NOTES AND NEWS

NOTES ON SOME MINERALS FROM SOUTHERN CALIFORNIA. III*

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In this paper have been grouped a number of brief descriptions of new mineral localities in southern California, and observations on some localities previously described. It is the intention of the writers to publish similar assembled data from time to time, in the hope that in this way the information may be made more readily available than if issued as separate items.

LINARITE AND ASSOCIATED MINERALS FROM DARWIN, INYO COUNTY, CALIFORNIA

This note describes linarite, aurichalcite, and a number of associated minerals collected from the Defiance Mine. No new minerals for California were found, but several in the list are new for the locality. The minerals may be grouped into two classes: the original country rock and ore minerals, and their alteration products. The geology and ore deposits of the Darwin district have been described by Knopf[1] and Kelley,[2] but the authors did not give or describe a complete list of the minerals occurring there.

PRIMARY MINERALS

Calcite. Coarsely crystalline limestone; the country rock.

Fluorite. Massive, cleavable material, often pale purple in color, occurring as patches and stringers in the calcite.

Galena. Massive, cleavable, occurring in the limestone in much the same manner as fluorite.

Pyrite. Cubic crystals scattered through the calcite matrix.

SECONDARY MINERALS

These are the products of surface, or near surface, alteration of the ores, and occur in general as coatings, or cavity fillings in the leached primary ore.

Anglesite. It occurs as fine grained, massive white incrustations on galena, or less com-

* Notes on some minerals from southern California: I., *Am. Mineral.*, **23**, 349–355 (1938); II., *Am. Mineral.*, **25**, 549–555 (1940).

[1] Knopf, Adolph., The Darwin silver-lead mining district, California: *U. S. Geol. Surv., Bull.* **580**, 1–18 (1915).

[2] Kelley, Vincent C., Geology and ore deposits of the Darwin silver-lead mining district, Inyo County, California: *Calif. Bur. Mines, Bull.* **34**, 503–562 (1938).

monly as aggregates of minute tabular, colorless crystals, with narrow pyramid faces {111}, modifying the dominant base and unit prism.

Aurichalcite. This mineral has not been reported heretofore from this locality. Its identification was confirmed by microchemical tests for copper and zinc. The aurichalcite occurs rather abundantly as rosettes and hemispheres of radiating needles, blue-green in color, and usually coated completely with transparent hemimorphite. Sometimes the needles are entirely uncovered, and project from the surface in delicate tufts.

Calcite. A second generation of this mineral appears as minute flat rhombohedra on the surface of the hemimorphite, often associated closely with later fluorite.

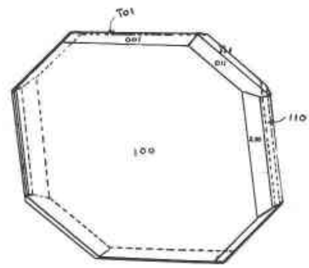
Fluorite. In addition to the massive purple fluorite of the primary ore, fluorite occurs in tiny colorless octahedra on the surface of hemimorphite, or on other secondary minerals. It is usually the latest of this series of minerals.

Hemimorphite. Colorless or white hemimorphite occurs as an abundant and often thick crust of imperfect crystals on fracture surfaces or cavity walls. Occasionally a single individual may be isolated; one such crystal showed on measurement the following forms: {010}, {110}, {011}, {101}, and {301}. Some of the hemimorphite appears green, due to an undercoating of aurichalcite, the color of which is transmitted through the overlying colorless crust.

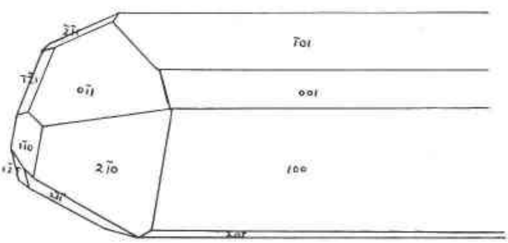
Hydrozincite. This mineral occurs as a crust of white or colorless blade-like crystals, showing no terminal faces; or as a white, fine grained coating. It is usually late in the paragenetic sequence.

Limonite. It occurs as pseudomorphs after pyrite, or as powdery coatings and crusts.

Linarite. Linarite has not previously been reported from Darwin. It occurs as crusts and coatings of brilliant blue crystals and grains, late in the sequence since it is seldom



A.



B.

