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Critical Commodity Resource Assessment for, and Their Mineral Residency in, the Eagle Mountain Mine, Riverside County, California

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The Eagle Mountain iron oxide-sulfide skarn deposit in southern California was the most significant iron mine of the western U.S. from 1948 to 1983, producing over 205 million tonnes (Mt) of crude iron ore with an estimated remaining resource of 345 Mt. Additionally, over 103 Mt of “coarse” and “fine” tailings remain on-site from ore concentrating operations. Ore samples were collected from the three main pits and an underground adit, along with systematic sampling across portions of both “coarse” and “fine” tailings piles to assess the potential value of critical commodities remaining on-site. A 68-element suite of geochemical whole rock analyses were measured using six different analytical methods along with a 48-element suite of analyses on pyrite from iron ores using a laser ablation inductively coupled plasma mass spectrometer and utilized to better understand critical element residency.

The Eagle Mountain iron ores and “fine” tailings contain critical elements, such as Co, Re, As, and Cu, with average concentrations often exceeding ten times average upper crustal abundance. Excluding Cu, most of these elements (plus Te and Ni) consistently reside in pyrite at levels that can exceed one hundred times their average upper crustal abundance. Cu, Au, Ag, Bi, Pb, Sb, Zn, and Pt are also found elevated above upper crustal abundances in inclusion-rich pyrite.

A critical commodity resource assessment was calculated using whole rock statistical data, iron resource and tailings tonnage, and 2024 U.S. Geological Survey mineral yearbook consumption and commodity values. Remaining Co and Cu in-situ ore is valued at >\$1,400,000,000 for Co and >\$817,000,000 for Cu, assuming an 80 percent extraction rate. The Co resource is >4 times U.S. annual consumption. Likewise, Co and Cu within the “fine” tailing piles are valued at >\$340,000,000 for Co and >\$238,000,000 for Cu with the Co resource ~1 times U.S. annual consumption.