THE MINERALS OF BRINTON'S QUARRY, CHESTER COUNTY, PA.

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BRINTON'S QUARRY is one of the most famous of the mineral localities in the serpentine rocks of southeastern Pennsylvania; it is the type locality for jefferisite, and is noted for the fine crystals of clinochlore that it formerly produced. An account of its present condition and list of minerals complete to date will therefore be of interest to collectors.

The quarry is located in Westtown Township, Chester County, Pa., three miles south of West Chester. It is along the Birmingham road (continuation of South New Street, West Chester) southeast of its crossing with the Street Road. On the ninth-coördinate system the location is West Chester quadrangle 5322.

It is variously referred to in mineralogies as West Chester, Birmingham, Westtown, etc., or merely as Chester County.

HISTORY AND PRESENT CONDITION

The quarry was first opened in 1730[1] and many farmhouses of the region dating before the Revolution are built of its serpentine. In the '70's of the last century, when operations were carried on by Mr. Joseph H. Brinton, the stone was in great demand for building purposes. On account of its softness, sawing machinery was at one time used to cut it into blocks, but by 1880 this had been discarded, and the operation was by hand and horse power.

The quarry afforded stone for four buildings of the University of Pennsylvania, for the Academy of Natural Sciences of Philadelphia (this has since been re-faced), for the court house at Wilmington, Del., for the buildings of the West Chester State Normal School, and for about twenty churches in Philadelphia and Baltimore. Experience has shown, however, that the stone disintegrates rapidly in the sulfuric acid-laden atmosphere of cities, and it is no longer used.

The appearance of the quarry at present is not over-encouraging to collectors. Really active work has not been done for a

[1] Second Geol. Surv. Pa. Rept. **C4**, 63, 1883.

score of years, two of the three quarry pits being filled with water of uncertain depth—from thirty to sixty feet (depending upon the imagination of your informant), and the chrome-green water together with the rugged grayish green cliffs present a scene which a fertile fancy might convert into a Swiss mountain lake.

In the largest quarry hole (the central pit), intermittent operations are carried on above the level of the water by a local contractor, occasionally exposing a vein of jefferisite, and veins of magnesite with magnetite. The minerals now to be found occur here, or in weathered condition on the dumps and old workings. Operations just beginning in the western quarry hole have as yet brought to light nothing of interest.

Geology

Serpentine.—The main rock of the quarry is compact green serpentine, which occurs in a lenticular outcrop about a quarter of a mile in length. It is in the same general belt as the exposures at Edgemont, Delaware County; and Street Road and Unionville, Chester County. The surrounding rock is Wissahickon mica gneiss, but ¼ mile to the north is an area of highly hornblendic gabbro, and the same distance to the south are exposed dikes of pegmatite. The serpentine contains veins of magnesite and magnetite, and smaller seams of deweylite, talc, and other alteration products.

Granite.—Cutting the serpentine is a dike of white granite several feet wide. It is composed of quartz, feldspar, and muscovite, with accessory tourmaline. This dike is exposed on the ridge between the main quarry and the eastern pit.

Pegmatite.—The serpentine is also cut by irregular pegmatite dikes, some composed of striated feldspar with pearly muscovite and little if any quartz—others of partially kaolinized feldspar and jefferisite, and still others of pure jefferisite.

Mineralogy

The minerals of this locality have been described in more or less detail in the following articles:

Benge, Elmer, and Wherry, Edgar T. Directory of the mineral localities in and around Philadelphia. *Mineral Collector*, **15,** 1908, p. 54.

Blake, W. P. Optical and blow-pipe examination of the supposed chlorite of Chester Co., Pa. *Am. J. Sci.*, **12**, 1851, p. 339.

Mineralogical Notices, *ibid.*, **13**, 1852, p. 116.

Brush, G. J. Ninth Supplement to Dana's Mineralogy. *Am. J. Sci.*, **31**, 1861, p. 369.

Mineralogical Notices, *ibid.*, **41**, 1866, p. 248.

See also Smith and Brush.

Craw, W. J. On the clinochlore of Chester Co., Pa. *Am. J. Sci.*, **13**, 1852, p. 222.

Dana, James D. Mineralogical Notices. *Am. J. Sci.*, **15**, 1853, p. 436.

System of Mineralogy, Fifth Edition, 1868: Sixth Edition, 1892.

Genth, F. A. Mineralogy of Pennsylvania, Report B, Second Geol. Survey, Pa. 1875.

Jefferis, William W. See Rand, Jefferis and Cardeza.

Lea, Isaac. An account of the minerals at present known to exist in the vicinity of Philadelphia. *Jour. Acad. Nat. Sci.*, Philadelphia, **1**, 1818, p. 462.

Rand, T. D., Jefferis, W. W., and Cardeza, J. T. M. Mineral localities of Philadelphia and vicinity. *Proc. Acad. Nat. Sci., Philadelphia*, 1892, p. 174.

Smith, J. Lawrence, and Brush, Geo. J. Reëxamination of American minerals. *Am. J. Sci.*, **15**, 1853, p. 215.

Wherry, Edgar T. See Benge and Wherry.

The minerals known to have been found in these quarries, arranged alfabetically, with references, are:

Actinolite. Dana, 1868, p. 778.

In fibers associated with chrysotile, especially in serpentine adjoining pegmatite.

Apatite.

A hexagonal crystal of green apatite was found by Mr. Biernbaum in 1913 in the vein of jefferisite on the west side of the main quarry.

Aragonite. Smith and Brush, 1853, p. 215.

