and dull so that it is impossible to obtain material for goniometric measurement.

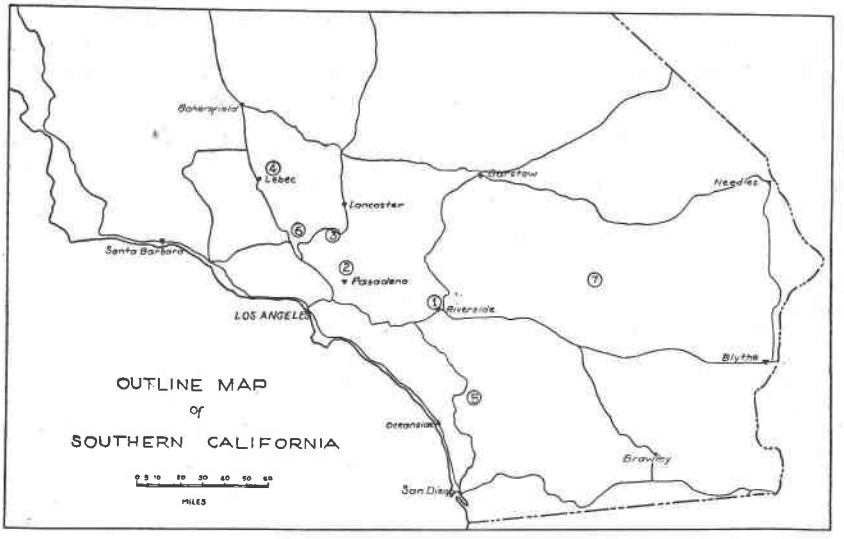
The optical properties and the chemical analysis definitely demonstrate the identity of "austinite" and "brickerite" Priority should be given the name "austinite."

NOTES ON SOME MINERALS FROM SOUTHERN CALIFORNIA

JOSEPH MURDOCH AND ROBERT W. WEBB,
University of California at Los Angeles.

INTRODUCTION

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



INDEX TO LOCALITIES. (1) Crestmore, Riverside County. (2) George's Gap, San Gabriel Mountains, Los Angeles County. (3) Acton, Los Angeles County. (4) Tejon Postoffice, San Joaquin Valley, Kern County, (5) Rincon, San Diego County. (6) San Francisquito Canyon, Los Angeles County. (7) Twenty-nine Palms, San Bernardino County.

way the information may be made more readily available than if issued as separate items. Unless otherwise indicated by initials (M or W) after each locality, the areas described were investigated by both authors.

(1) Crestmore, Riverside County (M)

Okenite.—Examination of several specimens from the Sky Blue Quarry at Crestmore, Riverside County, showed white, imperfect crystals, composed of silky fibers, and obviously pseudomorphs. These crystals varied from .5 to 1 mm. in diameter, and 2 to 3 mm. in length. A review of the literature on Crestmore, showed that Eakle and Rogers[1] noted these pseudomorphs, and determined them to be okenite after wilkeite. Some of these crystals were well developed, with smooth faces; accordingly they were measured on the goniometer, to determine, if possible, the axial ratio of the original mineral. The prism zone was well developed, and the measured angles checked satisfactorily with the hexagonal prism. No second order prism faces were detected. The terminations in most individuals were well rounded, showing no crystal faces but in several cases, pyramid planes were present. These were measured as accurately as possible, though in only a few instances were signals observed. In all, seven faces were measured, giving ρ angles approximately as follows:

Reading	Angle ρ
1.	40° 30′
2.	40 30
3.	40 30
4.	40 00
5.	40 00
6.	39 30
7.	39 30
Average	40°04′

This average checks very closely with Eakle and Rogers' reading of 40°09′ for a single pyramid face of wilkeite, and further confirms their findings of an axial ratio for this mineral that is close to apatite. If this is assumed as the unit pyramid, $c=0.730\pm$.

