

Magmatic Nickel Sulfide Mineralization in the Andong Ultramafic Complex, South Korea

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The Andong Ultramafic Complex (AUC) is a Late Triassic ultramafic cumulate in the Andong area, South Korea, exposed as an elliptical body approximately 3.5 km long and 1.2 km wide. It consists of wehrlite, pyroxenite, and Leucogabbro, and has been interpreted as a product of supra-subduction-zone magmatism. Mafic-ultramafic cumulates may host magmatic Ni-sulfide mineralization because they can contain immiscible sulfide liquid as a cumulus phase. However, magmatic sulfide mineralization in the AUC remains poorly studied.

Through detailed field investigation, we identified predominantly disseminated sulfides (Ni > 2000 ppm, S > 0.5 wt%) and locally developed lens-shaped net-textured to semi-massive sulfides, several tens of centimeters across (Ni > 2.3 wt%, S > 6.7–12.3 wt%). Pentlandite is the only identified Ni-bearing sulfide mineral. It is confined to wehrlite and locally pyroxenite, occurring with pyrrhotite + chalcopyrite. The sulfides occupy intercumulus spaces and rarely occur as inclusions within cumulus minerals.

These magmatic Ni sulfide mineralization is concentrated in wehrlite adjacent to pyroxenite dikes that cross-cut the host wehrlite and range from a few centimeters to several meters in thickness. The pyroxenite dikes lack chilled margins, and the adjacent wehrlite is characterized by a poikilitic texture in which coarse pyroxene encloses resorbed olivine.

To evaluate whether these pyroxenite dikes are spatially associated with sulfide mineralization, we conducted EPMA-WDS mapping of clinopyroxene in clinopyroxenite dikes, orthopyroxene in orthopyroxenite dikes, and clinopyroxene in the host wehrlite. The results show sharp Cr zoning in orthopyroxene and reverse Cr zoning in clinopyroxene from the pyroxenite dikes, whereas such zoning is absent in clinopyroxene from the host wehrlite. These features suggest that the pyroxenite dikes in the AUC formed under a dynamic magmatic environment involving magma replenishment or mixing. Together, these observations suggest that sulfide mineralization in the AUC was genetically associated with the emplacement of the pyroxenite dikes.