

The upper expression of a deep fault, Falla Oeste, northern Chile

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The open pit of the Chuquicamata porphyry copper deposit, northern Chile, provides unprecedented exposure of the upper levels of a deep fault system. With 3.3 km lateral and 0.55 km vertical outcropping of the system with an additional 0.56 km depth encountered in drillcore, the fault zone can be defined and characterized in some detail. A 400 to 500 m cataclastically-deformed zone is overprinted by wide fractured areas, breccia zones, and gouge-bearing fault planes. A concentration of gouge-bearing planes constitutes the contact between mineralized Chuquicamata rocks and non-mineralized rocks of the Fortuna complex. The cataclastic zone, best exposed to the west of the fault, is characterized by amphibole growth, later biotitic and chloritic alteration, and even later clays associated with supergene processes. Brecciated areas are present on both sides

of the contact. The east side breccia contains irregular anastomosing gouges (≤ 10 cm) through the sericite-clay matrix of the fragments to matrix-poor breccias with variably-lined angular fragments. Extreme grain size reduction is present in the foliated gouge bearing zones. Where deformation has been concentrated in a single fault, greater than 50% of the gouge particles are ≤ 15 microns in diameter. Where deformation has been partitioned along multiple gouges, there is a bimodal distribution of grain size. Assemblages of primary and secondary copper minerals are present in the majority of grain size fractions as is supergene zinc mineralization. Fragmentation of all assemblages is consistent with late fault movements. The presence of illite, montmorillonite, and nontronite within the gouges facilitates fault movement creating rock instability within the open pit.