The pseudomorphs were found in a granular aggregate of okenite, idocrase, and a dark brown material which in part formed the matrix between larger, subidiomorphic grains of idocrase. In addition to the pseudomorphs, okenite also occurs in massive fibrous form, interstitial to idocrase individuals. The dark brown material occurs often in rounded grains, occasionally showing a crystal face, but in no case with recognizable forms. It has a hardness of 2–3, and the microscope shows it to be quite completely altered to a mixture of limonite and a finely fibrous or granular doubly refracting mineral, whose index of refraction is approximately 1.52. It is too fine-grained, and too intimately mixed with

[1] Wilkeite, a new mineral of the apatite group, and okenite, its alteration product, from southern California: *Am. Jour. Sci.* (4), vol. **37**, p. 262, 1914.

limonite to permit its identification, but judging by the general shape of the grains, the parent mineral might have been diopside.

Grossularite Garnet.—Blue-green grossularite garnet was also found in the contact zone of the Sky Blue quarry. This occurs as deep to pale, blue-green grains and irregular patches, up to 4–5 mm. across, with occasional dodecahedral crystals up to 1 mm. in diameter. The matrix is massive, colorless grossularite, and the included grains are frequently abundant enough to strongly color the rock. The index of refraction of this garnet is 1.720, and its specific gravity, as determined with Clerici solution is 3.25.

Opal (*Hyalite*).—In the same locality as the blue-green garnet, and in many cases coating crevices in the garnet rock, is a stalactitic crust. This crust is mainly calcite, but often on it is deposited, in short stalactitic and finger-like forms, a later coating of perfectly clear, colorless opal. This hyalite is on the average 0.5 mm. in diameter and 2–3 mm. long.

(2) Almandite Garnet, from George's Gap, San Gabriel Mountains, Los Angeles County

Almandite Garnet.—Almandite garnet, in excellent, large, euhedral crystals was encountered by the construction crews building a new road in the San Gabriel Mountains, on the Angeles Crest highway, near George's Gap. The almandite crystals are deep brown to reddish-brown in color, and vary from a few millimeters to 3 or 4 cm. across. They occur in a zone of biotite-chlorite schist which is part of the San Gabriel formation as mapped by Miller.[2] The entire area of the garnet-bearing schist was excavated in building the road, and several hundred large crystals were collected. Many small crystals are present in the surrounding schistose rocks, but none have been found to compare in size with the first. The garnet has a specific gravity of 4.1 as determined with Clerici solution. The dominant form is the dodecahedron, with small modifying trapezohedrons, $n(211)$. When first obtained, specimens were covered with a thick, weathered coating of biotite and chlorite; upon scrubbing, fresh, brilliant, nearly transparent crystals were obtained. The crystal faces are almost invariably pitted due to partial inclusion of chlorite or biotite flakes.

(3) Zeolites, from Acton, Los Angeles County (W)

Heulandite.—Excellent, colorless crystals of heulandite, in seams, veins and cavities, were found filling vesicles, joints, and fractures in a blackish gray basalt, located about one-quarter mile west of the village

[2] William J. Miller, Geology of the western San Gabriel Mountains of California: *Univ. of Calif. at Los Angeles Pub. in Math. and Phys. Sci.*, vol. 1, pp. 1–114, 1934.

of Acton. The lava is a flow occurrence. Specimens are readily obtainable since the basalt has been opened up as a quarry for road material. The crystals vary in size from microscopic forms to 7–8 cm. in length. Veinlets of heulandite appear almost massive, with a cream-colored appearance; upon magnification, these veinlets are seen to be composed of minute crystals, each crystal by itself is nearly colorless. These seams can be traced through the highly fractured rock for some distance, occasionally almost disappearing and again widening into zones an inch or more in width, in which occur the larger crystals. The crystals and vein material check microscopically for heulandite.

