

Cobalt Potential from IOCG Tailings and Copper-Cobalt Deposits of the Atacama Region, Chile: Bioleach Alternatives for Sustainable Recovery

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Cobalt, a critical element for renewable energy and electric mobility, is primarily sourced from the Democratic Republic of Congo, followed by Indonesia, Russia, Australia, and Canada. Chile, which hasn't produced cobalt since 1944, holds untapped potential through mine tailings from IOCG (Iron Oxide Copper Gold) deposits and primary cobalt ore in copper-cobalt deposits in the Atacama region.

Studies in the Punta del Cobre IOCG district show that cobalt is primarily deported in pyrite, with concentrations in head feed ranging from 50 to 300 ppm, increasing up to 1,800 ppm during copper flotation, due to collateral pyrite concentration, as determined in the cleaner stage scavenger tailing. Determinations of cobalt in pyrite indicate levels between 4,000 and 4,800 ppm. Simple flotation can increase pyrite content in the tailings to over 70%, yielding cobalt concentrations up to 2,800+ ppm.

In the Las Cobalteras–San Juan district, cobalt occurs in vein deposits, often associated with copper, cobaltite, chalcopyrite, and pyrite. Ongoing exploration suggests that these deposits, which are genetically linked to major deformation zones along the Atacama Fault Zone, are similar to copper-cobalt lode deposits found globally. Hydrothermal alteration in the region, characterized by pervasive biotite potassic alteration, suggests formation temperatures well above 350°C, consistent with the proposed geological model.

Cobalt recovery experiments from pyrite concentrates using bioleaching technology have shown over 80% recovery within 120 days. The patented bacterial consortium, Kobald B, was cultured from onsite samples. Bioleaching has proven to be a cost-effective and sustainable option compared to higher-capital methods, especially for low grade cobalt in pyrite concentrates or small-scale deposits like those in Las Cobalteras–San Juan.

In conclusion, Chile has significant, untapped cobalt resources, both in tailings and primary deposits. Innovative recovery methods, such as bioleaching, offer not only economic opportunities but also environmental benefits, aligning with global sustainability goals.