Microstructural & petrological analysis of peridotite xenolith in Noyama-dake, Shimane prefecture ~ implication of plastic deformation during Japan sea opening

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A number of Cenozoic ultramafic xenoliths are located on the southwest Japan arc. In this study, we conducted microstructural and petrological analyses using peridotite xenoliths in Noyama-dake, Shimane prefecture. These microstructural and petrological results imply that these textures are formed by plastic deformation during Japan Sea opening (=15 Ma) with various stress conditions before Noramadake eruption (~7 Ma).

The microstructure of peridotites is classified into three types, including (1) coarse-grained equigranular texture (~ 1mm), (2) fine-grained texture (~50 um), and (3) large- and fine-grained fractured texture. Based on electron backscattered diffraction (EBSD) analysis, the olivine crystals in (1) coarse-grained equigranular texture and (2) fine-grained texture have a crystallographic preferred orientation (CPO), indicating plastic deformation with various stress condition. Straight cracks are observed in large olivine grains in (3) large- and fine-grained fractured texture. Basaltic melt and fine-grained olivine aggregates with CPO intrude in these cracks. These features indicate that large- and fine-grained fractured texture results from brittle-ductile deformation during volcanic eruption.

Based on electron probe micro analyzer (EPMA), (1) coarse-grained equigranular texture has origin of residual mantle, whereas (2) fine-grained texture and (3) large- and fine-grained fractured textures are originated from cumulus mantle. Two pyroxene geothermometer indicates that the rock has equilibrium temperature T ~ 1200C, resulting from high temperature at the pressure of spinel stability field (P ~ 1 to 2 GPa).

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