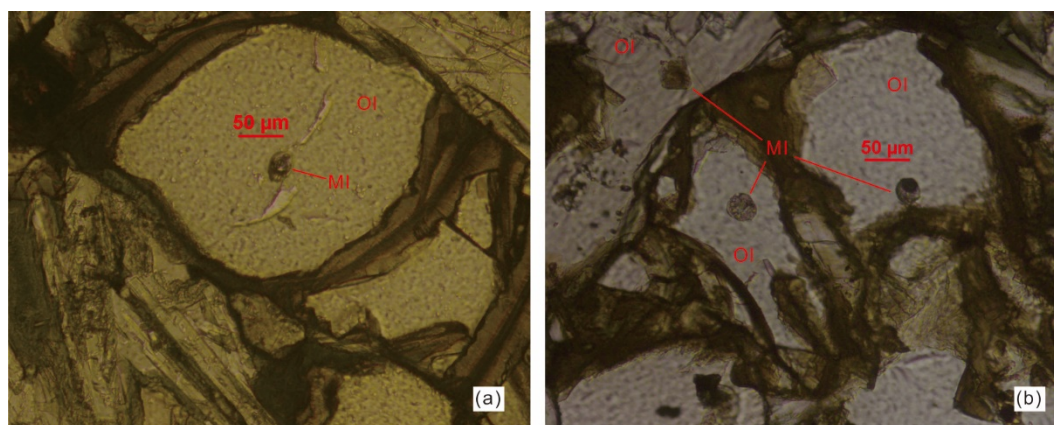
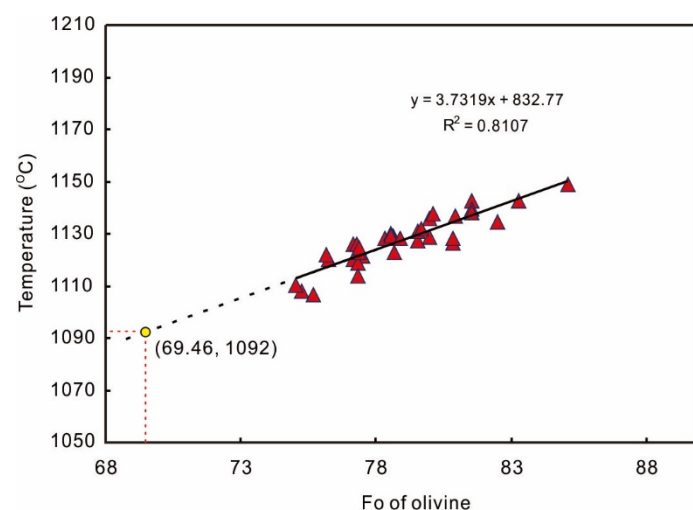


**Figure S1** BSE images of the measured typical olivine-spinel pairs from the JGD basalts. Ol, olivine; Sp, spinel. The zonation is clear for these olivine phenocrysts.

