MINERALOGICAL NOTES

MINERALOGICAL MAGAZINE, SEPTEMBER 1990, VOL. 54, PP. 515–516

Alstonite *in situ* at Brownley Hill Mine, Nenthead, Cumbria

THE mineral which eventually came to be known as alstonite was originally described by Johnston (1835, 1837) and Thomson (1835) from specimens obtained from both Brownley Hill Mine, near Alston, Cumbria [NY 776 446] and Fallowfield Mine, near Hexham, Northumberland [NY 938 677]. In these original descriptions the mineral was regarded as a form of barytocalcite which had been described as a new mineral by Brooke (1824). The separate identity of the Brownley Hill mineral was recognized by Thomson (1837) who proposed the name 'bromlite'. This name appears to have originated from a mis-spelling of the locality as 'Bromley Hill'. Four years later Breithaupt (1841) introduced the name 'alstonite', which became the accepted name for the species despite the apparent priority of Thomson's 'bromlite'.

Although Brownley Hill Mine is thus the type locality for alstonite no details of its occurrence here have ever been published, though according to Walton (pers. comm. in Spencer, 1910, p. 304) the original specimens were obtained from Jug Vein. Dunham (1948, p. 171) noted the presence of barium carbonates, including alstonite, in the north eastern workings of the mine. In a recent review of barytocalcite and alstonite occurrences in the northern Pennines, Young (1985) commented on the presence of alstonite at four localities, including Brownley Hill, though no detailed information on the occurrence at the type locality was given.

Beautifully crystallized specimens of alstonite are to be seen in many collections of British minerals. In most examples we have examined, the mineral forms white to colourless acute pseudohexagonal pyramids or bi-pyramids up to 6 mm long. In some specimens the alstonite is intergrown with very thin hexagonal platy crystals of 'nail head' calcite. In very many instances the alstonite encrusts compact crystalline white to pale pink baryte. Surviving acquisition details of Brownley Hill alstonite specimens suggest that they must have been collected in the mid years of last century, presumably shortly after the mineral's original description. Nall (1888) noted that the workings of Brownley Hill Mine which yielded alstonite had for some time been supposed to be inaccessible. Apparently the mineral was very highly prized by collectors of the day as Nall (loc cit.) further commented that even small specimens were then fetching as much as five pounds.

Some years ago parts of the workings at Brownley Hill could still be examined though these are now inaccessible. Underground investigation revealed extensive workings in Jug, West High Cross and High Cross Veins in the Great Limestone (Namurian), as noted by Dunham (1948). Mineralization remaining in unworked portions of the veins and on the walls of old stopes, suggested that the main minerals present, in addition to the ore minerals galena and sphalerite, are ankerite with smaller amounts of quartz, calcite, pyrite and locally baryte.

In view of Walton's comments (pers. comm. in Spencer, 1910) on the source of the original alstonite specimens, particular attention was paid to the Jug Vein workings. This vein was found to be up to 2 m wide: minerals present in the remaining veinstuff were found to be ankerite, quartz, galena and sphalerite. No trace of baryte or of any barium carbonate mineral was found.

Extensive workings on High Cross Vein revealed that it was up to 2 m wide. Ankerite and quartz are again the major gangue minerals. These are accompanied locally by pockets of coarsely crystalline white to very pale pink baryte and a little white calcite. High Cross Vein was well exposed in a stope in the Great Limestone above the Horse Level between Holme's Rise and Richardson's Rise. The vein is here almost vertical with a downthrow to the west of about 0.3 m and is up to 2 m wide. Over much of the approximately 60 m of accessible strike length of this stope the vein was seen to be composed mainly of broken limestone in which occur vertical bands of galena up to 10 mm wide. The east, or hangingwall, side is marked by a band of intergrown galena and ankerite up to 100 mm wide. Pink to white, compact crystalline baryte with, locally, some coarsely crystalline calcite, and small amounts of pyrite and galena, form a band up to 120 mm wide on the west or footwall. Towards the southern end of the stope several vugs in this baryte, elongated parallel to the vein walls, contain well developed alstonite crystals. In general these vugs are up to 50 mm across and 70 mm long but one spectacular vug up to 1.5 m long and 0.3 m wide was exposed near the floor of the stope.

It is clear that in the past many specimens have been collected from these vugs and several good examples of alstonite were obtained during the investigation. These exhibit the characteristic morphology of acute pseudohexagonal pyramids or more rarely bi-pyramids up to 5 mm long, the faces of which typically show prominent horizontal striations with a vertical medial re-entrant line. The identity of the alstonite was confirmed by X-ray diffraction (Ph 7475)*. The alstonite crystals commonly grow on coarsely crystalline baryte and locally ankerite (Ph 7476): in some specimens they grow on, and are intergrown with, large white crystals of 'nail

* BGS X-ray number

head' calcite. Examination of one sample of this calcite by X-ray diffraction revealed the presence of traces of barytocalcite (Ph 7474). Despite careful search of this and other specimens, barytocalcite has not been found separately on any of the alstonite-bearing samples. Insufficient material was available to investigate further the relationship of this barytocalcite to the associated minerals. Well crystallized barytocalcite was recorded by Young (1985) from the dumps of Brownley Hill Mine though the provenance of the mineral within the mine could not be established. In these specimens the only associated mineral is a little scalenohedral calcite: no alstonite was found. The dump specimens are unlike anything seen in the extensive workings during this investigation.

Almost all of the alstonite-bearing specimens obtained during this investigation bear a striking resemblance, both in morphology and paragenesis, to specimens of alstonite collected from Brownley Hill Mine last century. It is thus very likely that at least some of these early specimens were obtained from High Cross Vein. Jug Vein cannot be ruled out as a former source of alstonite specimens though it is noteworthy that no trace of barium minerals has been found in it.

Both alstonite and barytocalcite occur locally within the veins formerly worked at Brownley Hill though it has not been possible to establish the relationship of the minerals one to another.

Acknowledgements. We thank Mr Atkinson, M. Suttcliffe, R. Phillips and M. Wood all of whom provided essential help in the field investigations. This note is published with the approval of the Director, British Geological Survey (NERC).

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KEYWORDS: alstonite, Brownley Hill Mine, Cumbria.

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[*Manuscript received 20 October 1989; revised 20 December 1989*]