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REE content of volcanic rocks and their weathered horizons in the Muria Volcanic Complex, Central Java, Indonesia

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Abstract

We investigated bedrock samples and their weathered horizons collected from the Muria Volcanic Complex (MVC), Central Java, Indonesia. In addition to petrographic study, samples were analysed using X-ray diffraction (XRD), inductively coupled plasma-atomic emission spectroscopy (ICP-AES), and inductively coupled plasma-mass spectrometry (ICP-MS) for mineral composition, major elements, and trace elements, respectively. Bedrock samples (n = 10) from the MVC have ΣREE ranging from 364 to 739 ppm (avg. 579 ppm). Basanite (n = 2) and phonotephrite (n = 2) are consistently high in ΣREE (659 - 739 ppm) compared with basaltic trachyandesite, trachyandesite, and trachyte. Apatite is the only REE-bearing mineral observed in basanite and phonotephrite (up to ~1 vol.%). The ΣREE is positively corelated with P_2O_5, which inversely corelates with SiO_2. The weathered horizons contain clay minerals that consist primarily of kaolinite ± halloysite. The REE content of the weathered horizons (n = 7) is up to 183 ppm higher than those of the bedrocks. The decrease in CaO and P_2O_5 indicates a fractionation of apatite at early stage of magma evolution, resulting in the depletion in the ΣREE content in the residual melt. We suggest that apatite is the major host of REE in the MVC alkali-rich, silica-undersaturated volcanic rocks, as evidenced by our petrographic and geochemical data. We also suggest that the increase in ΣREE in the weathered horizon is due to the presence of clay minerals, particularly kaolinite and halloysite.

Keywords: *apatite, REE, volcanic rocks, weathered horizons, clay minerals*

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