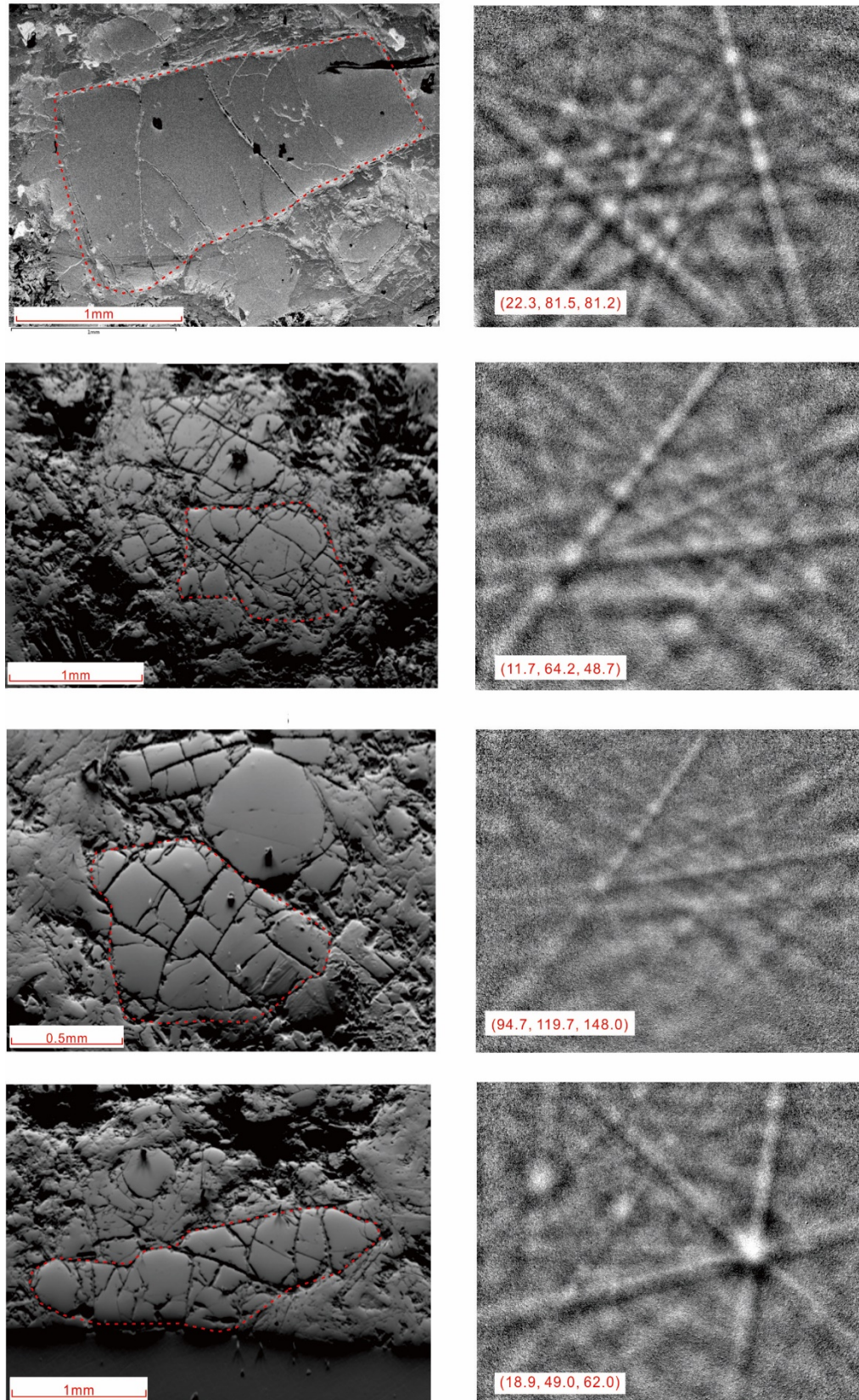


**Figure S2** Typical melt inclusions in olivine crystals in thin-section of the JGD basalts. Note that these melt inclusions have occurred devitrification.