Stilbite.—In the same quarry are found two occurrences of stilbite, each with slightly different physical properties. They were both identified as stilbite by optical means. (1) The largest crystals occur in the wider parts of the heulandite seams, and lie upon a base of well-formed heulandite crystals. The stilbite occurs in this relation as milk-white to colorless sheaves and plates, almost rosettes, with exceptionally brilliant pearly luster on all faces. The sheaves are often an inch or more in length; they never completely fill the open spaces in the heulandite seams. (2) A second occurrence of stilbite was noted in the same quarry, where seams and veins, in appearance and physical features like the heulandite seams, transect the basalt. Along the seams are pockets and cavities that are filled with tabular, platy crystals averaging 7–8 cm. in length. These are cream-colored, and often stained with a brown or black coating of iron and manganese oxides. Such cavities are exceedingly irregular, and in many places have been so completely filled that the specimens appear to be brecciated basalt cemented with stilbite. In this second type of occurrence, one never finds any associated heulandite.

Relations between Heulandite and Stilbite.—The heulandite was first deposited in the vein-fractures and joints in the basalt. The perfect crystals indicate freedom during crystallization. Since the stilbite fills the interstices between the heulandite crystals, and rests upon a matrix of them, it must be later, and must have formed well after the heulandite crystallized. The vein occurrence of stilbite was never found in juxtaposition with heulandite, but since optically the two occurrences of stilbite are similar, both occurrences undoubtedly were deposited at the same time.

(4) Gibbsite, from San Joaquin Valley, Kern County

Gibbsite.—During an investigation of some heretofore little known garnet-bearing rocks on the Tejon Ranch in the Southern San Joaquin Valley, Kern County, some boulders carrying a peculiar clay-like pink mineral were encountered on uplifted alluvial fans on the steep hillslopes

of the Tehachapi Mountains, at the southern edge of the valley. Several boulders were found, though the outcrops from which they were derived could not be located. Examination showed the material to be gibbsite, the hydroxide of aluminum. Index determinations checked, and blowpipe tests gave strong aluminum reaction with cobalt nitrate, and absence of silica. The gibbsite is pale pink to rose-red in color, the deeper shades of pink being most typical. This is a somewhat unusual color for this mineral. The gibbsite occurs in a gray chert breccia, the whole locally stained by limonite. The chert fragments are compactly cemented and partially replaced by the gibbsite, which shows a concentric structure where it fills the interstices; this structure is evident from color variations shown in the intergrowth. Gibbsite is a relatively rare mineral, and this occurrence is the first known to the writers in the state of California, although undoubtedly it is present as an alteration product mixed with the clays of the Riverside County deposits.

(5) Gastaldite, from Rincon, San Diego County

Gastaldite.—A bluish fibrous mineral occurring abundantly along the contact of a small pegmatite dike with diorite, was determined by its optical properties to be gastaldite—a variety of glaucophane. A more detailed description of this occurrence is planned to accompany a discussion of the Rincon pegmatites by the writers at a later date.

(6) Mariposite and Clinozoisite from San Francisquito Canyon, Los Angeles County

Mariposite.—The rare, green, chromium-bearing mica has been identified from the Sierra Pelona[3] schists of the San Francisquito Canyon. The mineral occurs in considerable abundance in the first large canyon entering San Francisquito from the east, just above the upper end of the lake floor that was San Francisquito Reservoir. The mariposite occurs as nests and lenses in talc-sericite and talc-actinolite schists. In some of the larger lenses, the flakes are 10–12 mm. in diameter. In color, the mariposite varies from an emerald-green to a greenish yellow. All of the material gives a chromium bead before the blowpipe. The mariposite is rather widely disseminated in some occurrences, being scattered in small flakes throughout talc schists. The commonest occurrence is in the larger lenses.

A mica closely related to mariposite is reported by Hulin[4] from the

[3] Hershey, Oscar H., Some crystalline rocks of southern California: *Am. Geol.*, vol. **29**, pp. 372–390, 1902.

