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 $\text{SiO}_2 > 52$ wt%, $\text{MgO} > 8$ wt% and $\text{TiO}_2 < 0.5$ 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 ($\text{MgO} > 20$ wt%) boninite through less magnesian andesite to dacite and rhyolite. These regional fractionation trends form subparallel curves on a $\text{SiO}_2$-$\text{MgO}$ 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 $\text{SiO}_2 = 55$ wt% at $\text{MgO} = 20$ wt% and $\text{SiO}_2 = 59$ wt% at $\text{MgO} = 8$ wt% on a $\text{SiO}_2$ vs. $\text{MgO}$ 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 $\text{H}_2\text{O}$-rich fluids. Melting experiments of peridotites have demonstrated that low-Si boninite-like melts with $\text{SiO}_2 < 54$ wt%, $\text{MgO} < 23$ wt% could be produced under 1-2.5 GPa and dry and water-undersaturated conditions. On the contrary, $\text{SiO}_2$-rich ($\text{SiO}_2 > 54$ 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