Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SCG10-P03 Room:Convention Hall Time:May 22 18:15-19:30

New geochemical classification of global boninites

Kyoko Kanayama[1*], Keitaro Kitamura[1], Susumu Umino[1]

[1]Department of Earth Sciences, Kanazawa University

Boninite is an important volcanic rock type associated with the initiation of a subduction zone. It is generally defined as a variety of high-magnesian andesites with $SiO_2 > 52$ wt%, $MgO > 8$ wt% and $TiO_2 < 0.5$ wt%. Compilation of the global data on bulk geochemistry of boninites defined as such shows a broad compositional range consisting of a number of regional trends which are characteristic to the individual volcanic suites, suggesting that the genetic conditions of boninite magmas are highly variable dependent on the tectonomagmatic situations. Therefore, re-evaluation of the classification scheme of global boninites is crucial to understand the genetic conditions of boninite magmas and their relationships with the tectonomagmatic settings.

Boninite is usually a part of volcanic rock suites which forms a continuous fractionation trend from magnesian (MgO >20 wt%) boninite through less magnesian andesite to dacite and rhyolite. These regional fractionation trends form subparallel curves on a SiO_2-MgO plot, namely boninite series, that differ from volcanic suites to suites. We advocate to classify these boninite-series rocks into high- and low-Si boninites by a discrimination line running through points of SiO_2 = 55 wt% at MgO = 20 wt% and SiO_2 = 59 wt% at MgO = 8 wt% on a SiO_2 vs. MgO plot. Boninites from Ogasawara (Bonin) Islands on the IBM forearc and western Pacific ophiolites in Papua New Guinea and New Caledonia show compositional trends of high-Si boninite series which are controlled by crystal fractionation of olivine and orthopyroxene. Whereas, boninites from Tonga arc, DSDP Site 458 and Guam, and Neo-Tethys ophiolites such as Oman and Troodos show Low-Si boninite series trends controlled by olivine, orthopyroxene and clinopyroxene fractionation. Low-Si boninite-series rocks do not evolve across the discriminate line by crystallization differentiation. Primary magmas of Low-Si boninites are characterized by enhanced LILEs and LREEs by slab-derived H_2O-rich fluids. Melting experiments of peridotites have demonstrated that low-Si boninite-like melts with $SiO_2 < 54$ wt%, $MgO < 23$ wt% could be produced under 1-2.5 GPa and dry and water-undersaturated conditions. On the contrary, SiO_2-rich ($SiO_2 > 54$ wt%) melts like high-Si boninites have never been produced by peridotite melting experiments. Instead, highly depleted REEs and high Zr/Ti ratios of high-Si boninite magmas require slab-derived felsic melts that reacted with the depleted harzburgite in the mantle wedge.

Keywords: boninite, Ogasawara (Bonin) Islands, Oman ophiolite, Troodos Ophiolite