The origins of red coloring of Takatsukayama scoria - chemical and visible-Raman microspectroscopic analyses -

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Scoria erupted at Takatsukayama volcano, which is one of the Higashi-Izu monogenetic volcano group, has varying colors from black to red, which had been quantified using CIE L*a*b* color space (increasing a* (redness) and b* (yellowness) values). The red coloring of the scoria was previously shown to be reproduced by the laboratory heating experiments under an atmospheric condition (Yamanoi et al. 2003). In this study, we investigate the origins of red coloring of Takatsukayama scoria with special attention to chemical forms of Fe by means of chemical and spectroscopic methods.

First, we measured total Fe contents and the bulk chemical compositions of the scoria by X-ray fluorescence spectrometry (XRF). Second, we measured chemically Fe2+ contents in the scoria by the phenanthroline method. We finally analyzed the scoria thin sections by visible and Raman microspectroscopy in order to determine iron-containing mineral phases.

The analytical results show that (1) the total Fe contents and bulk compositions remain almost unchanged despite the color variations, (2) the FeO (Fe2+) contents in the scoria show a good liner relation with the a* values (redness) of scoria, and (3) hematite-like materials are identified by visible and Raman microspectroscopy in the red parts of the olivine phenocryst and groundmass. Almost same results were also obtained in the red parts of the olivine phenocryst and groundmass in the heated products of the black scoria. While, the above features are not observed in the olivine phenocryst and black groundmass in black scoria before heating.

These imply that the red coloring of Takatsukayama scoria is induced by the high temperature oxidation of Fe2+, resulting in the formation of hematite-like materials in the olivine phenocryst and the matrix glass. We will conduct kinetics analysis for red coloring of analogue minerals and glass upon heating by visible and Raman micro spectroscopy in order to obtain temperature-time scales of the red coloring.