**Supplementary figures**

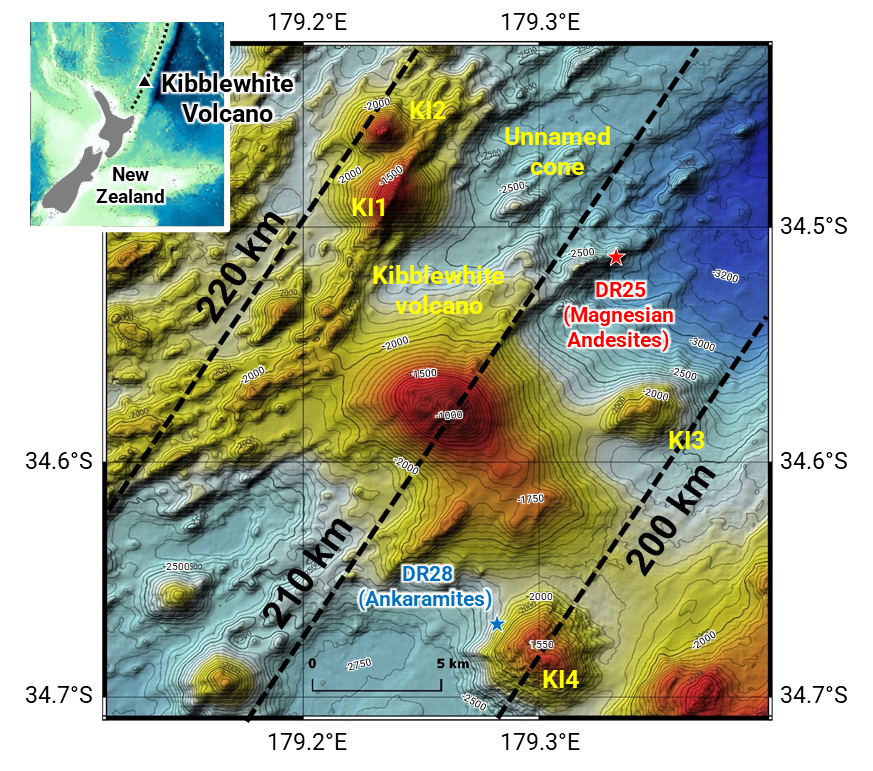


Figure S1. Bathymetric map of the Kibblewhite Volcano and the sample location. The blue and red stars indicate the ankaramites and magnesian andesites were sampled by dredge. The dashed black lines indicate the approximate distances from the trench, measured on Google Maps. The original image is after Hirai et al. (2023).



Figure S2. (a) Back-scatter electron image (BSE) for olivine xenocrysts in the magnesian andesites (samp. DR25-3). Forsteritic olivine xenocrysts (Fo92; Fo = 100Mg/[Mg+Fe]) are surrounded by thin rims (Fo85) which have similar compositions to groundmass olivines (Fo85). Chromian spinels with high-Cr# (= Cr/[Cr+Al]; 69–81) are also observed in the olivine xenocrysts. (b) Diffusion profiles of Fo content in the representative olivine xenocrysts. The analytical line profiles A and B are shown in (a). The resident times for the olivine xenocrysts were estimated using the DIPRA software (Girona and Costa, 2013)

