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Unravelling the Genesis of the La Colorada Skarn Deposit, Chalchihuites District, Zacatecas, Mexico

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The La Colorada deposit in the Chalchihuites District of Zacatecas, Mexico, includes intermediate sulfidation epithermal (IS), carbonate replacement (CRD), skarn, and porphyry styles of mineralization. The current operation mines the IS veins that extend from the overlying volcanic cover into underlying carbonate-rich sedimentary rocks and transitions to CRD. Significant Zn-Pb-Ag skarn-CRD with porphyry Cu-Mo mineralization was discovered below the eastern part of the IS vein zone by Pan American Silver from extensive drilling in 2018. With 95.9 Mt of indicated resources containing 94.4 Moz Ag, 1.2 Mt Pb, and 2.7 Mt Zn, and 147.8 Mt inferred resources including 132.9 Moz Ag, 1.5 Mt Pb, and 3.4 Mt Zn (06/30/2022) the La Colorada deposit is ranked among the top five Zn-Pb skarns in the world. This research aims to identify the causative intrusion(s) and develop a genetic model of the La Colorada deposit to guide the ongoing exploration, by employing skarn vectoring tools.

An E-W cross section is built after extensive core logging, revealing skarn zoning patterns and locating potential causative intrusions. Garnet color changes from yellow-green to red and pyroxene color brown to light green from distal to proximal locations. Electron microprobe analysis of skarn samples showed Mn wt % variation in pyroxene (expressed as johannsenite mole percent) of 0.7-54.5 Jo% and in garnet (expressed as spessartine mole percent) of 0.2-4.4 Sp%. The results show Jo% and Sp% depletion trends that point to distinct “hot centers” at depth, serving as vectors towards potential causative intrusions. Porphyry molybdenite Re-Os and zircon U-Pb dating together with skarn garnet U-Pb dating results place the main porphyry-skarn event age at ca. 62 Ma. Current results suggest that multiple fertile intrusive phases produced multiple skarns. Additional core logging and geochronology is being conducted to refine the intrusive sequence and skarn events at La Colorada.