Petrographic Characterization and Interpretation of the Cinta Colorada Marker Bed, Boleo District, Santa Rosalia, BCS, Mexico

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Abstract

The Cinta Colorada is a prominent red marker bed found across much of the late Miocene sequence of conglomerates and tuffaceous sandstones and mudstones hosting the Cu-Mn-Zn-Co ore deposits (minas) of the Boleo mining area. The Bolo Formation contains four main mantos and several minor ones for a total of nine mineralized beds. The Cinta Colorada lies above Manto 3 but below Manto 2, and is an excellent stratigraphic marker used for exploration in the sequence of ore horizons. A petrographic investigation was conducted to better characterize the Cinta Colorada unit. X-ray diffraction analyses indicate the bulk mineralogy of the Cinta Colorada is uniform over its range. The bulk mineralogy includes intermediate sodian anorthite (andesine), augite, hypersthene, hematite (providing the red color of the Cinta Colorada), and smectite (altered glass). The mineralogy is consistent with a volcanic source. Polarized light microscopy and SEM/EDS confirm the XRD results, showing the smectite has replaced volcanic glass, and that the rock is made of sand- to silt-sized crystal and felsic fragments of anorthite to basaltic volcanic rocks. Crystal fragments of andesine and hypersthene are breccia, but essentially fresh with no observed weathering or alteration. All of the felsic and crystal fragments have a thin, rough coat of very fine ash that appears to be sintered to the target clasts. That could likely have accumulated on the clasts as they were erupted through the hot ash cloud. The rock is grain-supported, and the interstices are empty—as opposed to the hotter, sandier type of pillow lava. The Mn oxides cement some of the grains, occasionally filling interstices. The Cinta Colorada appears primarily to be an air fall deposit, with no observed rhyolitic lava flow at the top. Later introduction of hydrothermal fluids (probably associated with ore deposition in the mantle and altered bed) replaced the volcanic glass with smectite clays and deposition of the Mn oxide cement, producing the Cinta Colorada in its present state.

Field Methods

Data collected in the field includes 31 samples from various points on the Mina Boleo mining complex (Figure 4). The samples were all from different sections of the Cinta Colorada only. Although the “red ribbon” varied in thickness (Figures 5-9), the basal 6 cm were always constant. The thickness was measured by a 100cm Jacob's staff and a GSA 10km ruler. The 31 samples covered an area of over 1.5 million m² and were from different altitudes. To document data collection, Field MOVE Clino and MOVE software was installed through cell phone app and downloaded to a Microsoft Surface Pro 2 tablet. A rock hammer was used to extract each sample then placed in a sample bag and labeled appropriately.

Laboratory Analysis

The samples were made into thin sections and divided into 13 areas (Figure 10). Petrographic microscopes, XRD and SEM/EDS were used to examine and identify mineral assemblages and bulk mineralogy.

Conclusions

The Cinta Colorada contains well preserved volcanic fragments and cemented by a volcanic glass. This indicates a volcanic origin. Well-deformed poorly altered pumice layer when the face point to an air fall origin. Bulk mineralogy of the Cinta Colorada over the area shows major similarities.

References


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