[4] Geology and ore deposits of the Randsburg Quadrangle, California: *Calif. State Min. Bur., Bull.*, **95**, p. 25, 1925.

Randsburg district, where flakes occur in a schist in a similar relation to the San Francisquito Canyon locality. Knopf[5] described the occurrence of mariposite in the Mother Lode district. However, the San Francisquito canyon occurrence is the first known to the writers in Southern California.

Clinozoisite.—On the eastern edge of what was the San Francisquito reservoir, in the Sierra Pelona schists, near the mariposite locality, occurs a quartz vein in which large crystals of clinozoisite were found intergrown with quartz. The clinozoisite crystals are often three to four inches in length, with bundles of crystals an inch or more in diameter. Much of the clinozoisite outcrop was destroyed in excavating for a road, but good specimen material is still available in the old road embankments.

(7) Lamellar Quartz from Twenty-nine Palms, San Bernardino County, California (M)

Lamellar quartz.—An outcrop of pure white quartz, about five miles southeast of Twenty-nine Palms, on the road towards White Tank, attracted the writer's attention; investigation showed it to possess some unusual features. Although this particular outcrop could be traced only a few feet in any direction, it was undoubtedly a quartz-rich portion of one of the numerous pegmatite dikes which cut the granite of this area.

The quartz showed in many places a nearly perfect parting, which produced flat surfaces over areas six to eight inches across. The luster on this surface is strongly pearly, and flakes can readily be split off parallel to it. The plane surface is interrupted by occasional rounded and irregular areas of normal glassy quartz, with the usual conchoidal fracture. It is further marked by faint parallel striations, unevenly spaced, sometimes entirely absent, which are seen to be narrow lamellae with slightly different orientation from the main surface. These striations indicate the trace of a second direction of parting, not nearly as perfect at the first, and not so readily visible on a hand specimen. The luster on this second surface is usually dull, as if frosted, but sometimes highly vitreous. In this plane, the edges of the more prominent lamellae of the quartz are plainly visible. The angle between these two directions, measured on a number of specimens, varies between 65° and 75°. Occasionally, a third still poorer direction of parting was observed. Its presence was shown by straight cracks intersecting the best parting surface. This third separation makes an angle of approximately 87° with the first, and 81° with the

[5] The Mother Lode System of California: *U. S. Geol. Surv., Prof. Paper* **157**, pp. 38–39, 1929.

second parting. The luster on the third is strongly vitreous, with the parting surface ordinarily discontinuous over any area, being composed of a number of small, parallel faces.

Several thin sections were made, some cut parallel to the best parting, others normal to it and along the line of the second parting. Those cut parallel to the best, often showed a single large quartz grain (in the area of the section), or sometimes a number of very large grains, in essentially parallel position. Occasional inclusions of differently oriented grains are found, as was observed in the hand specimen. The large grains do not extinguish uniformly, but as a vague mosaic of areas which extinguish almost, but not quite, simultaneously. As nearly as could be observed under these conditions, the *c* axis of the quartz is inclined at an angle of about 40° to the plane of the parting. Accurate measurement on the universal stage was not possible because of the irregular extinction.

A section cut normal to the best parting, shows long parallel lamellae of varying width, with alternate strips which generally extinguish simultaneously. Neighboring lamellae extinguish only a few degrees apart. Several measurements of this difference gave values ranging from 3° to 5°. These lamellae extinguish uniformly throughout their length, which in some cases is entirely across a section. This confirms the observation on the broadside section, that the lamellae are made up of very large individuals, even though they do not have quite even extinction on the broad face.

The alternate arrangement of these lamellae strongly resembles albite twinning, and the observed structure may be explained as a pseudomorphic replacement of a triclinic feldspar by quartz. The unusual feature of this is the replacement of feldspar lamellae essentially by single individuals, rather than by an aggregate of small grains. The presence of these large individuals is of course responsible for the perfection of the best parting over such large areas.