SOME MINERALS OF SPECIAL INTEREST IN SOUTH-WEST ENGLAND

ARTHUR W. G. KINGSBURY

One hundred and fifty years ago, when this Society was founded, the science of mineralogy was still, relatively, in its infancy, but Cornwall and, to a less extent Devon were already well-known for rare and unusual minerals. Among the many well-defined and established species which by then had already been described and named, a considerable number were known to occur in the south-west, and of these not a few had been discovered for the first time as new minerals in Cornwall or Devon.

Cornish mining had been through a period of lean years during the latter half of the eighteenth century, but with the beginning of the new century there came a resurgence which in due course set Cornish mining rising to its full tide of output and prosperity. New mines were opened in ever increasing numbers, and new developments and innovations took place in all phases of mining activity and mineral production. With the increase in the opening, and re-opening, of mines there was a great extension of interest in minerals and mineralogy, and Cornwall at this period could boast of many well known and competent mineralogists, mining engineers, and geologists. Discoveries of many new minerals and new occurrences were made, and mineral collections were formed in increasing numbers; dealing in minerals also became a serious and often profitable occupation, and at one time many dealers were operating in and from Cornwall. It was in large measure due to them and their encouragement of miners to look for and collect for them fine specimens and unusual minerals, that so much interesting material has survived and been preserved.

During the middle and latter half of last century one of the best-known Cornish mineral dealers was Richard Talling, of Lostwithiel; not only did he get hold of and find an enormous number of specimens, many of them exceedingly fine and beautiful, and often rare, but he also discovered a number of new minerals or distinct varieties. Among these, for example, may be mentioned botallackite, tallingite, langite, woodwardite, bayldonite, liskeardite, ludlamite, churchite; in 1847 Talling re-discovered fluellite at Stennagwynn Mine, St. Stephens, and he also re-discovered childrenite at the George and Charlotte Mine, Tavistock, and all the specimens of Cornish fluellite, and most of those of childrenite from " Tavistock ", hitherto preserved in collections, were found by or obtained from Talling. Other unusual specimens obtained by Talling were two supposed to be garnet pseudomorphous after some tetrahedral mineral, one of which he sold to the British Museum in 1864, and which were subsequently proved to be the rare beryllium mineral danalite (Miers and Prior 1894, pp. 10-14; Kingsbury 1961, pp. 921-940). Because he did not wish mine-owners or other rival dealers to know the sources of his material, Talling rarely gave away the exact locality of any unusual specimen,

and some of his so-called localities were so vague as to be of little topographical value and were even misleading in some instances.

Up to the end of last century, despite the far more limited methods of identification and facilities available than now exist, the south-west had produced, in addition to many hundreds of other fine and rare specimens, nearly 40 new minerals and well-defined varieties which for the first time had been found in or recorded from Cornwall and/or Devon. During this present century, in spite of the gradual decline in mining and many localities becoming abandoned, overgrown, or no longer accessible, a further number of new minerals have been found and described in the south-west, and of these, six have been discovered in the last twenty-five years.[1]

In addition to these new species and varieties, many other minerals, some very rare, others not so rare, have been recorded from Cornwall and Devon in the intervening years (Spencer 1958, pp. 787-810), and the list now includes about 300 species and well-defined varieties.

During the last twenty-five years or so the present writer has himself succeeded in discovering in Cornwall and Devon a considerable number of occurrences of minerals hitherto not recorded in the south-west. Upwards of fifty such minerals have already been identified and confirmed, though at present they may not all have been actually recorded; there are, in addition, some further species whose identity, while suspected or almost certain, has yet to be confirmed, and most of these may in due course be added to the list. There is no doubt that a number of hitherto unrecorded minerals have been unrecognised, overlooked, or mistaken in the past at many localities in both Cornwall and Devon, in associations and environments or paragenetic conditions in which they might have been expected to occur. Careful and methodical searching, where the associations are favourable, has resulted in many such minerals, some rare but some relatively common, being discovered. The danalite found originally by Talling is a case in point. It has always appeared unlikely that these were the only specimens to be found in Cornwall, but nothing was known of their locality, and for a long time minerals of the helvine group had been rare, difficult to identify, and even more difficult to recognise.

