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LINEAMENT TECTONICS AND SOME ORE DISTRICTS OF THE SOUTHWEST

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This study examines the structural framework of the Southwest for evidence of the four principal trends of lineament tectonics. It attempts to classify their intersections and compares the positions of those trends that appear most favorable with the positions of the presently known mining districts.

by EVANS B. MAYO

This is a controversial topic. The author, in presenting his analysis, is aware that the study of lineament tectonics and relation of ore districts to regional structure is complicated by insufficient data and, unavoidably, by personal bias.

The development of lineament tectonics has been summarized by Umbgrove.[1] Early attempts to fit ore districts into the Cordilleran framework were made by Billingsley and Locke,[2,3] who do not refer to lineament tectonics, although their approach is similar; they observe that heat and fluids, including the ore-depositing fluids, are most likely to rise at or near intersections of major structures where the crust is fractured, or weakened, to great depth.

As a result of studies distributed over the earth—including ocean basins as well as continents—some tectonists recognize four dominant structural trends: 1) northwest; 2) northeast; 3) nearly east-west, or equatorial; and 4) nearly north-south, or meridional. Baker[1] proposed a theory to account for these trends and Sonder[4] called their world-wide arrangement the regmatic shear pattern. Moody and Hill[5] proposed a much more complicated shear network which, although fascinating and perhaps ultimately useful, will not be followed here. In a recent review of deformation within the Cordillera, Wisser[7] mentioned the four fundamental directions.

The fact that many geologists deny the existence of the regmatic shear pattern implies that the fundamental structures are far from obvious. It may mean, also, that some geologists are not accustomed to examine regional and world maps analytically. The maps require much study, and certain features should be isolated on overlays. Even so, with the present limited knowledge, uncertainties remain. The following analysis is a qualitative experiment, subject to change as information accumulates, and should be supplemented by the western sheet of the Tectonic Map of the United States.[1]

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LINEAMENT FRAMEWORK, SOUTHWESTERN U.S.

Many have probably gained the impression that the Cordillera of the West is oriented northwest-southeast and from this, unless experience rules otherwise, it is natural to assume that the structure likewise trends northwest-southeast. To an important extent this is true, yet anyone tracing off the western sheet of the Tectonic Map all the recorded northwest-southeast structures may be surprised to see what a small part of the entire area they occupy. In southwestern U. S. (Fig. 1) the northwest-southeast structures are mostly restricted to the eastern, southern, and western parts. The eastern margin of the Cordillera from northern Colorado to the International Boundary near El Paso, Tex., is obviously determined by some structure other than northwesterly ones. In eastern Nevada and far southward toward the Gulf of California many mountain ranges, valleys, and faults are meridional. In the Rocky Mts. of Colorado, and at many places in southern Arizona, the crystalline Pre-Cambrian is foliated northeast-southwest. The Uinta Mts. of Utah trend approximately east-west, in much the same way as a broad belt of transverse, west-northwest structures—the Texas lineament of Hill[1,3] and Ransome[10] in southern Arizona, southwestern New Mexico, and southern California.

It seems, then that there are four regmatic shear directions in the Southwest, but at many places they are discontinuous, and their projections must be inferred. To clarify these trends the four sets have been isolated into two systems: 1) northwest-northeast and 2) east-west-north-south (Figs. 2 and 3).

Northwest-Northeast System: A number of prominent northwest-trending zones of structure are easily recognized. They are designated by circled Roman numerals, the northeast-trending structures by circled capital letters.

Perhaps no two geologists would agree completely on the positions of all these belts. Names given below are for convenience only, and may be discarded where other names have priority.

(I) The Sierra Nevada-Lower California belt contains the Jurassic-Cretaceous granitic massifs of the Sierra Nevada and Lower California. These

14229

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