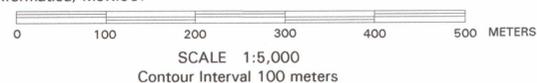


Base is an enlarged pre-print of the Saric 1:50,000 scale topographic map, now available as map H12A48, Instituto Nacional de Estadística Geográfica e Informática, México.

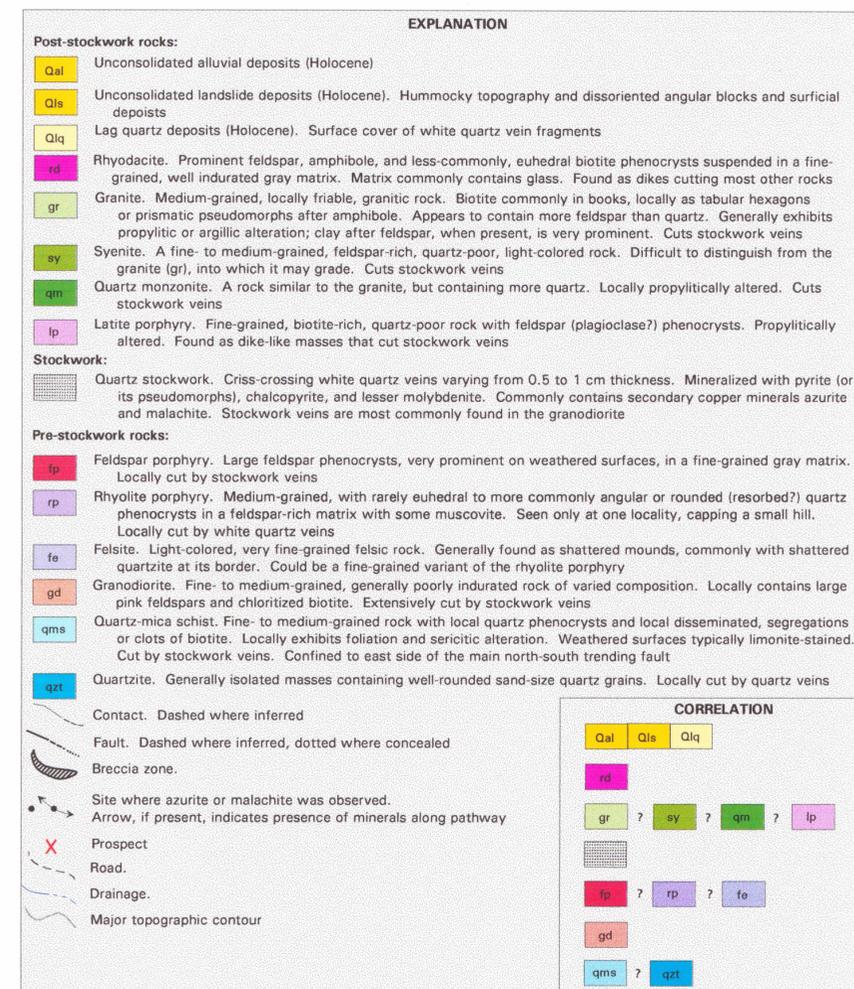
Geologic mapping by R.G. Eppinger and P.K. Theobald, April, 1982.



## GEOLOGIC MAP OF THE LOS TAMALES CHALCOPYRITE-MOLYBDENITE STOCKWORK, NORTHERN SONORA, MEXICO

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A cooperative mineral exploration program was conducted in the late 1970's and early 1980's in a portion of the Sonoran Desert of northern Mexico by the Mexican Consejo de Recursos Minerales and the U.S. Geological Survey. The program included reconnaissance-scale collection of stream-sediment, heavy-mineral-concentrate, water, and rock samples. Follow-up studies in several areas included more detailed sampling and geologic mapping. The Los Tamales area was identified initially by a well water sample highly anomalous in Ag, Co, Cu, Mo, Ni, SO<sub>4</sub>, and U (Erdman and others, in press). In November, 1981 more detailed geochemical sampling was undertaken (Turner and others, 1984), followed in April, 1982 by mesquite sampling and geologic mapping. The map presented here is a result of 5 days of field mapping. Descriptions and rock names given are based on field relationships, and are used without the benefit of follow-up petrographic work, whole-rock chemical analyses, or age determinations.

The study area occurs within a northwest-trending Jurassic magmatic arc that extends across northern Sonora and southern Arizona. The plutonic, volcanic, and related sedimentary rocks of the arc are locally overlain by Cretaceous strata, are intruded by Late Cretaceous granodioritic plutons, have been affected by Late Cretaceous to early Tertiary regional metamorphism, and are intruded by Tertiary garnet-bearing two-mica granites (Haxel and others, 1984; Anderson and Silver, 1986).

Geologic mapping of an approximately 1 km<sup>2</sup> area at Los Tamales revealed the presence of a quartz stockwork containing chalcopyrite, molybdenite, and related secondary minerals. The stockwork mainly cuts a medium-grained, compositionally varied, but chiefly granodioritic body (gd). Other pre-stockwork rocks include quartz-mica schist (qms), minor feldspar porphyry (fp), rhyolite porphyry (rp), and quartzite (qzt). The stockwork-bearing granodiorite is cut and segmented by an areally extensive, medium-grained biotite granite (gr). The granite is commonly propylitically and argillically altered. Other post-stockwork rocks include minor quartz monzonite (qm) and syenite (sy) bodies; and latite porphyry (lp) and rhodacite (rd) dikes. The quartz monzonite and syenite, found in the northeast part of the mapped area, may be compositional variants of the biotite granite (gr). The main structural feature is a large north-northwest-trending fault that generally controls the major drainage in the area and, where exposed, cuts pre- and post-stockwork intrusive rocks.

Secondary copper minerals (principally malachite and azurite) were observed as coatings on outcrops of pre- and post-stockwork rocks. The outcrop pattern of the chalcopyrite-molybdenite quartz stockwork and sites where secondary copper minerals were observed are shown on the map. The stockwork and visible secondary copper minerals extend beyond the mapped area. A small prospect was found in the south-central part of the mapped area, as well as three exploratory drillholes from a 1970's drilling program by Cia. Esplumil (results unknown).

### References Cited

- Anderson, T.H., and Silver, L.T., 1986, The border connection-correlations and contrasts between Arizona and Sonora, in Beatty, B., and Wilkinson, P.A.K., *Frontiers in geology and ore deposits of Arizona and the southwest*: Arizona Geological Society Digest, v. 16, p. 72-73.
- Erdman, J.A., Eppinger, R.G., Marsh, S.P., Miller, W.R., and Theobald, P.K., in press, Mesquite (genus *Prosopis*) as a surrogate well-water sample in the search for Cu/Mo occurrences, a lesson from Los Tamales, northern Sonora, Mexico: *Geology and Ore Deposits of the American Cordillera*, Proceedings of the April 1995 Symposium, Geological Society of Nevada.
- Haxel, G.B., Tosdal, R.M., May, D.J., and Wright, J.E., 1984, Latest Cretaceous and early Tertiary orogenesis in south-central Arizona: thrust faulting, regional metamorphism, and granitic plutonism: *Geological Society of America Bulletin*, v. 95, p. 631-653.
- Turner, R.L., Erdman, J.A., and Harms, T.F., 1984, Analytical results and sample locality map of stream-sediment, panned-concentrate, and mesquite samples from the Los Tamales area, San Juan quadrangle, northern Sonora, Mexico: U.S. Geological Survey Open-File Report 84-289, 29 p.