As more occurrences in other parts of the world were recorded and more data were obtained, it seemed highly probable that there were favourable localities and environments in Cornwall and Devon. As the result of some years' careful searching in likely environments in the south-west, all three members of the helvine group have been found and identified, the various occurrences having been recently described by the writer (Kingsbury 1961, pp. 921-940). What is, however, rather interesting is that at least one specimen of danalite, though mistaken for garnet, had been collected in Cornwall just before or very soon after the beginning of the last century, at least 50 years before it was described as a new mineral in 1866. Two other rare beryllium minerals, euclase and herderite, were recently recorded

[1] A new mineral was discovered in Cornwall not long ago jointly, but quite independently, by the present writer and the late Sir Arthur Russell, and has been recently described. See R. J. Davis and M. H. Hey: Arthurite, a new copper-iron arsenate from Cornwall: Miner. Mag. 1964, vol. 33, pp. 937-941.

(Kingsbury 1958, pp. 315-316) from Cornwall, in each case in likely environments and where they could easily have been confused with other minerals present, and for which the two respective localities were well-known, namely topaz in the one case and apatite in the other.

In the unusual alkali- and lithium-rich aplite dyke at Meldon, near Okehampton, there are now and then exposed coarse, complex pegmatite lenses which show evidence of several stages or phases of mineralisation. The environment and associations are congenial to the occurrence of many rare minerals. In one or two of these pegmatites the present writer has found and identified a number of species containing beryllium, lithium, and alkalis, among which are bavenite, beryl, beryllonite, chrysoberyl, eudidymite, milarite, and rhodizite, as well as spodumene, amblygonite, montebrasite, and pollucite, most of these being new to the south-west.

Scheelite, which is usually regarded as rather a rare mineral in the south-west and of which there are relatively few recorded occurrences, has been found in many of the pyrometasomatic deposits in the Okehampton district, and in similar environments in Cornwall. Among some new localities may be mentioned Ivy Tor Mine, Belston; the Railways quarry, Red-a-ven Brook Mine, the aplite quarry, the limestone quarry, and Wheal Forest, all in the Meldon area; Ford Mine and Ramsley Mine, Sticklepath. Some of the largest crystals of scheelite (nearly 1½ inches) found in the south-west were collected by the writer a few years ago at Ramsley Mine, together with many of the puzzling octahedral quartz pseudomorphs which have now been proved to be pseudomorphous after bi-pyramidal scheelite. One quite unusual occurrence of scheelite has also been found, where it is apparently of late, low-temperature formation and is associated with pyrite, stibnite, jamesonite, galena, some arsenopyrite and other sulphides, and gold, in a carbonate matrix in one of the veins in the North Cornwall antimony district near St. Teath. This occurrence recalls the similar but very unusual associations in the Hillgrove district, New South Wales, Australia, and is probably the first and hitherto only such occurrence known in Cornwall.

Several members of the easily-overlooked alunite-beudantite group, namely jarosite, plumbojarosite, and beudantite itself, have been found in appropriate conditions at a number of new localities; two of the very rare members of the group have also been identified, svanbergite [$SrAl_3(PO_4)(SO_4)OH_6$] in andalusite-schist at Wheal Coates, St. Agnes, and argentojarosite [$AgFe_3(SO_4)_2(OH)_6$] at Treore Mine, St. Teath. The latter mine was re-opened in 1915 and worked primarily for arsenic, but the assays nearly all showed high values for silver and gold. When the dumps were being levelled and scattered about five years ago, the writer also collected a fine specimen of moss-like gold in quartz from close to the old shaft which had been filled in.

