

The Epithermal to Skarn-Porphyry Transition at La Colorada Deposit (Zacatecas, Mexico)

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The Ag-Zn-Pb La Colorada deposit in Mexico is a large system featuring intermediate sulfidation (IS) epithermal, carbonate replacement (CRD), skarn, and porphyry styles of mineralization. With resources of 195 Moz Ag (254g/t), 0.6 Mt Zn (2.40%), and 0.3 Mt Pb (1.38%) in IS veins, and 367 Moz Ag (35g/t), 9.1 Mt Zn (2.79%), and 4.2 Mt Pb (1.29%; 06/30/2024) in skarn-CRDs, La Colorada is currently the world's second-largest Zn-Pb skarn in our database with >1700 skarns.

The volcanic-hosted IS veins transition downward into CRD veins in carbonate-rich sequences, with the same mineral assemblage, but more calcite. The veins transition into massive CRD, and deeper skarn with the appearance of pyroxene and/or garnet. In the skarn, garnet:pyroxene ratio increases, pyroxene color changes from brown to green, and garnet color darkens towards causative intrusions with red garnet endoskarn or porphyry-style veins. In addition, microprobe analysis show Mn decreasing from 30.6 to 0.1wt% in pyroxene and 1.9 to 0.1wt% in garnet. Skarn zoning patterns and Mn trends reveal two syn-skarn intrusive centers.

Illite crystallinity, a temperature proxy, of hydrothermally altered volcanic rocks next to IS veins range from 0.6 (~245°C) to 1.9 (~300°C). Fluid inclusion homogenization temperatures in sphalerite and quartz from IS and CRD veins range from 234°C to 325°C. The spatial trend of both data sets indicate two heat and fluid sources that coincide with the two syn-skarn intrusive centers.

Metal zonation features highest Mo grades inside the porphyry, Cu in the porphyry and proximal skarn, Zn-Pb in distal skarn-CRD, and Ag (>100g/t) in distal CRD and IS veins. Lower Ag grades (>25g/t) show plumes rising from the deep skarn into the epithermal environment.

The findings at La Colorada reveal connections between different styles of mineralization in a skarn system and can be used as an exploration model in similar systems.