by the Gruner[4] staining method, a simple test for the identification of any mineral of the helvite group.

*X*-ray examination by F. A. Hildebrand of the U. S. Geological Survey of genthelvite from El Paso County, Colo., confirms the identity of genthelvite.

This crystal is deposited in the U. S. National Museum.

## A XONOTLITE OCCURRENCE IN PUERTO RICO[1]

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Xonotlite, a relatively rare hydrous calcium silicate, $Ca_3Si_3O_8(OH)_2$ (Berman, 1937, p. 391), has been found in Puerto Rico in an unusual contact association with serpentine and a metavolcanic rock. The mineral was recognized by Robert Berman and Evelyn Cisney, U. S. Geological Survey, using optical and *x*-ray methods, respectively, from samples collected by the writer.

The xonotlite was discovered in the walls of a tunnel connecting the Rio Yauco and the Rio Loco, not far from the town of Yauco, Puerto Rico. This tunnel is part of the Southwestern Puerto Rico Project of the Puerto Rico Water Resources Authority. The xonotlite occurs approximately 2,000 feet from the outlet portal of the tunnel on the Rio Loco, at the contact of a large serpentine massif and a metavolcanic rock. The mineral was also identified at the surface outcrop of the contact about 150 feet above the tunnel.

The serpentine massif crops out over an area of about 35 square miles and is the largest serpentine body in Puerto Rico. The serpentine exposed in the tunnel is intensely sheared throughout. Its contact with the metavolcanic rock is sharp but uneven in the tunnel; and from its expression on the surface, the contact is seen to be essentially vertical.

The metavolcanic rock has been altered beyond precise recognition at the contact, but it possibly is related to a trachyte that occurs in a relatively fresh state several hundred yards away from the contact. The metavolcanic rock is finely porphyritic with an aphanitic groundmass. At the contact the phenocrysts are augite and feldspar, the latter mineral being completely altered to a variety of chlorite. The matrix, which in hand specimens is white, is seen under the microscope to be a very fine-grained aggregate of slightly brownish material of very low birefringence. It is probably a clay. Farther away from the contact the clayey ground-

[4] Gruner, John W., Simple test for the detection of the beryllium mineral helvite: *Econ. Geol.*, **39**, 444–447 (1944).

[1] Publication authorized by Director, U. S. Geological Survey.

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mass is rich in fine pyroxene needles, and the color of the rock matrix is dark olive gray.

The xonotlite lines the serpentine-metavolcanic contact as disconnected masses and pods, as much as 3 inches thick. The mineral is found only at the contact and does not penetrate either of the wall-rocks. It possesses the characteristic physical and optical properties that have generally been ascribed to xonotlite. Optically, it is colorless, acicular, and biaxially positive, having indices of $\alpha=\beta=1.581$ and $\gamma=1.591$. Its acicular habit makes a positive measurement of the $2V$ doubtful. The mineral exhibits parallel extinction. Physically it has a hardness of 6 and is unusually tough.

The xonoltite exhibits the following three, rather distinctive habits:

(1) *Massive habit.* Found only in a few places and only where the xonotlite is 2 inches or more thick. It apparently consists of randomly oriented small crystals. Individual crystals are not apparent to the naked eye. The mineral aggregate is light gray to medium gray and has a slightly greasy luster.

(2) *Parallel-fibrous, translucent xonotlite.* This is the most common form of xonotlite found. The long, fibrous crystals are too thin to be distinguished individually with the naked eye. The color varies from medium gray to very light gray. Only one small spot was seen with the flesh-pink coloration that reportedly characterizes freshly broken xonotlite (Foshag and Larsen, 1922; Schwartz, 1924, 1925; and Shannon, 1925). At right angles to the fiber direction, the mineral has a sharp hackly fracture and a dull glassy luster. Parallel to the fiber direction the luster is slightly pearly. Specimens in the writer's possession more than two years have lost some of their translucency and have developed white streaks.

Of interest is the fact that the fiber direction lies in the plane of the contact and is generally parallel to the slickensides, which everywhere score the contact surface.

(3) *Chalky white, acicular habit.* The luster varies from chalky to pearly. This form of the mineral is somewhat less tough than the other forms and breaks rather easily, producing a splintery fracture in which the needle-like crystals are evident. This variety of xonotlite commonly occurs as thin layers between the fibrous translucent variety and the wallrock. It is probably an alteration product of the other varieties.

The only other vein mineral noticed in the vicinity of the contact was prehnite, which occurs as small veins in the metavolcanic rock.

Several hypotheses may explain the origin of the xonotlite deposit. One is that the xonotlite was formed along the contact during the shearing movement that slickensided the wallrock. The orientation of most of the xonotlite crystals parallel to the slickensides strongly suggests a genetic relationship between the mineral crystallization and the displacement along the contact. Possibly the heat generated by this movement was sufficient to alter a pre-existing calcite vein into the hydrous calcium silicate, xonotlite, in the presence of siliceous emanations from the serpentine. The calcite may have been deposited at the contact in a pre-movement stage. A possible alternative to this hypothesis is that the xonotlite formed prior to the movement along the contact but that this movement caused recrystallization of the original xonotlite into the parallel-fibrous variety. The massive xonotlite described above would thus be relict from the pre-movement deposit. In any event, the origin of the xonotlite apparently is related to emanations from the serpentine. The fact that the xonotlite is confined to the contact plane and does not penetrate the wallrock indicates, however, that conditions at the contact were critical to its formation.

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# CUMMINGTONITE FROM THE MIKONUI RIVER, WESTLAND, NEW ZEALAND

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Cummingtonite has not been recorded from New Zealand, although a considerable part of the South Island is made up of metamorphic rocks of various kinds. However, large areas of these rocks are situated in the geologically little explored region of the Southern Alps. Some years ago I collected a number of boulders of unusual appearance from the rivers draining the Southern Alps in Westland. Recent examination has shown the presence of abundant cummingtonite in some of these.

The cummingtonite-bearing boulders were collected from the Mikonui River where the main road crosses it just south of the town of Ross. The boulders were well rounded and ranged up to two feet in diameter, a not uncommon size in these swift mountain torrents. These boulders have a typically rusty surface, evidently due to the partial decomposition of the iron-bearing minerals. On breaking them with a ham-