FIG. 1

covered by other secondary minerals. Its identification was made by tests for copper, lead and SO_4, and crystallographic measurements. The crystals are mostly quite small, and appear in two habits: first, short prismatic, parallel to the *b*-axis; second, thin tabular, parallel to {100}. Typical crystals with these habits are shown in Fig. 1, A and B. The prismatic crystals have no important dominant form, but usually {$\bar{1}$01} is better developed than the others in the orthodome zone. Less common are: {$\bar{2}$01} {$\bar{7}$01} {$\bar{3}$02}. One crystal shows a narrow face close to {$\overline{39}$·0·20}. Measured and calculated readings for this face follow:

	Measured	Calculated
ϕ_2	126°49′	126°34½′
ρ_2	−90 00	−90 00

The terminations frequently show good prism faces, {110} and {210}, and often {011} or {$\bar{2}$11}. Less common are: {$\bar{1}$21}, {$\bar{1}$11}. The tabular crystals are frequently twinned on {100}, as shown by the repetition of {$\bar{1}$01}, {001} or {$\bar{1}$11}. The dominant form is {100}, modified by narrow faces, some of them mere lines, of {001}, {101}, {110}, {120}, {$\bar{1}$11}. Less commonly {$\bar{2}$11} takes the place of {$\bar{1}$11}.

Malachite. This mineral never occurs in good crystals, but is rather common as a coating of minute flakes and fibers on cavity surfaces.

Wulfenite. In some of the cavities a few shapeless grains of wulfenite were seen.

Orthoclase Phenocrysts from Cinco, California

An interesting occurrence of orthoclase crystals has been the collecting ground of hundreds of collectors for the past few years near Cinco, a wayside railroad station on the Owenyo branch of the Southern Pacific Railroad, about fifteen miles north of Mojave, California. This locality was known as early as 1908, when Cinco, then a boom town of 1000 population or more, was a center of activity during the construction of the Los Angeles/Owens River aqueduct, which was completed in 1913. It was not until about 1928 that the locality became generally known. In spite of the present widespread distribution of the orthoclase (mostly twinned) crystals from this locality, no geological or mineralogical description of them has ever appeared. The locality is represented in almost all California collections of minerals, and has widespread representation in collections all over North America. Not only are the specimens noted for their abundance, but also for size, perfection of development, and variety of forms. The locality is now more famous than the well-known locality at Goodsprings, Nevada, crystals from which were recently studied.[3] The collecting grounds are reached by an aqueduct inspection road turning from State Highway No. 7 from Mojave to Little Lake, California, one-quarter mile north of a wayside gasoline station called Cinco. The road ascends the Sierran escarpment by a series of switchbacks. The right hand fork is followed wherever a junction is encountered. After about four miles, an elongate ridge summit is reached, where the road retraces

[3] Drugman, J., On some unusual twin-laws observed in the orthoclase crystals of Goodsprings, Nevada: *Mineral. Mag.*, **25,** 1–14 (1938).

on the opposite side of the ridge. The car may be parked at this point as the locality is east along the ridge.

The geology of the general region is discussed by Baker.[4] No one has, however, noted the specific geologic conditions in the region. Areally the most extensive formation is the quartz monzonite-granodiorite of the Sierra Nevada batholith, which includes in this area few remnants of the older metamorphic sequence, represented by fragmentary xenoliths of quartzites; these are more or less continuous with, and lithologically like, the Kernville Series[5] to the north. This sequence is intruded by a number of rhyolite dikes varying in thickness from eight or ten feet up to 30 or 40, with generally a steep dip (40°–50° NE) and westerly strike (N 40° W). Many of these dikes, and in particular the southernmost of the group, are characterized by many well developed phenocrysts of orthoclase, ranging in size from 1 up to 10 cm. in length. There are also abundant phenocrysts of quartz, seldom over 1 cm. across, and usually much less. Commonly the dikes show a fine grained chilled margin phase, without phenocrysts.

The phenocrysts, both of feldspar and quartz, may be readily broken out of the matrix where the rock is weathered, and supply excellent specimens of well formed crystals. The feldspars are practically all Carlsbad twins, with an occasional Baveno twin, and much less commonly single individuals. The quartz crystals are invariably simple bipyramids, with the prism either absent or very slightly developed, with rounded edges or surfaces. Both minerals occur in a relatively fine-grained groundmass made up of orthoclase, quartz, biotite, and plagioclase. In thin section, the biotite is rare, and much of the plagioclase occurs as small, idiomorphic crystals and as a fine-grained aggregate of interlocking grains. This feldspar shows a maximum extinction angle of $15° \pm$ and is probably near andesine (An_{35-40}) in composition. The quartz shows considerable resorption. The orthoclase is only slightly affected by resorption, and is ordinarily only slightly altered. The alteration products are kaolinite and sericite. The plagioclase is all badly altered, with the prominent development of calcite. The biotite has been occasionally preserved where included in an orthoclase grain, but elsewhere is completely altered to mixtures of chorite and sericite.