Among other recent discoveries, one other of rather unusual interest may be mentioned. About twelve years ago the writer had collected two unknown minerals at the South Terras Mine, St. Stephen-in-Brannel, near St. Austell, and for some years their identity remained unsolved. More recent examination, however, has now shown that they are, in fact, identical with two hitherto very uncertain and

unconfirmed nickel minerals originally found at a locality in Saxony in 1858. These two latter minerals had long since been relegated to the limbo of the doubtful, but the discovery of the South Terras material has shown that the two hitherto uncertain minerals are, in fact, two perfectly valid species. An account of them is due to be published shortly in the Mineralogical Magazine.

Some of the minerals discovered last century by Richard Talling had been confused, and have for many years remained of uncertain status, while their compositions, structure, and true identity have been doubtful. This applied particularly to the copper chlorides, thought to be atacamite and varieties of it, but the position of several of them has been clarified in recent years and some new data have come to light. All the old specimens, originally collected by Talling, from the Botallack area, St. Just, and thought to be atacamite, have now been proved to be paratacamite (Bannister, Hey and Claringbull 1950, pp. 280-286), a different mineral. Atacamite, however, has more recently been identified from Wheal Owles, in St. Just, and from some other localities in Cornwall (Kingsbury and Hartley 1956, pp. 349-350). Tallingite, originally regarded as a variety of atacamite, was re-discovered by the present writer at several new localities, in the St. Just area and elsewhere, and has been shown (Bannister *et al.* 1950, pp. 280-281; Kingsbury 1954, pp. 386-406) to be a variety of connellite; it is not uncommon at many places in Cornwall. Botallackite was also formerly thought to be a variety of atacamite, but as the result of being re-discovered by the writer at several new localities in the St. Just area, and at an entirely new locality near Perranporth, it has been proved to be a distinct mineral and of species rank (Embrey and Kingsbury 1956). Its locality has nearly always been given in the literature and in textbooks as " Botallack mine ", or just " Botallack ", which in most instances meant the mine of that name, and is usually mentioned as having occurred with " atacamite " (now = paratacamite) and tallingite. The Survey Memoir on the Land's End district (1907, p. 104), however, gives Carnyorth Mine as a locality for " atacamite and botallackite ". This is, in any event, quite incorrect, and it seems to be the result of the mistaking as actual localities of the two parts of the name of the Company, " Botallack and Carnyorth ", which for a time, about the period when these minerals were found and described held and worked the Botallack sett. The present writer, in fact, has never felt altogether certain about the generally recorded locality for botallackite and the other copper chlorides found by Talling being the correct one. There is no doubt that they were all found together, and in view of the apparent confusion over their identities and compositions, other older reported occurrences in the St. Just area are much open to question. The conditions, moreover, under which botallackite may be formed and, in particular, can be found, are now known to be extremely critical and exceedingly restricted, and there is no doubt that this has not, hitherto, been realised or generally known.

For a long time nothing very definite to prove or disprove Talling's locality was known, but a few years ago, quite by chance, the present writer acquired the missing evidence. Folded up and tucked into the back of a second-hand copy of an old out-of-print book was part of a letter which was at once recognised as being

