The Use of Hyperspectral Remote Sensing for Mineral Exploration in Italy: the Punta Corna Co-Ni Vein System (Piedmont, Italy)

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The aim of this study is to test the effectiveness of hyperspectral remote sensing for producing mineral distribution maps of the Punta Corna Cobalt Project, a brownfield exploration prospect owned by Altamin Ltd., located in the Servin Valley in the Western Alps (Italy). The objective of the work is to highlight the relative abundances and compositions of Visible Near (VNIR)- to Short Wave Infrared (SWIR)-optically active alteration minerals, genetically associated with hydrothermally driven metallogenetic processes. Hyperspectral remote and proximal sensing of mineral alteration footprints could support the mineral exploration in the area. The Punta Corna district is defined by hydrothermal polymetallic ores characterized by Fe^{2+}-rich carbonates and Co-Ni sulfide mineralization in form of E–W-trending subvertical veins, showing a maximum thickness of 6–7 m. Major veins formed during the post-metamorphic structural evolution of the Alpine belt, and sharply crosscut metaophiolitic host rocks' foliation. The country rock is affected by intense sericite–quartz-carbonate alteration proximal to ore. The method is based on mapping mineral occurrences through band ratios and feature extraction indexes performed on satellite images, using the PRISMA hyperspectral imagery (Italian Space Agency), combined with products acquired with other multispectral instruments, and supported by field-based hyperspectral data on hand specimens and DEM-based geomorphology. PRISMA provides imagery in a continuum of 234 spectral bands in the VNIR to SWIR wavelength regions, at a spatial resolution of 30 m. Laboratory IR spectroscopy and mineralogical (XRD) and geochemical (ICP-MS/ES) analyses were performed to identify possible target alteration minerals and to validate the interpretation of satellite images. The first results of the investigation, validated through fieldwork, show that satellite imagery is effective in mapping alteration minerals associated with the Co-Ni mineralization (i.e. white mica, chlorite, and supergene goethite), and could represent an additional tool for guiding toward prospective areas where Co-Ni-bearing veins occur.