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A NEW OCCURRENCE OF MILLERITE

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INTRODUCTION

A previously unreported occurrence of millerite and other associated nickel minerals was recently observed at the Klau quicksilver mine in the Santa Lucia Range, San Luis Obispo County, California (sec. 33, T 26 S, R 10 E). The only other occurrence of millerite in the southern part of the state is described by Eckel *et al.* (1941) from the nearby Libertad mine.

GEOLOGIC SETTING

Mineralization at Klau occurs along the Los Tables thrust zone, a major structural feature of this part of the coast ranges. At Klau the thrust zone is a mass of gouge and breccia nearly a thousand feet wide. Most of the gouge has been derived from the serpentines of the Franciscan formation which crop out on either side of the fault zone. Most of the brecciated blocks are shales and sandstones of probable lower Cretaceous age. The entire gouge and breccia zone as well as some of the adjacent rocks has been extensively altered by hydro-thermal action which has produced a silica-carbonate rock.

MINERALIZATION

The quicksilver veins at Klau exhibit several groups of minerals which are not commonly associated with cinnabar at other places in California and Nevada. Open cuts made during the past year provided much information on the deposit and the sequence of mineralization. Most of the earlier workings had caved so badly that they were not examined.

The following brief descriptions are confined to the minerals closely associated with the ore deposits and the gouge zone. The most striking mineral associations are found in the silica-carbonate masses in the main

vein and in the associated gouge. The shales and sandstones which occur as breccia fragments in the mineralized zone contain little of special interest. Mineralization seems to have occurred in three waves: First, quartz, sparse pyrite and very minor amounts of linnaeite were deposited. Second, chalcedony, millerite and some calcite were deposited. Third, and last, the deposition of cinnabar, sparse metacinnabar and marcasite occurred. The latter two minerals are closely associated with one another. Subsequently, the action of meteoric waters has produced an array of hypogene minerals including morenosite, bieberite, epsomite and a series of hydrous iron sulfates.

Sheaves of slender millerite crystals occur in the chalcedony vugs and in some instances have attached euhedral cinnabar crystals. The cinnabar crystals are usually rhombic, quite clear and present a striking appearance with the brass yellow millerite and sparkling minute quartz crystals which line the vugs. In no instance are the millerite crystals more than a millimeter long, but their perfection and mode of occurrence make them ideal for micromounts. In addition, millerite occurs in quantity in the clay gouge adjacent to the vein together with the green alteration product, morenosite. In some instances, the morenosite gives the gouge a bright apple green color. The abundant millerite, surprisingly, seems to have gone unnoticed in earlier descriptions of the region and the morenosite was called "unidentified sulfates of iron" (Forstner, 1903).

Occurrence of bieberite in several specimens led to a search for the primary mineral, which proved to be linnaeite occurring as microscopic isometric crystals in the fractured vein quartz. Both nickel and cobalt are believed to have been carried by hydrothermal solutions from the serpentines during the formation of the vein system.

Earlier reports on the district referred to all iron sulfides present as pyrite. This is, without doubt, an error because bulk of the observable mineral is marcasite. The crystals have a pale yellow color, a hardness of 6+, an uneven fracture, and are commonly tabular cockscomb or spear-shaped twins. No marcasite was observed growing on the millerite filaments although millerite and cinnabar are intimately associated in this manner. It is quite likely that much of the marcasite is of supergene origin and was one of the last minerals to be deposited. Melanterite, the decomposition product of marcasite, is found as a coating on the walls of the underground drifts and the acid mine waters have the disagreeable odor of decomposing marcasite.

ACKNOWLEDGMENT

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HYDROCUPRITE DISCREDITED¹

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The name hydrocuprite was proposed for a supposedly new mineral from Cornwall, Pennsylvania by Genth.² It was described by Genth as follows:

"Peculiar orange-colored coatings associated with cuprite and magnetite from Cornwall, were first noticed by Prof. W. Th. Roepper, of Bethlehem, who showed them to me several months ago. On a visit to the mines, a short time ago, I secured a considerable number of specimens from the 'big hill' at Cornwall, and proved them to be a new mineral."

"Amorphous; orange yellow to orange red; forms very thin, sometimes raglike coatings upon magnetite; soft."

"On heating looses water and becomes black; contains water and cuprous oxide. It is impossible to obtain from the quantity that I have noticed, enough for analysis; its composition is probably H_2O , Cu_2O ."

This is the entire description of the mineral and no subsequent work has been done. In Dana's "System of Mineralogy," 7th edition, it is listed as an "ill-defined, supposedly amorphous, form of Cu_2O with an indefinite amount of water."

Specimens in the U. S. National Museum labelled hydrocuprite from Cornwall, Pennsylvania, fit Genth's description perfectly, and it seems quite certain that they are identical with his "hydrocuprite." This material, on the basis of its x-ray powder photograph and optical properties, has been identified as cuprite, variety chalcotrichite. Likewise, specimens in the collection labelled hydrocuprite from Somerville, New Jersey, have been found to be cuprite. The indefinite amount of water found by Genth is not essential water, but rather is surface-held, due to the fine-grained, felt-like nature of the material.

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The International Union of Crystallography has accepted the invitation of the National Research Council of Canada to hold its Fourth General Assembly and International Con-

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² Genth, F. A., Prel. Rep. Mineral. Penn., *2nd Geol. Surv. Penn. Rept. of Progress*, B, p. 46 (1875).