from Talling, and was, in fact, signed by him. There was nothing to show to whom it was addressed, as the first part was missing, but it was evidently in reply to some enquiries about the locality of the botallackite, and other minerals, and was apparently written not long after 1865. The letter is very vague and " cagey ", as one might have expected, and does not actually give away any exact or specific locality by name, but it provided the essential piece of evidence, about which there can be no doubt, that the exact spot where the botallackite and other copper chlorides were originally found and collected by Talling, about 1860, and was not in Botallack Mine at all, but in Wheal Cock, the neighbouring mine about half a mile to the north, in the 20 fathom level out under the sea. Wheal Cock had always been a distinct and separate mine, but after about 1840 it was included in the Botallack sett and was worked as part of that group though still as a separate mine. In 1843, in his classic work on the mines of Cornwall and Devon in the Transactions of this Society, W. J. Henwood (pp. 10-11) had described a visit he had paid in the year 1831 to the 20 fathom level in Wheal Cock, also describing the well-known incident, which took place there shortly after his visit, in which the miners, in following a rich bunch of copper upwards towards the sea, failed to realised how near to it they were and had to put a drill-hole right up through the roof of the level which was, in fact, the sea-bed, and had had to stop it up by the insertion of a wooden plug! In the letter mentioned above, Talling briefly refers to having heard that this incident took place about thirty years previously, but without saying where it was, and he goes on to describe how he had succeeded in getting into the level and had found the wooden plug still in position! This conclusively proves that the locality was Wheal Cock. He then gives an account of how the copper minerals had formed crusts and stalactites on the walls and floor of the level, due to the sea-water seeping through.

Among the other rare and unusual minerals first found by Talling was the hydrous yttrium phosphate churchite, described by A. H. Church as being the first British mineral to contain cerium. In this case, too, Talling had never divulged the locality beyond the vague fact that it occurred in a copper-lode near Lostwithiel. For many years Sir Arthur Russell, as well as the present writer, had pieced together what limited information and largely circumstantial evidence there was. This and the fact that the rather unusual matrix was similar to much material on the dumps at Tretoil Mine, Lanivet, not far from Lostwithiel, had lead to some tentative conclusions that this mine could have been the original locality. Many hours of searching proved fruitless, and many hundredweights of likely-looking matrix were broken up, without success. The matrix of nearly all the old specimens is very characteristic, a quartzose, rather schistose chloritic rock, which is without much doubt a highly altered, much sheared greenstone. In 1952, however, success was at last attained, and Sir Arthur's suspicions were virtually confirmed when the writer found a small specimen of churchite in a cavity in some of the typical schistose matrix. This was recorded briefly in 1956 (Kingsbury 1956, p. 282).

There are many interesting details and little known facts about a number of the rare and unusual minerals which were found or first described about the same time as this Society was founded. Some of these early accounts and references have

been rather lost sight of or overlooked, as they are often rather scattered and contained in rare works which may not be generally known or readily accessible, and the present occasion would seem an appropriate one on which to mention them and draw some additional attention to them. Two works in particular, both now difficult to get hold of, contain exceedingly accurate and interesting descriptions and remarkably fine drawings and coloured plates, not only of many rare Cornish and other minerals already well-known, but also of a number of other minerals and specimens from Cornwall and Devon of which these descriptions were often made many years before they were actually named and described as new species. The first of these now rare works is " Specimens of British minerals selected from the Cabinet of Philip Rashleigh ", the first part of which was published in London in 1797, and a second part in 1802, the two normally being bound together in one volume.

Philip Rashleigh, of Menabilly, near Fowey, made one of the most outstanding early collections of minerals, his Cornish specimens being especially fine. (See Russell 1952, pp. 1-24). He was probably one of the most notable among the many early Cornish mineralogists, studying and recording details of his specimens with unusual care, and died in 1811, only three years before this Society was founded. As most people are aware the greater part of his magnificent collection now belongs to the Royal Institution of Cornwall and is preserved in their Museum at Truro.

