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Re-examination of the alleged occurrence of wollastonite and epistilbite in Jersey

Wollastonite. Teilhard de Chardin and Pelletier (1911) described an occurrence of wollastonite associated with calcite at the Hermitage, Elizabeth Castle, near St. Helier, in veins separating porphyritic dolerite from a small dyke of 'porphyrite' (actually aphyric dolerite) which intrudes it. Mourant (1961) commented that the identification as wollastonite 'is extremely doubtful' (p. 86) and went on 'white crystals do occur embedded in calcite in precisely this situation, but they were found impossible to identify . . . such rough [optical] data as were obtained would not fit wollastonite.'. The original specimens both of 'wollastonite' and 'epistilbite' were presumably transferred to France in about 1950 with the Jesuits' geological collection which, some twenty years later, was sold to a dealer.

A specimen recently collected from this locality by one of us (A.E.M.) has been examined in an attempt to verify or otherwise the long-standing claim for the occurrence of wollastonite at the Hermitage. The specimen carries a vein, up to 15 mm wide, which occupies a fracture within the aphyric dyke and consists essentially of translucent, slightly milky quartz, a little calcite in discrete and fairly large crystals, and abundant, buff, compact prehnite. In thin-section the vein has a marginal zone of fine-grained, turbid, granular prehnite containing a few grains of pleochroic, iron-rich epidote, and a little sphene. The central part of the vein comprises coarser, bladed prehnite occurring as stout crystals, as radiating masses in places arranged perpendicular to the vein walls, but more commonly in random orientation, as 'bow-tie' aggregates, and as groups of clear, stout crystals often with castellated terminations. The main associated mineral is quartz; a little calcite, epidote, sphene, and interstitial chlorite are also present. Wollastonite has not been identified. The identity of the prehnite has been checked by X-ray powder diffractometry and hence, assuming that this occurrence is indeed that from which the alleged wollastonite was obtained, there seems little doubt that the original identification was mistaken. Prehnite frequently occurs in veins in many of the igneous rocks in Jersey and its occurrence at the Hermitage is to be expected, much more so than wollastonite.

Epistilbite. Teilhard de Chardin and Pelletier (1921) also published a *liste supplémentaire* of mineral occurrences in Jersey in which they described the occurrence in Waterworks Valley, St. Lawrence (known also as St. Lawrence Valley), of 'une zéolite monoclinique, très calcique, dont l'espèce n'a pu être déterminée exactement . . .' The occurrence was described thus: 'Les cristaux incolores, très petits, et piquants, semblent être facilement décomposables, car on ne trouve souvent plus, dans les fissures de la roche, qu'une croûte blanche de calcite et de silice provenant sans doute de leur altération.'

In the early 1930s one of us (A.E.M.) located what seemed likely to have been the occurrence described by the two Jesuits—a small abandoned quarry in the Jersey Shale Formation of Brioverian (Upper Proterozoic) age, to the north of Dannemarche Reservoir in Waterworks Valley—and described the small crystals found there (Hey and Mourant, 1933). The identification as epistilbite was on the basis of morphology and some optical and chemical tests.

In April 1981 a small fragment taken from the display specimen of 'epistilbite' from St. Lawrence in the Jersey Museum was sent to the British Museum (Natural History) for confirmation of its identity, because the specimen label had been lost during removal of material from St. Helier to new premises at La Hougue Bie, and some doubt had arisen because of the similarity in appearance of the St. Lawrence 'epistilbite' and adularia crystals from L'Etacq, St. Ouen.

Examination confirmed beyond doubt that the fragment was of St. Lawrence 'epistilbite'. It matched perfectly the specimen (BM 1933,38) collected by Mourant and used by Hey as the basis of their description. An initial optical examination of crystals from both St. Lawrence specimens indicated, however, that they were orthoclase, variety adularia, rather than epistilbite, an identification confirmed by X-ray powder diffraction. Electron microprobe analysis of BM 1933,38 gave a composition $KAlSi_3O_8$ with a trace (0.3–0.6%) Ba. Ca was present only in very small amounts (< 800 ppm), and was absent from some specimens. The Ba content is consistent with that of many adularias. Dr Hey's laboratory notebooks show that the original identification was based on optical data and positive tests for Ca and H_2O. There seems, however, to be no trace of calcite on the specimen.

It is perhaps significant that the habit of the St. Lawrence adularia is very similar to that of epistilbite (Dana, 1892, p. 578). The adularia forms colourless to milky, transparent to translucent simple prismatic crystals up to 1 mm long and about 0.4 mm across, showing good {001} cleavage. The habit is typical of adularia, with the prism {110} terminated by pinacoids {001} and, presumably, $\{\bar{1}01\}$. This simple habit compares with adularia of Felsőbanya type described by Kalb (1924) and the Adularia I habit of Raaz (1925). The dominant pinacoid of Adularia I is $\{\bar{1}01\}$ and both Kalb and Raaz suggested that adularia with this simple habit formed at lower temperatures than the more complex crystals of Adularias II and III. A temperature of formation of 300–400 °C was suggested by Raaz. A recent study by Franke and Ghobarkar (1982) of the habits of hydrothermally grown synthetic K-feldspars confirms the conclusions drawn by Kalb (1924) and Raaz (1925) concerning the variation of habit of natural crystals with temperature of formation. The habits of the synthetic K-feldspars vary according to temperature of formation and chemical environment, and there is a close correspondence between the habits of synthetic K-feldspars grown at temperatures between 400 and 700 °C in a weakly alkaline environment and Kalb's Drachenfels, Striegau, and Zillertal types. Adularia of ideal Felsőbanya (Adularia I) type, however, was not produced in these experiments.

