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Spectral Sensitivity of Heavy Metal Concentration in Mine Soils: A case study of Gagok mine, South Korea

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Heavy metal contamination in soils of mining area accompanies contaminations in drainage and vegetation. The traditional soil survey methods for heavy metal contamination requires significant investment of time, labor, and money although the methods can drive accurate assessment. Moreover, the point-based survey is problematic to understand spatial distribution with limited sample numbers. Remote sensing approaches may provide alternative solutions to understand spatial distribution of contamination with minimal investment of time and labor. It is very critical to understand spectral signals associated with heavy metal concentration to apply the phenomenon to remote sensing approaches. This study investigated spectral signals associated with heavy metal concentration in mine soils based on chemical analysis, mineral composition analysis, and spectral analysis. The study site is a Pb-Zn skarn ore deposit located in Gangwon province, South Korea, where the ore was formed by granite intrusion to slate and limestone. The chemical analysis revealed that the soils are contaminated with heavy metals. Mineral composition classified the soils into two types with silicate/clay mineral group and silicate/carbonate/clay mineral groups. Spectral analysis showed that sensitive spectral bands to heavy metal concentration is located in SWIR region for silicate/clay mineral group and VNIR region for silicate/carbonate/clay mineral group. It reveals that mineral composition and geochemical reaction play an important role in spectral signals manifested by heavy metal concentration.