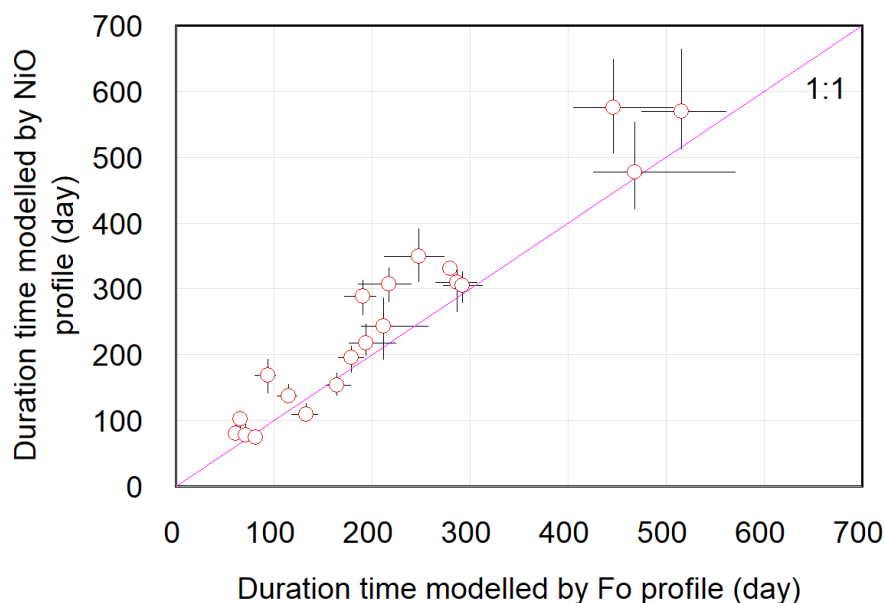


**Figure S3** Olivine crystallization temperature calculated by Al-in-olivine thermometer versus Fo content of olivine phenocrysts. The yellow closed circle represents the extrapolated temperature (1092 °C) for the averaged rim compositions (Fo = 69.46) of the JGD olivine based on the regressed relationship of crystallization temperature vs Fo of olivine.

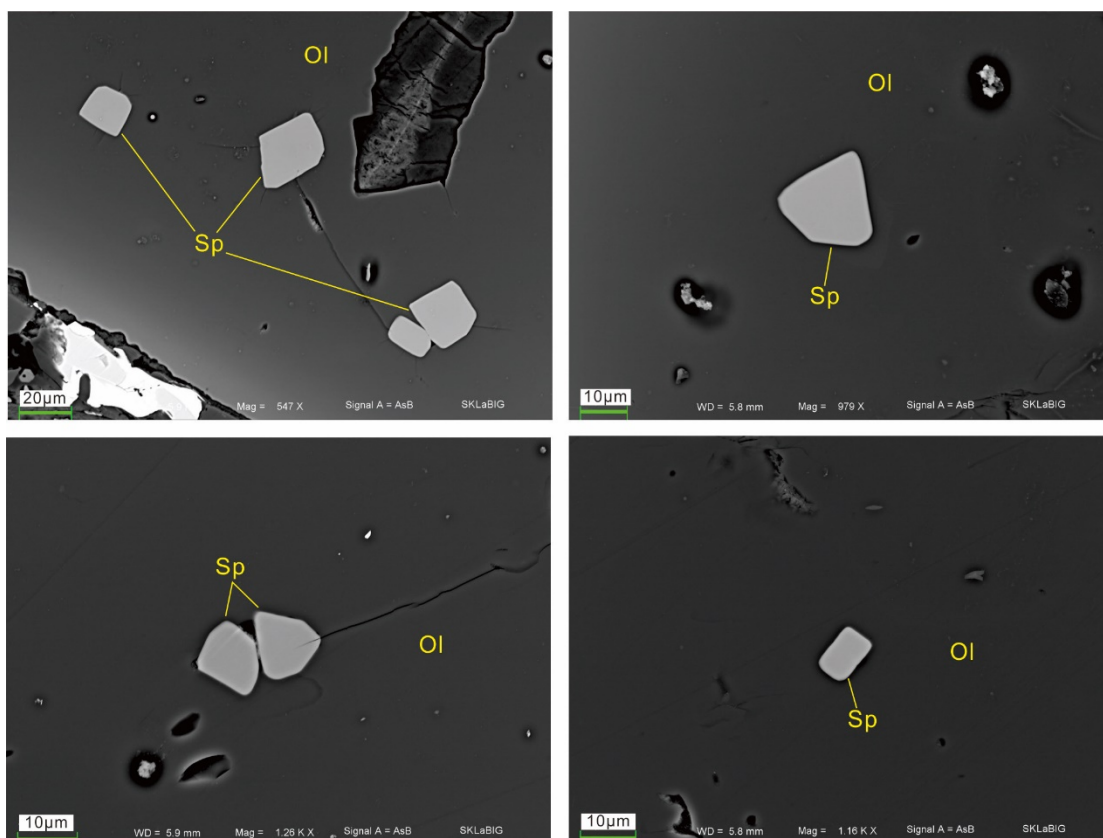




**Figure S4** EBSD images for the measured typical olivines.



**Figure S5** Diffusion timescales modelled by NiO profiles vs the diffusion timescales modelled by Fo profiles. The timescales modelled by NiO profiles are generally larger than that modelled by Fo profiles.



**Figure S6** Close BSE images of olivine-hosted spinels from the JGD basalts. The lacking of zonation indicates each of the spinel has homogeneous composition from core to rim. Ol, olivine; Sp, spinel.