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Punta Corna Co-rich Vein System (Italy): Late-Alpine Hydrothermal Circulation and Metallogenesis

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The Punta Corna Fe-Co-Ni-Ag-Bi deposit is located in the Lanzo Valleys, Piedmont (Italy). It consists of five-element mineralization exploited for Fe and Co until the 19th century and then abandoned. The global concern for strategic raw material supply, such as Co, has raised a renewed interest in old mining sites where economic potential was not fully investigated.

Hydrothermal activity started with silicification and sericitization of the host rock, followed by the precipitation of Fe-rich carbonates (siderite and ankerite), calcite, quartz, and baryte. This first stage concludes with the deposition of base metal sulfides (pyrite, chalcopyrite, galena). The Fe-Co-Ni arsenides comprise nickeline, overgrown by safflorite, then euhedral skutterudite, and final rammelsbergite in siderite and quartz gangue. Native Bi and As may be recognized in the core of skutterudite and safflorite (Moroni et al., 2019). The final hydrothermal stage is characterized by sulfides and sulfosalts such as tetrahedrite, chalcopyrite, sphalerite, galena, pyrite, and bournonite. This stage, at the very end, also includes Bi-Sb sulfosalts such as the emplectite-chalcostibite solid solution, horobetsuite and wittichenite in siderite, quartz, ankerite, and baryte.

Fluid inclusion studies employing microthermometry, cathodoluminescence, and micro-Raman spectroscopy revealed the presence of different fluid types, suggesting a mixing process as the cause of ore precipitation. These fluids exhibit distinct temperatures, salinities, and composition, indicating diverse provenance sources. The evolution of fluids associated with Stage I mineralization and those linked to the arsenides align with existing models, stating that the transition from base metal sulfides to Fe-Co-Ni arsenides is triggered by a process of rapid reduction caused by the oxidation of a reducing agent (Markl, 2016). The presence of Bi-Sb sulfosalts, appearing in the late stages of the mineralization, may represent a connection to the hydrothermal Au-Bi-Sb veins in the nearby Gran Paradiso Massif (Cevales et al., 1961).