On the occurrence of the rare mineral Carminite in Cornwall.

By Arthur Russell.

[Read November 17, 1908.]

THE mineral carminite was first described by F. von Sandberger in 1850 in a paper which appeared in Poggendorff's Annalen, entitled 'Carminspath, ein neues Mineral aus der Ordnung der Arseniate'.[1] It occurred near Horhausen, Rhenish Prussia, forming clusters of fine needles of a carmine- to tile-red colour, implanted on quartz, limonite, and beudantite, and accompanied by pyrolusite, clear crystals of mimetite, and an undetermined yellow, earthy mineral. In a subsequent paper in 1858, 'Ueber den Carminspath,'[2] he gave the precise locality as the Luise mine, Horhausen, Rhenish Prussia; and a quantitative analysis, on 0·068 gram by R. Müller, showed the mineral to be an anhydrous arsenate of iron and lead: As_2O_5, 49·11; Fe_2O_3, 30·29; PbO, 24·55 = 103·95. A trace of phosphoric acid was also present.

No other locality appears to have been recorded in mineralogical literature for this rare species; but in the Mineral Collection of the British Museum (Natural History) there are exhibited specimens of carminite from Ems in Nassau. On these specimens the minute needles of carminite are deposited on gersdorffite.

On examining some specimens of scorodite, which I found during 1906 at Hingston Down Consols mine, Calstock, Cornwall,[3] I noticed on one or two of them some tufts of minute, red needles of an unknown mineral. The very small quantity of the substance precluded, however, the

[1] F. von Sandberger, Ann. Phys. Chem. (Poggendorff), 1850, vol. lxxx, pp. 391–392.

[2] F. von Sandberger, ibid., 1858, vol. ciii, pp. 346–347.

[3] Hingston Down Consols mine commenced working about 1846, and was for many years a large producer of copper ores. After being abandoned for a long time, it was re-opened about 1904 by the Clitters United Mines Co. Ltd., since which date it has produced considerable quantities of tin, copper, wolframite, and arsenical pyrites, and also some fluor-spar. Thanks to the courtesy of the late manager, Captain J. Paull (now of South Crofty mine), Mr. Richards and myself were able to visit the mine on many occasions and collect the material described in this paper.

possibility of my determining the species. A sharp look-out was therefore kept in the hope of finding more material, and in the early part of 1908 my friend Mr. Jehu Richards, of Callington, a keen mineral-collector, was successful in obtaining from the same locality several excellent specimens of the mineral, all of which he kindly sent to me. Since then, although both Mr. Richards and myself have repeatedly visited the mine, no more specimens have come to light. The exact spot at which the mineral occurred was the 65 fathom level on the south lode, in granite.

The carminite occurs as tufts of minute carmine-red or reddish-brown needles, the colour being very beautiful and characteristic. These tufts are either disposed on beautiful bluish crystals of scorodite, or on quartz crystals, or poised as delicate star-like aggregates on brilliant, colourless, hexagonal prisms of mimetite. On other specimens the carminite occurs as a fine velvety coating on chalcopyrite and blende, and rarely in the form of minute stalactites with a drusy surface. In one case the mineral forms brilliant carmine-red, crystalline aggregates, studded over hollow, spindle-shaped crystals of mimetite.

Viewed under the microscope with a high power, the needles are seen to taper to a fine point. They are strongly refractive (greater than methylene iodide, 1·74), show strong double refraction, give straight extinction, and are optically positive. No optic axial figure was observable through them in convergent light. Dr. G. F. Herbert Smith very kindly examined some of the needles with a view to measurement, but he was unable to get any definite reflections. I am indebted to him also for the identification of the forms on the associated mimetite.

The needles scratch calcite with difficulty, the hardness being therefore slightly over 3. The specific gravity could not be determined, owing to lack of pure material. Before the blowpipe, the mineral is easily fusible to a steel-grey globule, and with soda yields beads of lead. Heated in a bulb-tube with charcoal, it gives a mirror of arsenic. It is difficultly soluble in hot, dilute hydrochloric acid; the solution reacts for ferric iron, and, on cooling, deposits needles of lead chloride.

Since the amount of material used by Müller for his analysis was exceedingly small (0·068 gram), his results were probably not very accurate. It is therefore to be regretted that in the case of the Cornish mineral it has been found impossible to make a quantitative analysis, partly owing to lack of material, and partly owing to the difficulty of separating the carminite from the other closely associated minerals.

The following are the associated minerals:—massive mispickel; chalcopyrite; blende of a steel-blue colour; earthy covellite; scorodite,

both in brilliant crystals (the finest ever found in Cornwall) and in light greyish-blue, cellular and stalactitic masses; pharmacosiderite[1] in small, bright green cubes; mimetite in slender, colourless crystals with the forms *c* {0001}, *m* {10$\bar{1}$0}, *a* {11$\bar{2}$0}, *x* {10$\bar{1}$1}, and also in stout, cream-coloured prisms and tapering forms; anglesite, rarely in colourless, striated crystals, imperfectly developed; opaque, white quartz crystals; and colourless, pale violet, or greenish, etched fluor-spar.

Cornwall has long been famous for the number of rare minerals it has produced, and it is therefore gratifying that we should still be able to add from time to time the names of species new to the county, and in this case new also to the British Isles.

[1] The beudantite occurring with carminite at the Luise mine, Horhausen, was at first mistaken by Sandberger for pharmacosiderite, but later (Ann. Phys. Chem. (Poggendorff), 1857, vol. c, p. 612) he showed its true nature. The Cornish mineral was examined by the writer, and is undoubtedly pharmacosiderite.