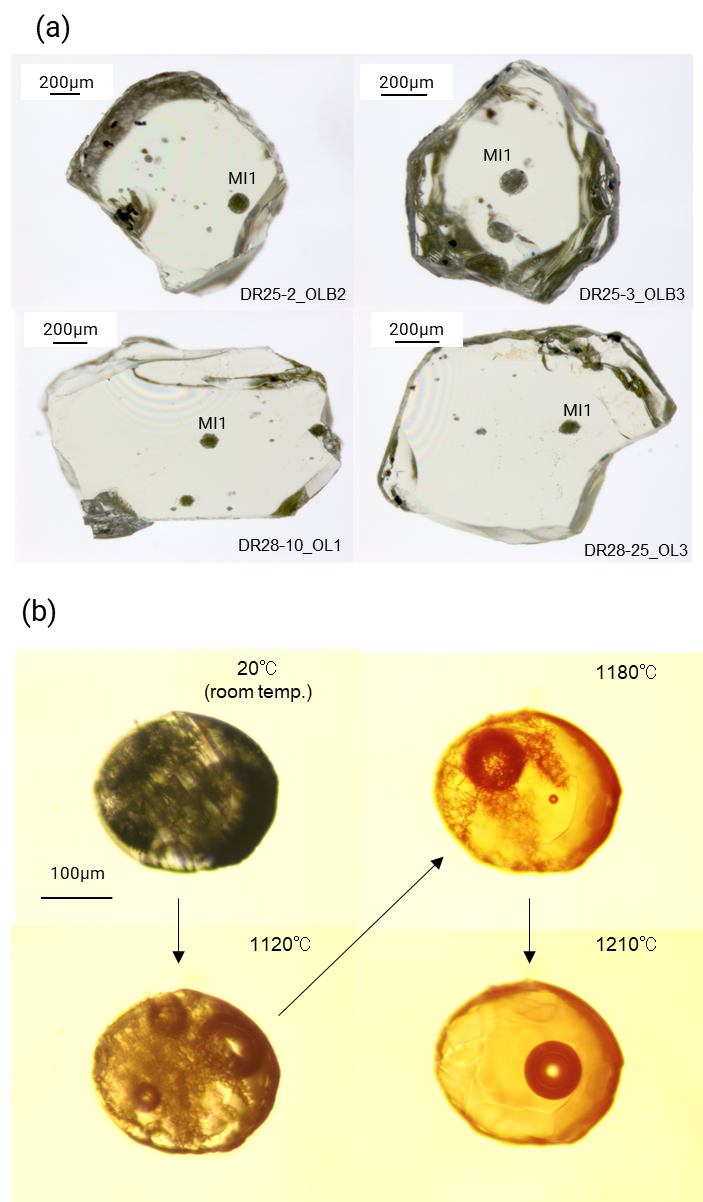


Figure S3. (b) Representative pictures of olivine-hosted melt inclusions from the ankaramites and magnesian andesites. Opaque spheres are partially crystallized melt inclusions. (b) The apparent change of the representative melt inclusion during a homogenization experiment from 20℃ (room temperature) to 1210℃ (completely homogenized) on a heating stage.

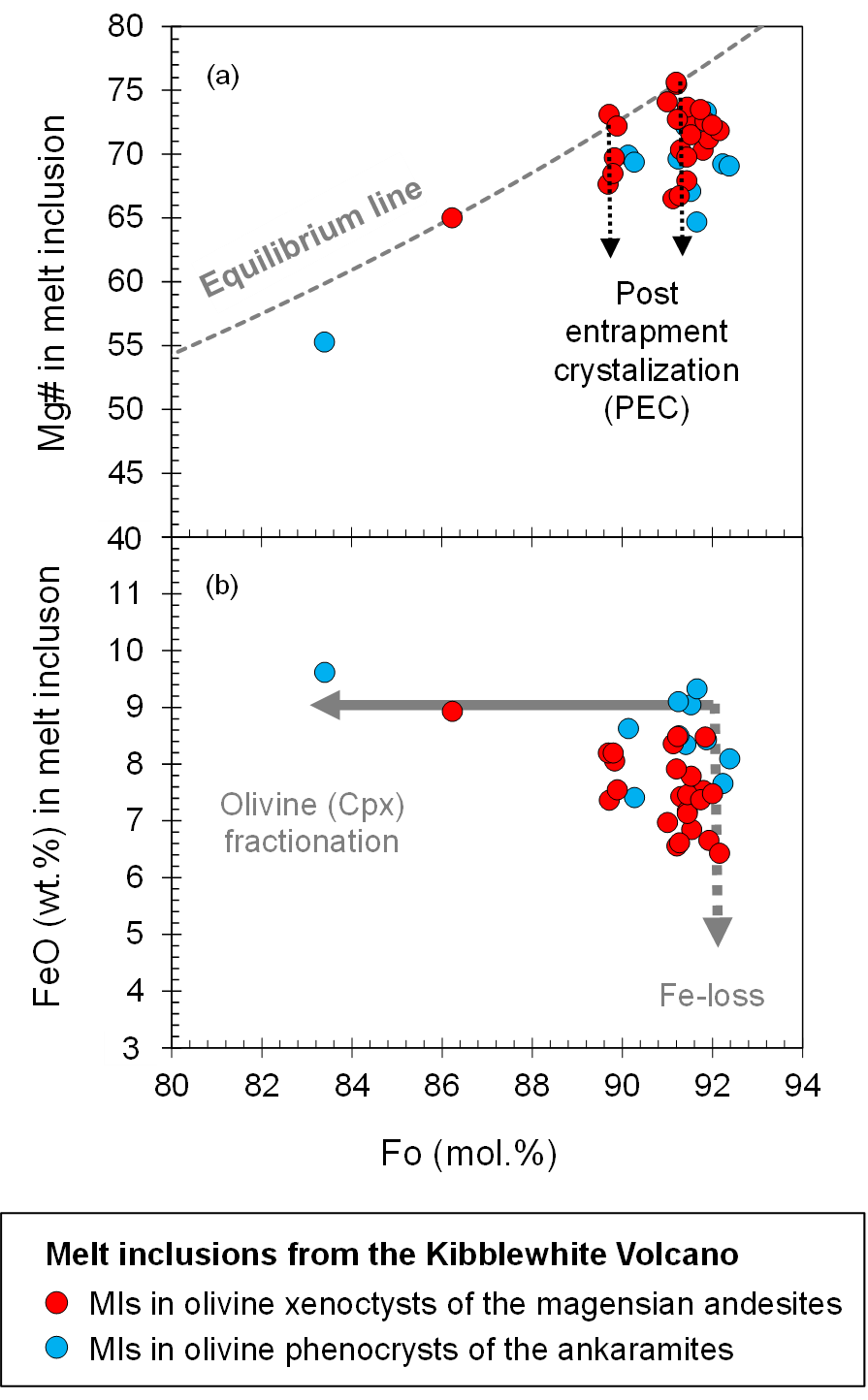


Figure S4. (a) Mg# (= 100Mg/[Mg+Fe]) of the homogenized melt inclusions versus forsterite contents (Fo) in the host olivines. Dashed lines are calculated equilibrium compositions with the host olivines, assuming mineral-melt Fe/Mg exchange coefficient (Kd) as 0.33 and Fe3+/Fetotal in melt inclusions as 0.1. (b) FeO contents of melt inclusions versus Fo contents of host olivines. FeO contents in the melt inclusions are variable, caused by re-equilibration of the melt inclusions with the host olivines (known as “Fe-loss”;Danyushevsky et al., 2000). Since fractionation of olivine and clinopyroxene do not significantly change FeO contents in melts, we estimated FeO contents of the initial melts were approximately 9 wt.%.

**References**

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