[4] Baker, C. L., Physiography and structure of the western El Paso Range and southern Sierra Nevada: *Univ. Calif. Pub. Bull., Dept. Geol.*, **7,** 117–142 (1912).

[5] Miller, William J., Geologic sections across the southern Sierra Nevada of California: *Univ. Calif. Pub. Bull., Dept. Geol. Sci.*, **20,** 331–360 (1931);——and Webb, Robert W., Descriptive geology of the Kernville Quadrangle, California: *Calif. Jour. Mines and Geol., Rept.* **36,** 343–378 (1940).

One orthoclase crystal, almost completely kaolinized, was seen in thin section to be filled with inclusions of plagioclase, some rectangular, others showing definite crystal outlines, and arranged in parallel orientation. This orientation differs in the different halves of the Carlsbad twin of orthoclase, and all or most of the inclusions are albite twins.

Many of the orthoclase phenocrysts, even the freshest in appearance, on being broken, showed cores or small patches of a soft, pale bluish material, probably chlorite (or possibly talc, since it is very fine grained) which has apparently been derived from the alteration of original biotite or some other mafic mineral.

The orthoclase phenocrysts show dominant development of the pinacoids $\{010\}$, $\{001\}$, the prism $\{110\}$, negative dome $\{\bar{2}01\}$, and less commonly small modifying forms of $\{\bar{1}11\}$ and $\{120\}$. Except where badly kaolinized, the crystal surfaces are smooth and the edges and corners sharp. Since there are no roadcuts or workings exposing these dikes, no entirely fresh material was avilable.

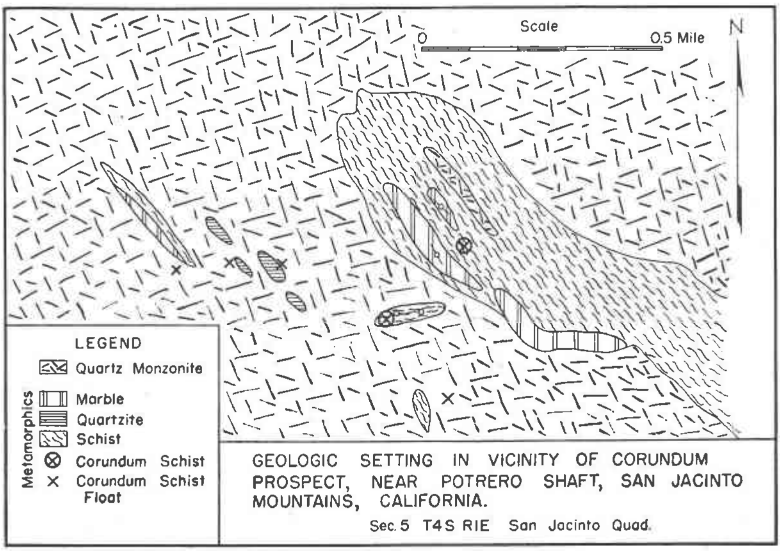
Hemimorphite Crystals from Lead Hill Mine, Barstow, California

About five miles northeast of Barstow, at the locality known as Lead Hill, occurs a series of fissure veins in metamorphic rocks carrying a variety of minerals. Some of these veins were mined for lead and silver in the early days. Most of the gangue material is barite, which, where the deposit is vuggy, shows well developed and often fairly large crystals. These are simple tabular crystals with base and prism. In addition, there occurs considerable coarsely cleavable calcite stained brown by oxide and closely resembling siderite. Less common, and often associated with residuals of galena, occur crusts of minute perfect hemimorphite crystals, rarely over 1 mm. in length, and often needle-like in appearance. These have been presumably derived from the alteration of sphalerite, though none of this mineral has been identified.

