

Abstract ID: 27

Title: EARLY PROTEROZOIC VOLCANOGENIC MASSIVE SULFIDE DEPOSITS, JEROME, ARIZONA

Student: No

Topic: Economic Geology

Medium: Invited Oral Presentation

Author 1 (CONTACT AUTHOR)

Name: Paul Lindberg

Org: Consulting Geologist, Sedona, Arizona

Country: USA

Keywords: Early Proterozoic, Arizona, world class copper, volcanogenic massive sulfide

Abstract: Rocks of Early Proterozoic age host world class volcanogenic ore deposits in the Verde mining district of central Arizona. Mining of copper ore at Jerome lasted from 1883 to 1953 with a production of 33,655,430 metric tons of ore that yielded 1,644,300 metric tons of copper metal, 44,158,870 kg zinc, 314,450 kg lead, 1,579,000 ounces silver and 57,313,000 ounces gold. The outcropping United Verde massive sulfide deposit and its footwall veins plunge to the NNW and were mined for copper ore to a depth of 1372 meters. The mine produced 88.5% of district tonnage. The supergene-enriched UVX ore deposit, discovered in 1914 beneath Paleozoic and Tertiary cover rocks on the down-dropped east side of the Verde fault, produced 10.5% of district tonnage between 1915 and 1938. Small ore production also came from the Verde Central, Copper Chief and Cliff deposits, but all mines are now inactive. By 1970 exploration geologists active in the district had supplanted the old selective replacement theory of ore genesis with the volcanogenic model. Well preserved "black smoker" sulfide columns have been recovered from local ores. Two ore horizons are recognized within the local volcanic succession with the older Verde Central horizon lying at the apex of cauldron fractured Deception Rhyolite. The highly productive United Verde horizon lies at the apex of the stratigraphically higher Lower Cleopatra Rhyolite extrusion. Submarine emplaced massive sulfide deposits accumulated above Mg-chlorite footwall alteration zones that formed at vent sites where mineral laden hydrothermal fluids entered the sea floor along cauldron fractures. Contemporaneous chert exhalite beds were deposited distally from the vent sites. Immediately overlying the United Verde ore horizon is unaltered Upper Cleopatra Rhyolite that has a newly determined Pb207/Pb206 age of 1738.5 +/-0.5 Ma (Sam Bowring). Post-ore rocks include rhyolite blister domes, volcanoclastic sediments and turbidites, mafic flows, jasper beds and a diorite sill. North-northwest trending F1 folds and near east-west F2 "cross folds" are ubiquitous in local Precambrian rocks. High angle reverse faulting associated with the Laramide Uplift ~75 Ma was followed by prolonged erosion and removal of some of the Paleozoic sedimentary cover. A unique Laramide age decollement fault offset and local unroofing of the UVX deposit allowed for Tertiary supergene enrichment of the Precambrian age deposit. Tertiary sediments and Miocene Hickey Basalt were later deposited onto the unconformity cut into Paleozoic and Precambrian rocks prior to basin and range extensional faulting ~8-10 Ma when the Verde graben was formed. Erosion of graben

fault scarps over the past few million years has exposed the Precambrian rocks and ores of the Jerome area.