

THE SAN XAVIER FAULT, PIMA MINING DISTRICT, ARIZONA

by

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The San Xavier fault is a low-angle, undulating surface underlying approximately 50 square miles of the northeastern pediment of the Sierrita Mountains, south of Tucson, Arizona. This fault has long been recognized as a major postmineral structure separating ore-bearing rock in the upper plate from barren rock in the lower plate, or footwall. Three large open-pit copper mines (Mission, Pima, and San Xavier North) and numerous smaller underground mines are located in the upper plate.

The upper plate includes Precambrian granite, Paleozoic and Mesozoic rocks, Laramide quartz monzonite porphyry, and the Helmet Fanglomerate. The thickness of this upper plate ranges from a few tens of feet along the outcropping portion to approximately 2,000 feet in the central trough. The lower plate is dominantly Precambrian granite and granodiorite.

The Helmet Fanglomerate crops out in the southern part of the upper plate north of Twin Buttes. The location of the Helmet Fanglomerate roughly coincides with the central trough of the San Xavier fault, and this fault forms the basal contact of the fanglomerate.

The outcrop of the south and west margins of the fault is roughly arcuate shaped, opening to the northeast. A structural contour map of the fault surface, based on several hundred drill-hole penetrations, reveals a central, northeast-plunging trough, with steeper dipping southern and western flanks. As presently delineated, the fault extends north from Twin Buttes approximately 8 miles and is about 6-8 miles across the widest portion.

There are two published hypotheses regarding the age and direction of movement of the San Xavier fault and the formation of the Helmet Fanglomerate. The first (Cooper, 1960) proposes that the upper plate moved northward approximately 6 miles from the area of Twin Buttes during post-Helmet time. The second (Weaver, 1965) proposes gravity sliding of the upper plate to the east into a tectonic basin being formed by the rising Sierrita batholith. The Helmet Fanglomerate was later shed into the same tectonic basin onto the upper plate. A recent paper (Lukanuski, 1975) suggests that the Helmet Fanglomerate and other similar formations in southern Arizona were formed in rapidly developing, local tectonic basins undergoing tilting.

Comparison of geologic features in the upper plate with the area south of Twin Buttes, microstructures in the Helmet Fanglomerate, and the basal fault contact of the Helmet Fanglomerate favor a northward direction of movement in post-Helmet time or perhaps contemporaneous with Helmet formation.

The record of geologic events in this part of the Pima mining district includes preintrusive, premineral faulting and folding with a general northwest trend, Laramide intrusion and mineralization, development of the San Xavier fault and northward movement of the upper plate, and high-angle normal faulting of the upper plate and the San Xavier fault.

References:

Cooper, J. R., 1960, Some geologic features of the Pima mining district, Pima County, Arizona: U.S. Geol. Survey Bull. 1112-C, 103 p.

Lukanuski, J. N., 1975, Locomotive-type post-ore fanglomerates as exploration guides

for porphyry copper deposits (abst.); Society of Economic Geologists meeting with AIME: *Econ. Geology*, v. 70, no. 1, p. 248.

Weaver, R. R., 1965, Geologic interpretation of the Ruby Star Ranch area, Twin Buttes mining district, Pima County, Arizona: unpublished M.S. thesis, University of Arizona, 74 p.