibole rim composition. The two post-recharge MEs were at 800–850 °C and relatively oxidized conditions (δNNO: 0.9–1.9) as shown also by magnetite-ilmenite pairs. The strongly hydrous nature of the mafic recharge magmas could have played an important role in the dominantly explosive character of the latest eruptive period of Ciomadul.