

Lone Star Vent Complex: Brecciation and Its Relationship to Porphyry Copper Orebody

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The Lone Star porphyry Cu(-Mo) deposit (Safford District, Arizona) is hosted in Late Cretaceous andesites that are cut by a complex series of heterolithic, texturally varied breccias and intruded by a series of Paleocene porphyritic rocks. Mineralization centers on the breccia “vent” complex which has been modeled as a group of downward narrowing conical bodies “diatremes”. This study focuses on the characteristics and variability in the breccias, their timing in relation to intrusions and mineralization, and their influence on supergene features.

Although volcanic sediments and intrusion breccias have been recognized with multiple possible age relationships to each other, to intrusions, and to mineralization, detailed characterization, determination of the number and types of breccias, and their relationships to other key features is poorly understood. Four sets of intrusions are known (oldest to youngest): dacite, quartz latite, quartz monzonite, and square quartz porphyry. Dacites reportedly grade upward into tuffaceous units, whereas later intrusions cut the breccias.

New logging shows that the breccias of the vent complex are highly variable in clast size, angularity, sorting, matrix types, and relationship to dikes and mineralization. Some breccias contain mineralized clasts and porphyritic intrusive rocks, while others are cut by dikes and have variably mineralized matrix. Poorly-sorted, clast-supported volcanoclastics are interlayered with others that exhibit bedding. These cycle abruptly locally with well-sorted beds with dips that often increase with depth suggesting fluidized behavior and vertical transport. Others are heterolithic, subangular with sericitized matrices. Some contain likely (but altered) igneous matrix. Sheeted fractures previously interpreted as distal markers are late and post-date mineralization.

An undisrupted copper ore shell suggests that much brecciation was pre-mineralization; however, new observations suggest brecciation had a complex history that overlapped with emplacement.