Radiating white crystals on serpentine. Now found only on the dumps.

Asbestos (See chrysotile).

Beryl. Genth, 1875, p. 71.

Mentioned in the Mineralogy of Pennsylvania as occurring in hexagonal crystals in the granite dike.

Bronzite (See enstatite).

Chromite. Benge and Wherry, 1908, p. 54.

Nodules of granular chromite occur; crystals reported.

Chrysotile (asbestos). Dana, 1868, p. 778.

Soft fibers $\frac{3}{4}$ in. to 1 in. long associated with magnetite and deweylite. Masses of fibers 5 in. in diameter. West wall of main quarry, south of pegmatite dike.

Clinochlore. Blake, 1851, p. 339; 1852, p. 116; Craw, 1852, p. 222; Dana, 1853, p. 436.

Plates six inches or more in diameter have been found, as well as monoclinic, pseudohexagonal, crystals. At present plates two to three inches in diameter and occasionally small crystals are obtainable.

Deweylite. Jefferis, 1892, p. 189.

Masses of yellow deweylite with dendritic markings, admixed with talc, on west side of main quarry. Common on slickensided faces and lining joint planes. Occurs in veins in magnesite.

Enstatite, var. bronzite.

Large metallic-looking grains in serpentine, particularly in the western pit.

Ilmenite. Dana, 1868, p. 778.

Occurs in large lumps imbedded in serpentine.

Jefferisite. Brush, 1861, p. 369; 1866, p. 248.

Named after its discoverer, the late William W. Jefferis, of West Chester, who found it at this locality. It was determined to be a new species by Brush.[1]

Occurs in veins, either alone or with triclinic feldspar as an altered pegmatite, also in fine flakes between the serpentine and the granite dike. The best vein is exposed on the west side of the main quarry. It is one to three feet thick, and composed of pure jefferisite. Most of the flakes are small, but plates are found up to 5 in. in diameter, and frequently six-sided crystals.

Limonite.

Occurs with drusy quartz in the zone of weathering.

[1] This mineral had been previously known as phlogopite to collectors.

Magnesite. Blake, 1851, p. 339.

White compact magnesite is found in numerous veins in the serpentine. One about two inches wide is exposed near the diving board at the northwest corner of the main quarry. It is massive, and in some places traversed by a network of green deweylite veins. Specimens four inches or more across may be obtained.

Magnetite. Blake, 1851, p. 238.

In veins in serpentine, also in grains in the massive rock. A vein from 1 in. to 2 in. wide is visible near the magnesite vein just mentioned. It affords large lumps of hard, lustrous black magnetite. Like the magnesite, it is cut by small deweylite veins.

Muscovite. Dana, 1868, p. 778.

Pearly plates with oligoclase in pegmatite on west wall of main quarry.

Oligoclase. Jefferis, 1892, p. 189.

In pegmatite dike on west side of main quarry. Glassy cleavages showing striation.

Quartz (drusy). Genth, 1875, p. 57.

In veins near surface, and in honeycomb quartz. Fragments loose on the ground at top wall of main quarry. This mineral is a characteristic product of the weathering of serpentine.

Quartz (var. amethyst). Dana, 1892, p. 1068.

Has been reported, but it is doubtful if amethyst occurs in the serpentine; probably came from the adjoining Wissahickon gneiss.

Ripidolite (See Clinochlore).

Sepiolite. Benge and Wherry, 1908, p. 54.

Has been reported by Philadelphia collectors.

Serpentine. Lea, 1818, p. 478.

The main rock of the quarry; specimens of translucent material approaching williamsite are often found. Also pieces containing bronzite grains, veins of chrysotile, deweylite and magnesite, which make handsome polished specimens.

Talc. Dana, 1868, p. 778.

Green foliated talc occurs in the serpentine in flakes up to an inch in diameter. Also occurs as steatite, especially near pegmatite dikes.

Tourmaline. Jefferis, 1892, p. 189.

Occurs in aggregations of crystals in pegmatite, especially near the jefferisite vein on the west side of the main quarry. Lumps 2 in. in diameter of aggregated crystals.

The paragenesis of the minerals is summed up in the following table:

1. Magnesic igneous rocks.
   (a) Primary: bronzite, magnetite, chromite, ilmenite.
   (b) Metamorphosed: actinolite, serpentine, chrysotile, dewEylite, talc, clinochlore (magnetite).
   (c) Weathered: quartz (drusy), limonite, magnesite, aragonite.
2. Granite and granitic pegmatite.
   (a) Prim. ry: oligoclase, muscovite, beryl, tourmaline, apatite.
   (c) Weathered: jefferisite.

The geologic history of the locality may accordingly be interpreted to have been: A magma high in magnesium but low in silicon intruded into the Wissahickon gneiss of this region, solidifying as a peridotite, composed of bronzite, olivine, and the accessory minerals magnetite, chromite and ilmenite (1(a)). At a later period a granitic magma solidified in the vicinity—probably at some depth below the peridotite, as no large body of granitic rock is now exposed nearby—giving off small dikes of granite and pegmatite, as well as considerable quantities of heated solutions. Acting on the minerals of the peridotite, these produced the minerals of 1(b); the olivine being completely, and the bronzite partly, converted to serpentine, while locally, because of unusual features of composition, the other minerals of this group developed, in relatively small amounts. Subsequently erosion of the region brought the serpentine mass to the surface of the earth, and rain water acted upon it, producing the minerals of 1(c). Simultaneously rock 2 was subjected to the action of the weather and from biotite originally present in it the mineral jefferisite developed.