Among the plates and text descriptions of mineral specimens given in Rashleigh's book, some are the first and earliest references in mineralogical literature to species which were still un-named. These include bournonite (Part I, Pl. 19, Figs. 1 and 2, and p. 34), scorodite (Part I, Pl. 14, Figs. 1 and 4, and pp. 26-7), chalcophyllite (Part I, Pl. 9, Fig. 2, and p. 18), clinoclase (Part II, Pl. 10, Fig. 4, p. 10, and Pl. 11, Fig. 4, and p. 11) and connellite (Part II, Pl. 3 and 4, and pp. 3-4, and Pl. 12, Figs. 1 and 6, and pp. 13-14). The locality for these specimens of connelite is given simply as Wheal Providence, without any parish, but the one meant was probably the Wheal Providence in Lelant. It is almost certain, however, as has been pointed out by Sir Arthur Russell, that this locality is a mistake (probably on the part of the dealer) and that the real locality was Wheal Gorland, Gwennap. The specimens are far more characteristic of this latter mine which is the best known of the few authentic localities. It may, nevertheless, also be mentioned that the present writer has collected some small specimens of connellite, associated with chalcophyllite in gossany quartz, at another Wheal Providence, in the parish of Gwinear.

Two other specimens figured in Part I of Rashleigh also call for special mention; these are what are described as malachites from Wheal Carpenter, Gwinear, figured on Pl. 13 and on Pl. 14, Fig. 3, and described on pp. 25-6. They are, without any doubt, specimens of the rare mineral bayldonite which was described as a new species by A. H. Church in 1865, after examining material collected by Talling. Bayldonite was re-discovered at Wheal Carpenter by Sir Arthur Russell about fifteen years ago, and some of the specimens from this mine

are remarkably similar to those figured by Rashleigh. Talling's material almost certainly came from Penberthy Croft Mine, St. Hilary, which was the best-known locality for the mineral in Cornwall, though it is now almost impossible to find.

One of the most astonishing mining ventures ever undertaken in Cornwall was the Wherry Mine, worked out on a shoal at the seaward end of the Wherry Rocks, in Mount's Bay, Penzance, between 1778 and 1798, and of which a detailed account was given by Sir Arthur Russell (1949, pp. 517-533) in 1949. The mine was well-known for its beautiful crystals of cassiterite, which occurred in a mineralised quartz-porphyry or elvan, and the Rashleigh Collection contained a number of examples, no less than ten entries appearing in the catalogue. There are a few specimens in the Society's collection at Penzance, while Sir Arthur had several more in his own collection, but apart from these, which together probably do not amount to much over two dozen in all, very few, if any, other specimens from the Wherry Mine appear to have been preserved. At one time there were evidently a number of these rare and unusual specimens in the Oxford Collection, but they appear to have been broken up at some time for teaching material, and only one or two fragments, found in a box of mainly rubbish, now remain of them. There were three main types of ore, one showing cassiterite disseminated through the pinkish to buff quartz-porphyry matrix, another showing veins or aggregates of more or less massive cassiterite with some chlorite in a similar buffish to whitish matrix, and a third, quite different, type. This latter type consists of fine-grained, massive, dark green chlorite, containing minute slender prismatic crystals of brown cassiterite, grains and patches of a tin-white cobalt mineral, and with surface crusts of pink erythrite. The Rashleigh Collection contained a specimen of the cobalt ore and Sir Arthur had several further specimens in his own collection, one or two of which had originally been obtained by Sir Humphrey Davy. Sir Humphrey Davy had also reported finding nickel, and " oxide of uranium " and pitchblende on the dump.

As mentioned by Sir Arthur, a prospectus of the Wherry Mining Company issued in 1836 had referred to " a large cobalt lode " running north and south, while in 1843 W. J. Henwood (*op. cit.*, p. 33) had tantalisingly referred to an intersection of the Wherry elvan by " the Black Lode "; no other details, however, have ever been recorded about this lode.

The association of nickel, cobalt, and uranium is by no means uncommon in some of the Cornish veins and is, moreover, typical of some of those of the later, cross-course suite, almost always having a north-south trend. Other minerals frequently present in small amounts in such veins include galena, blende, chalcopyrite, arsenopyrite or löllingite, and chalybite. Several of these occurred at the Wherry Mine, and it seems pretty certain that Henwood's " Black Lode " and the " cobalt lode " of the prospectus are really one and the same, a north-south nickel-, cobalt-, and uranium-bearing cross-course which intersected the elvan. It is, moreover, unlikely that any of this mineral assemblage other than cassiterite and some chlorite, was actually present in the elvan itself; the mixed cassiterite-massive chlorite-cobalt ore assemblage evidently was obtained from close to or at the intersection.

