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Preliminary Report to Accompany Geologic Map of the Mountain Pass District, San Bernardino County, California

by

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The geology of the Mountain Pass district, San Bernardino County, California, has been mapped by the U.S. Geological Survey in the course of its investigations of the rare-earth mineral deposits of the district. The rare-earth minerals have been found within an area of about 20 square miles transected by U.S. Highway 91, 60 miles southwest of Las Vegas, Nevada. The geology of this area was mapped on aerial photographs by J.S. Olson, with the assistance of E.D. Jackson, during the fall of 1950, and the geologic map was compiled at a scale of 1:15,000. This preliminary report is a summary of the principal geologic features, to accompany the geologic map and aid in its interpretation.

The rare-earth mineral deposits were discovered in the Mountain Pass district in 1949 by H.E. Woodward and Clarence Watkins, of Goodsprings, Nevada, while prospecting with a radiation counter, and the presence of rare earths in the ore was recongnized spectrographically by E.T. Schenck of the U.S. Bureau of Mines, Boulder City, Nevada. The principal rare-earth mineral was shown to be bastnaesite by D.F. Hewett, who has guided the Geological Survey's work in the district. During the period 1949-51 this work has included also the detailed mapping of the Birthday Claims (Mocam) area by W.N. Sharp and L.C. Pray, and the detailed study of the calcite-barite-bastnaesite body near the Sulphide Queen mine by D.R. Shawe, W.N. Sharp, and J.C. Olson.

The area of known rare-earth mineral occurrences is bounded on the east and south by the alluvium of Ivanpah Valley; on the west by the Clark Mountain fault, and westward-dipping normal fualt along which, according to Hewett, the Paleozoic sediments and Mesozoic sediments and volcanic rocks on the hanging wall have been displaced as much as 12,000 feet relative to the pre-Cambrian rocks of the footwall; and on the north by a prominent cross-fault that cuts the Clark Mountain fault and is just a few hundred feet north of the Mocam shaft. The pre-Cambrian block that extends 10 miles north of this cross-fault is not known to contain any of the rare-earth mineral deposits or alkalic intrusives.

The pre-Cambrian metamorphic complex consists of hornblende and mica gneisses and schists, containing sillimanite or coarse garnet in some places, invaded by biotite grantie gneiss with coarse rectangular or eye-shaped feldspar grains; by light-colored granitic augen geniss and associated pegmatites; and by minor dike rocks of mafic to intermediate compositions. All these pre-Cambrian rocks have a foliation that strikes about parallel to the general trend of the Clark Mountain fault and dips 50-80° W. in most places. Units based upon the relative proportions of the various pre-Cambrian rock types have been recongnized but are not designated on the accompanying map.

Potash-rick dike rocks intrude the folated pre-Cambrian rocks and may be late Mesozoic, like certain other intrusive and extrusive rocks in the region, but their age is uncertain. These potash-rich rocks range in composition, and generally decreasing age, from dark biotite shonkinite through several varieties of syenite to granite. They are cut by andesitic dikes that are probably Tertiary.

The biotite shonkinite is composed of potach feldspar and more than 50 percent dark minerals. The dark mineral is mostly biotite, but augite and hornblende are common; and aegirine and soda-amphiboles, such as riebeckite, indicate alkaline affinities.

The syenites range from rocks that are nearly all potash feldspar to some that are rich in biotite, hornblende, or augite, approaching shonkinite in composition. The granite contains potash feldspar and as much as 30 percent quartz, minor sodic plagioclase, and very little biotite or other dark minerals. The rocks intermediate in compositions between shonkinite, syenite, and granite, together with the wide distribution of all the varieties throughout the district, suggest their derivation from a common magmatic source.

Of the seven larger intrusives, the two nearest U.S. Highway 91 are potash syenites, with 2 or 3 percent quartz; the southeasternmost is red granite; and the other four are composite shonkinite-syenite bodies. These intrusives appear to dip southwest at moderate to steep angles. The thinner dikes, mostly 2 to 10 feet thick, are numbered in the hundreds, and they include types from shonkinite through syenite to granite.

contains breccia fragments of several types of older rock, and is discordant to the pre-Cambrian structure. These features, together with the wide distribution of the carbonate veins and their close association with the potash-rich dike rocks in the district, suggest that the materials forming the carbonate rocks were probably derived largely from the same magmatic source that supplied the alkalic dike rocks; but the nature of the fluids transporting the rare constituents is not yet understood.

Dikes, chiefly of andesite, and a few of felsite (rhyolite?), cut across the potash-rich dikes and the carbonate rocks. The andesitic dikes accur in swarms in four principal areas in the district and appear to have been emplaced in fractures formed distinctly later than the alkalic dike rocks and carbonate rocks. In general, and andesitic dikes have an easterly trend in contrast to the north-westerly trend of the alkalic dikes.

Unconsolidated gravels and alluvium, derived from rocks within the district, from Clark Mountain, and from the Mescal Range, have accumulated to considerable thickness near Mountain Pass and U.S. Highway 91. Ridges with several hundred feet of relief have been formed by the dissection of these unconsolidated materials. The gravels probably obscure some rare-earth mineral deposits.