

MINERALOGICAL MAGAZINE

JOURNAL OF THE MINERALOGICAL SOCIETY

Vol. 32

December 1961

No. 255

Beryllium minerals in Cornwall and Devon: helvine, genthelvite, and danalite.

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[Read 2 November 1961.]

Summary. Helvine and genthelvite are recorded for the first time in Britain; of the former, three occurrences in Cornwall and one in Devon, and of the latter, one occurrence in Cornwall, are described. British danalite has hitherto been represented by two old specimens with the vague locality 'Redruth', Cornwall; occurrences at four Cornish localities are described, and a further Cornish locality is provided by two old specimens previously labelled as garnet. Partial chemical analyses for the helvine, genthelvite, and danalite specimens are presented; helvine and genthelvite occur in pyrometamorphic-hydrothermal deposits in metamorphosed calcareous sediments and, in one instance, in greenstone; danalite in hydrothermal deposits or lodes in metamorphosed greenstone; the parageneses of the three minerals are discussed.

THE helvine group of minerals, $(\text{Mn,Fe,Zn})_4\text{Be}_3\text{Si}_3\text{O}_{12}\text{S}$, comprises helvine, genthelvite, and danalite, which are the manganese-, zinc-, and iron-rich members respectively of a three-component system. None of the pure end-members is known to occur in nature; iron and manganese appear in all the recorded analyses, whereas zinc appears in about half of them although probably present in the remaining specimens in trace amounts.

A comprehensive account of occurrences of helvine and danalite at Iron Mountain, New Mexico, U.S.A., together with a review and discussion of the whole helvine group, has been given by Glass, Jahns, and Stevens.¹ As shown in their paper, and in subsequent records, helvine has been found more widely than danalite, its environments including granite- and syenite-pegmatites (rare), hydrothermal veins,² and—more frequently—in contact-metamorphic deposits, skarns and tactites.

¹ J. J. Glass, R. H. Jahns, and R. N. Stevens, *Amer. Min.*, 1944, vol. 29, p. 163.

² See also H. Neumann, *Norsk Geol. Tidsskr.*, 1950, vol. 28, p. 234 [M.A. 11-511].

Danalite has been found in granite, but mainly in contact-metamorphic skarns and tactites. Genthelvite has only been found in pegmatites hitherto, and but five occurrences, three of them as single crystals, have been recorded.

Minerals of the helvine group are frequently associated with members of the garnet group, and the two may easily be confused in the field and in the hand specimen. Not only do both helvine and danalite, and genthelvite to a smaller extent, show similar variations of colour, mainly yellow and red shades but occasionally greyish or greenish, to those of garnets occurring in similar calcareous environments, but their crystals also can be of modified octahedral or dodecahedral habit. Only when in simple tetrahedra can they be readily recognized, but they are more frequently massive, or in anhedral grains embedded in the matrix; like garnet they are isotropic, and have refractive indices in the grossular range. In the past, the recognition and identification of minerals of the helvine group has, for these reasons, been by no means easy; J. W. Gruner,¹ however, more recently devised a simple and rapid staining test for members of the helvine group, which may also be used for detecting even one or two minute grains in a large amount of crushed material or in a hand specimen; the identification may then be completed by X-ray powder-photograph or by partial chemical analysis.

Previous occurrence of danalite in Cornwall.

Danalite is the only member of the helvine group hitherto recorded from Britain, and of two specimens in the British Museum mineral collection, one, B.M. 39955, was bought from R. Talling, the Cornish mineral dealer, in 1864 as 'Garnet, large tetrahedrons with quartz and mispickel, Redruth, Cornwall', and was described by Miers and Prior² in 1892. A second specimen, B.M. 74451, is closely similar in appearance and was bought from F. H. Butler in 1894;³ according to Miers, the locality is also 'Redruth', Cornwall, and fragments from this specimen have been examined by Glass *et al.* (*loc. cit.*). Miers and Prior also described some small yellow tetrahedra, and one partly red and partly yellow, occurring in cavities in the red danalite, and suggested that this

¹ J. W. Gruner, *Econ. Geol.*, 1944, vol. 39, p. 444.

² H. A. Miers and G. T. Prior, *Min. Mag.*, 1894, vol. 10, p. 10.

³ Talling had died shortly before this, and F. H. Butler, who was his son-in-law, had taken over all his stock of minerals; from the similarity of the two specimens, there is little doubt that they were both originally acquired by Talling and from the same source.

