

Statistical Data Analysis of the Guadalupe and Don Ese Ag-Au Epithermal Vein Systems to Understand the Geochemical Processes Involved in Orebody Formation

Arturo Ramirez* and Philip Goodell

Department of Geological Sciences, The University of Texas at El Paso, El Paso, TX 79968

*E-mail, aramirez12@miners.utep.edu

The Sierra Madre Occidental (SMO) is a Cretaceous-Tertiary silicic ignimbrite province in northwestern Mexico. It is the result of tectonic and magmatic events produced by the subduction of the Farallon plate under North America (80–40 Ma) and the opening of the Gulf of California (14–12 Ma), thus forming the SMO metallogenic provinces. The Late Eocene-Oligocene was a major period of metallic mineralization hosting various deposit types, principally intermediate-sulfidation Ag-Au (\pm Pb-Zn-Cu) epithermal veins, which have been economically significant.

The study area is located in the Palmarejo district in southwest Chihuahua, where mining activities date back to the early 18th century. Since then, the Palmarejo district has seen intermittent mining activities until the Australian company Bolnisi Gold NL began exploring in 2003, leading to the discovery of new Ag-Au resources at Palmarejo, Guadalupe and La Patria. Coeur Mining acquired Bolnisi Gold NL in 2007, and continued to develop the Palmarejo mine, which was the world's fifth largest silver producer in 2013. Currently, mining activities in the Palmarejo district are transitioning to Guadalupe. Coeur Mining's acquisition of Paramount Gold and Silver began in 2014 as they share property boundaries where Guadalupe is adjacent to the Don Ese deposit, which appears to be an extension of the structure hosting the Palmarejo mine.

In this region, mineralization is controlled by NW-trending structures that served as the migration paths for metalliferous fluids leading to the formation of ore deposits. The intersection of structures are demonstrated to be important zones and particularly at inflection points. On a regional scale, large-scale lineaments are recognized through satellite imagery. Trend measurements of lineaments have been compiled and analyzed to determine the frequency of lineations in a given orientation. A pull-apart basin geometry is recognized where the northern and southern boundaries are coincident with the trends of the transform faults in the Gulf of California, suggesting that early stages of extensional deformation was a contributing factor for mineralization. Analyzing these lineations may provide insights into the paleostress regimes that produced the current structural framework.

Statistical multi-element data analysis has been completed for 2985 samples from 292 drill core sites from the Guadalupe vein, and for 5267 samples from 37 drill core sites from the Don Ese vein. Univariate and multivariate data distributions are analyzed in order to evaluate the geochemistry, detect trends or structures, and define zonation patterns within the data. Plots are created with the use of R and ioGAS softwares. Spatial distribution of data is represented using ArcGIS and Leapfrog Geo 3D. Metal ratio and metal abundance zoning can provide insights into geochemical processes involved in the precipitation of precious metals for the Guadalupe and Don Ese systems. Preliminary results show two mineralizing episodes indicated by distinct populations within the data.