Magnesian andesites from the Kibblewhite volcano, Kermadec arc

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Kibblewhite (34°35′S, 179°15′E) is a volcanic complex along the southern segment of the Kermadec arc volcanic front. The summit of Kibblewhite is about 1000 m below sea-level. The volcano is surrounded by a cluster of four satellite cones and has a 24 km diameter base at ~2600 m water depth (Wright et al., 2006).

Samples were collected from this volcano by dredging during the RV SONNE Vitiaz (SO255) cruise in March-April 2017. The recovered lavas range from basalt to rhyolite (SiO_2 = 49.9-70.9 wt.%; Mg# = 78.2-28.8) and belong to the Low-K to Medium-K series of Gill (1981), consistent with previous observations (Wright et al., 2006). Here, we focus on magnesian andesites (SiO_2 = 57.4-58.8 wt.%; MgO = 5.3-5.7 wt.%; Mg# = 56-58) collected from DR25 at the NE base of the Kibblewhite volcano.

The magnesian andesites are aphyric with skeletal olivine and cpx microphenocrysts and sometimes contain olivine phenocrysts. Olivine microphenocrysts in the magnesian andesites have restricted compositions (Fo = 84-85; NiO = 0.13-0.17), which are in equilibrium with host rocks. Olivine phenocrysts in magnesian andesites extend to more forsteritic compositions (Fo = 86-93) and have higher NiO contents (0.19-0.35 wt.%) that can be in equilibrium with residual arc mantle (Fo = ~93; Ishii et al., 1992). The forsteritic olivine phenocrysts have thin rims (Fo = 85) that are in equilibrium with host rocks without reaction rim, which suggests that the olivines are antecrysts, which have grown within the same magmatic system but in a more primitive magma, rather than xenocrysts. The Sr, Nd and Pb isotopic compositions of magnesian andesites ($^{87}Sr/^{86}Sr$ = 0.70356-0.70368; $^{143}Nd/^{144}Nd$ = 0.51296-0.51297; $^{206}Pb/^{204}Pb$ = 18.84-18.85; n = 2) are consistent with the range of published data for the Kibblewhite volcano (Timm et al., 2014).

Fractionation of 15% olivine with the same amount of cpx from the primary melts explains the continuous Fo-NiO trends formed by the olivine microphenocrysts and antecrysts. Estimated primary melt of the magnesian andesite is also andesitic (SiO_2 = 54.8 wt.%) with 12.7 wt.% MgO, and its normative composition is similar to that of melts generated in melting experiment of hydrous lherzolite at 1 GPa (Hirose and Kawamoto, 1995). This suggests that the primary melt of magnesian andesite is generated by melting of hydrous mantle at <=1 GPa pressure.

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