Volatiles (halogens, N) in volcanic front magmas, Miyake-Jima, Northern Izu-Bonin Island Arc, Japan

Huyer, G., University of Ottawa, Canada*
Hattori, K., University of Ottawa, Canada
** E-mail: ghuye008@uottawa.ca*

Miyakejima is a volcanic island composed of tholeiitic basalts erupted through 5 distinct eruption stages between 10 000 BP and 2000 AD. Following the most recent eruption in 2000, the volcano released 15 Mt of SO_2 over 20 months, with emission rates of up to 40 000 tonnes of SO_2/d. A total of 15 samples representing individual eruption events within these stages were examined for volatiles to evaluate their behaviour in subduction zones. They range in Mg# (= 100*Mg/Mg+Fe^{2+}) from 35 to 54, and contain phenocrysts of Ca-plagioclase, olivine, clinopyroxene and Fe-Ti oxides. Fluorine (36-168 ppm) increases with increasing Y, suggesting its behaviour as an incompatible, insoluble element during fractional crystallization, and ~ 36 ppm F in primitive magmas. Cl (42-1200 ppm) shows a weak positive correlation with Y. Its enrichment is attributed to a contribution of external Cl (such as seawater-derived brine) coupled with fractional crystallization. Both Br (0.7-9.8 ppm) and Iodine (0.07-0.13 ppm) show weak inverse correlations with Y, indicating that they likely underwent various degrees of degassing from magmas. Even taking degassing into consideration, average concentrations (3.4 ppm Br, 0.09 ppm I) are twice the average MORB values (1.65 ppm Br and 0.048 ppm I), suggesting that Br and I released from subducting slabs are incorporated in arc magmas. The content of N varies from 20-60 ppm, which is greater than unaltered and altered MORB (~ 20 ppm), suggesting the contribution of N from sediments into the parental magmas. Copper content varies from 20 to 160 ppm, with a median value of 105 ppm, enriched relative to MORB (~ 80 ppm). The samples contain rare red Ca-plagioclase megacrysts, the color of which is due to the presence of native copper in crystals and melt-inclusions. Presence of native copper in these plagioclase and Cu-Fe-S inclusions in olivine melt inclusions suggest Cu remained in the melt and was not lost by degassing.