At one point in this locality, where the veins apparently cut limestone, and other calcareous rocks, thin coatings of malachite, and rarely of azurite, were noticed. Here also, are occasional thin crusts and minute globular masses of a yellowish-green mineral giving microchemical tests for Cu, Pb, Ca, As, and Cl; this may be a cupriferous hedyphane, although the material so far found is too scanty to make this identification definite. Aurichalcite allegedly occurs at this locality but it has not been found, all supposed specimens so far tested proving to be malachite. From some of the workings, small grains of wulfenite, not showing crystal form, have been collected.

Corundum and Associated Minerals near Banning, San Jacinto Mountains, California

In 1939, large crystals of corundum embedded in mica schist were submitted to the Department of Geology of the University of California, Los Angeles, by Mr. B. G. Funk, of Los Angeles. The specimens were of special interest because the corundum showed sapphire-blue cores, and was progressively zoned outward, sapphire-blue alternating with dull gray, and micaceous material. The locality was visited with the permission of the owner in the hope of finding sapphire of commercial quality. While this hope was not realized it is thought that the locality warrants further description, a brief account of its discovery having recently been published by Mr. Guy E. Hazen,[6] of Wickiup, Arizona, to whom the writers are indebted for permission to collect at the locality.



GEOLOGIC SETTING IN VICINITY OF CORUNDUM PROSPECT, NEAR POTRERO SHAFT, SAN JACINTO MOUNTAINS, CALIFORNIA.
Sec. 5 T4S R1E San Jacinto Quad.

FIG. 2

The locality, situated on the northwestern flank of San Jacinto Mountains, in Sec. 5, T 4 S, R 1 E, San Jacinto Quadrangle, is readily accessible from the Potrero shaft of the Metropolitan Water District's Aqueduct system, being about two miles from the mouth of the shaft. The geology of the region has been described in reconnaissance by Fraser,[7] and in de-

[6] Hazen, Guy E., Corundum crystals—California: *The Mineralogist*, **9,** 81–82 (1941).

[7] Fraser, Donald M., Geology of San Jacinto Quadrangle south of San Gorgonio Pass: *Calif. Bur. of Mines, State Mineralogist Report*, **27,** 494–540 (1937).

tail from observations along the line of a tunnel of the Los Angeles Metropolitan Water District, by Henderson.[8] A detail of the geology of the corundum deposit is given in Fig. 2.

The rocks consist of a series of metasedimentary types, mica schists, quartzites, and marbles, present chiefly in large roof pendants and smaller xenolithic masses, remnants of a more extensive sequence of unknown, but presumed, Paleozoic age. These are extensively intruded in the general region by diorites and gabbros, followed by granite and quartz monzonite, the latter only present in the corundum area. Widespread erosion has resulted in deeply weathered soil slopes especially in the plutonic rocks, with the hills supported by metamorphic remnants.

The corundum occurs in the usual barrel-shaped crystals, varying from microscopic size to individuals 14 inches in length and up to two inches in diameter. The crystals are coated externally with muscovite and biotite rims, making the hardness deceptive. The crystals occur both parallel and transverse to the foliation of the biotite schist, which in places is almost a biotite gneiss. The crystals are occasionally sufficiently blue so that the color is megascopically visible, but in several hundred specimens examined, none was found suitable for cutting. That corundum-bearing rocks have a wide distribution in the general sector is suggested by the many fragments of crystals picked up on weathered slopes within a mile of the main exposure. Similar corundum crystals have been found as float in many other parts of the San Jacinto Mountains.

The corundum in this occurrence is thought to have formed during the metamorphism of a highly aluminous sedimentary rock, under initial dynamothermal conditions. No evidence suggesting the introduction of aluminous material during invasion of batholitic rocks younger than the metasedimentary sequences was found.

Adjacent to the corundum deposit, along the contact of the large roof pendant shown in Fig. 2, are found several areas of garnet-diopside-wollastonite-quartz mineralization, formed on contacts by silicification of the marbles of the pendant. Impregnation by silicate solutions has extended into the pendant through a zone 100 yards wide, with development of massive and crystallized grossularite in a matrix of white quartz, calcite and large radiating clusters of white wollastonite. Diopside is also present in minor amounts. The absence of aluminous minerals in this tactite is considered significant in relation to the corundum since, were the corundum formed at the same time as the tactite zone, by the quartz monzonite intrusive, aluminous minerals would be expected in the tactite as well as in the xenoliths of biotite schist.

[8] Henderson, L. H., Detailed geological mapping and fault studies of the San Jacinto tunnel line and vicinity: *Jour. Geol.*, **47**, 314–325 (1939).