The identity of nearly all the cobalt minerals recorded at various localities in Cornwall and Devon has been very uncertain, and practically none of them had or have been fully examined. There is no doubt that a large part of those that have been preserved, let alone reported, consists of intergrowths or mixtures, and as " smaltite " and cobaltite have often been both recorded at the same localities, most of the reported occurrences must be treated with reserve as far as the identity of the minerals are concerned. An early recorded occurrence of " smaltite " at Huckworthy Bridge Mine, Sampford Spiney, Devon, for example, has now been identified as a cobaltiferous löllingite. In 1868, T. M. Hall in his Mineralogists' Directory had stated that cobaltite occurred at the Wherry Mine, but in 1887 Robert Hunt refers to the cobalt as " tin-white cobalt ", or what was usually called or regarded as " smaltite "; Sir Arthur Russell also refers to the Wherry Mine cobalt mineral as being smaltite.

Not long ago the present writer had some most remarkable good fortune when he acquired a considerable number of mineral specimens, mostly Cornish, which had been contained in a Regency cabinet purchased by a relation at an antique shop. The antique-dealer had suggested that he should throw away all the "rubbish" in the drawers, but as these had been seen to contain some nice minerals, he was firmly instructed to take them out and pack them up with great care. This, as it subsequently turned out, was most fortuitous indeed, for when the minerals were later given to the writer and examined, it was found that there were among them no less than sixteen specimens, all typical and unmistakable and including several of the cobalt ore, from the Wherry Mine. In order to try and identify the cobalt mineral present, it was decided to sacrifice one small specimen, and X-ray powder photographs and other examination proved conclusively that the primary cobalt mineral in these Wherry specimens is, in fact, cobaltite. Three other definite occurrences of cobaltite in the south-west have been recently confirmed; near the Crowns mine engine-houses at Botallack; at Wheal Cock, St. Just; and at Wheal Friendship, Mary Tavy, Devon, where it is intergrown with galena.

The second rare work which contains many plates and descriptions of early Cornish minerals is James Sowerby's " British Mineralogy ", in five volumes, 1804 to 1817. There are several specimens which are particularly interesting and relevant to the present occasion.

In Volume II, 1806, on Pl. 134, and pp. 63-64, Sowerby figures and describes two specimens of the wavellite from the original, classic locality in North Devon usually given simply as " Barnstaple ". The date and circumstances of its first discovery are slightly uncertain and conflicting, but it was about the year 1785, and the locality was, in fact, much nearer to South Molton than to Barnstaple. These original specimens were collected in what is now the overgrown western portion of High Down Quarry in the parish of West Buckland and situated at Heddon, $1\frac{1}{4}$ miles W.N.W. of Filleigh, and only $4\frac{1}{2}$ miles from South Molton. A reproduction of Sowerby's plate is given in Fig. 1; after describing the habit, appearance, and colour of the wavellite, he goes on, on p. 64, to say:

