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Linking Geochemical Variations and Deformation Microstructures in the Yugu Peridotites, Gyeonggi Massif, Korea

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Orogenic peridotite massifs provide key insights into mantle processes and their coupling with deformation and metasomatism. The Yugu peridotites, exposed in the Gyeonggi Massif of South Korea, represent a highly deformed mantle-derived body whose origin and tectonic significance remain debated. In this study, we present a preliminary investigation of the relationship between geochemical variations and deformation microstructures in the Yugu peridotites and associated pyroxenites.

Field observations reveal a strongly deformed, locally serpentinized peridotite body consisting mainly of spinel harzburgite and lherzolite, with concordant dunite and pyroxenite layers parallel to the foliation. Based on microstructural characteristics, the peridotites are classified into proto- to mylonitic (PM/M) harzburgites and ultra-mylonitic (UM) lherzolites. Pyroxenites occur as less-deformed lenses in PM/M peridotites and as highly deformed layers in UM peridotites.

Mineral chemistry and thermometry indicate higher deformation temperatures in UM rocks (porphyroclasts: ~980–990 °C; neoblasts: ~745–760 °C) compared to PM/M rocks (porphyroclasts: ~920–930 °C; neoblasts: ~710–730 °C). Major- and trace-element compositions of olivine, spinel, pyroxenes, and amphiboles show systematic differences between PM/M and UM samples. Chondrite-normalized REE patterns of clinopyroxene and amphibole are characterized by strong enrichment in LREEs and MREEs, suggesting pervasive mantle metasomatism. Two distinct amphibole populations—magnesio-hornblende in PM/M rocks and pargasite in UM rocks—reflect different hydration and deformation conditions.

These results suggest that melt–rock interaction, deformation localization, and metasomatism were closely linked during the tectonic evolution of the Yugu peridotites, possibly through melt-assisted deformation processes in the upper mantle. This integrated geochemical and microstructural approach provides new constraints on the mantle evolution beneath the Gyeonggi Massif.