Goniometric measurements of the Jersey adularia have not been made but instead the dimensions were measured of the principal axes of the rhombic basal cross-sections of twenty crystals, giving an average ratio of 1.72, compared with a value of 1.69 calculated from the interfacial angle of {110} given in Dana. The calculated ratio for epistilbite is 2.43.

A second and different specimen of 'epistilbite' from the quarry in Waterworks Valley was collected by one of us (A.E.M.) in 1981. This shows clear, transparent, colourless, prismatic crystals of adularia, smaller than those described above, but with the same simple habit, though many crystals are terminated by a single pinacoid. A specimen of adularia occurring in narrow veins was collected from the large disused quarry in the Jersey Shale Formation at L'Etacq and was used for comparison. This occurrence was described by Robinson (1948) and our examination confirms his record of sharp, transparent, colourless crystals, similar in size to those of the second St. Lawrence specimen, and of simple 'Adularia I' habit. Identification as adularia was confirmed by optical properties and by measurement of the ratio of the principal axes of the basal cross-section, a mean of ten measurements being 1.78.

There is no doubt, therefore, that the St. Lawrence 'epistilbite' is adularia. Its occurrence and habit are typical of low-temperature hydrothermal parageneses.

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Some observations on the mineralogy and genesis of braunite

ALTHOUGH braunite $3Mn_2O_3 \cdot MnSiO_3$ is best known from its occurrence in regionally metamorphosed manganese deposits such as the gondites and kodurites of India (Roy, 1981) it also occurs in hydrothermal veins (Frenzel, 1980) and in unmetamorphosed sediments (De La Hunty, 1963). A minor occurrence in the lower Cretaceous sedimentary manganese ores of Groote Eylandt is interesting as it indicates a sabkha-type origin for the mineral, and suggests a possible origin for the presence of small amounts of boron commonly found in braunite.

The presence of braunite was first noted by the writer in 1975 (Ostwald, 1980). The occurrence of irregular zones of braunite around sand grains in manganiferous clays suggested that it was a reaction product, possibly produced during sedimentation of MnO_2 colloids. Occurrences of skeletal crystals in dense cryptomelane were more difficult to explain. Recently further occurrences of braunite and cryptomelane showing chevron layering have been noted and examined. Typical occurrences are shown in fig. 1.

Under the optical microscope braunite is brownish grey against pale grey cryptomelane, and it commonly occurs as parallel, tabular layers alternating with cryptomelane, and with definite angular morphology. Fortification-type structures also occur, with re-entrant angles common.

The chemical compositions of the braunite and

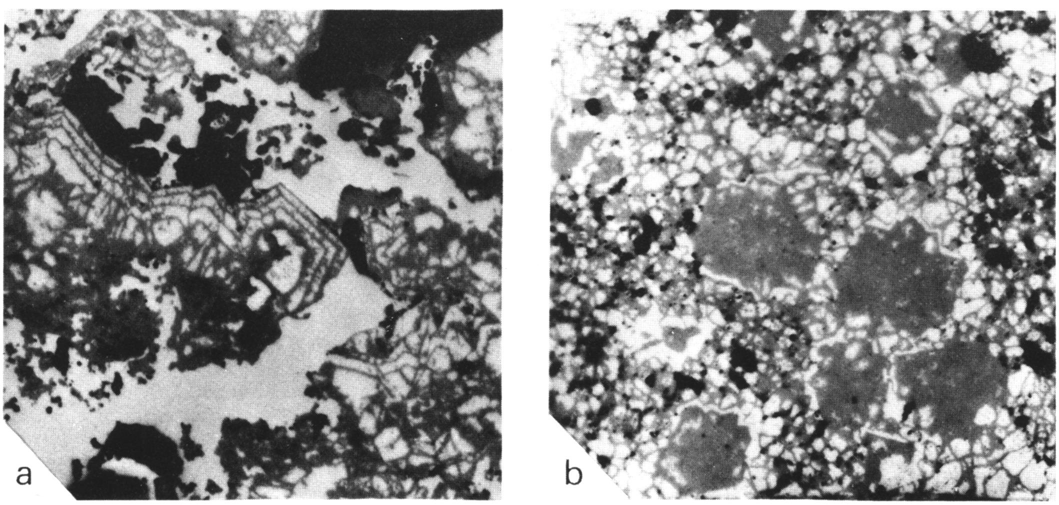

FIG. 1. Examples of (*a*) chevron layered structures and (*b*) fortification structure of braunite (dark grey) and cryptomelane (pale grey). Reflected light (× 300).