" The lower figure has small dark circles, which seem to be the same substance

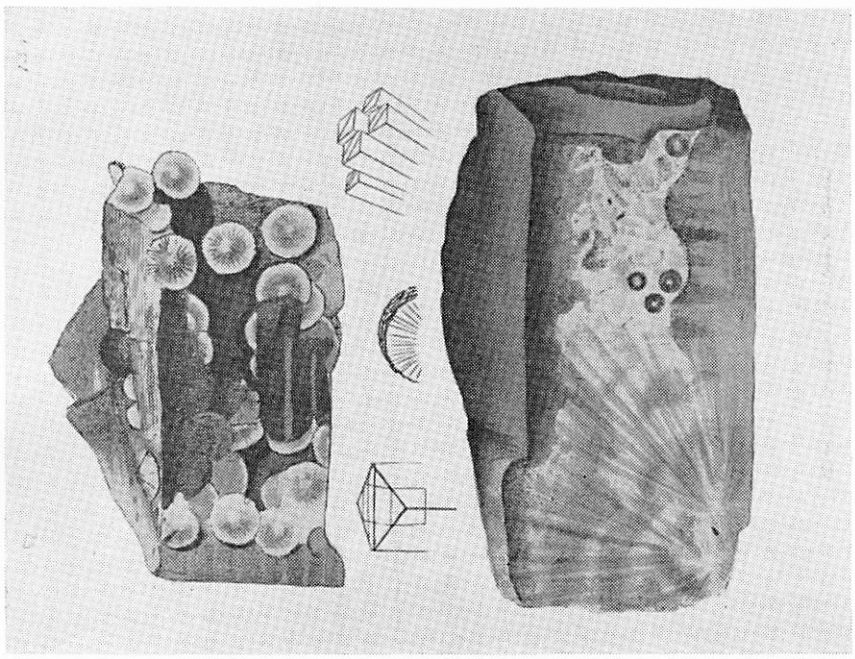

Fig. 1. Reproduction of Pl. 134, from Sowerby's British Mineralogy, Vol. II, 1806, showing two specimens of Wavellite.

" with the margin darkest. Those large spreading radii, which condense into " white opaque circles with the help of smaller stellae, terminate towards the " ends. The whiter parts are small opaque clusters, in which the three darker " ones are embedded."

These small dark circles show very distinctly on the plate.

In 1945, the present writer visited High Down Quarry, and though it has been abandoned now for many years, succeeded in collecting quite a number of typical specimens of the wavellite. When these specimens were being re-examined not long ago, it was noticed that there were present on some of them some very small globular crystalline aggregates which appeared to differ somewhat from the globular aggregates of wavellite. They were colourless and more glass-like, with a brighter lustre, and had on their surfaces small crystal exfoliations which had hexagonal outlines and flat tops, in direct contrast to the crystal terminations of the wavellite. Some of them were embedded in or showed through radial aggregates of wavellite, and it was clear that these other globules, whatever they were, had been formed prior to the wavellite. Some were rather greyish in appearance, and where broken across, showed a much finer radial fibrous structure, with a darker outer rim. One specimen in particular showed many more of these curious glassy globules than the others, some of the globules being embedded in the wavellite, others being attached to the surface of what was originally a joint in the black Culm slate. In size they range from about 3 mm. down to 0.5 mm. in diameter, and once seen are fairly distinct from the wavellite, owing to the glassy appearance and the hexagonal form of the exfoliations on their surfaces. Quite a number were broken across and showed up as darker circles. During these investigations, the writer remembered that there was a plate of Sowerby's which, he recollected, showed something rather reminiscent of these curious little globules, and when it was found and examined, it was clear that the lower figure showed three or four exactly similar broken globules, embedded in the wavellite. There was no doubt they were the same and that Sowerby had also already noticed them in or before 1805. X-ray and other examination has confirmed that, as it was by then suspected, these curious little glass-like globules with the hexagonal exfoliations, and showing the dark rims when fractured, were indeed variscite, a mineral hitherto not recorded as a Cornish, or British, species. Variscite was so named by Breithaupt in 1837, from material found in Saxon Voigtland.

On another plate in the same volume, Pl. 142, and on pp. 79-80, Sowerby figured and described two specimens of wavellite from Stennagwynn mine, where it had been found about the year 1800. It was rather rare here, and has never, in fact, been a particularly common mineral in Cornwall; it has, however, now been found at several other localities in the St. Austell area, in most cases in white fibrous crusts or aggregates in cavities in the " stent " veins in the clay-pits, and often associated with turquoise. At Stennagwynn it usually occurred, as is well shown by Sowerby's upper figure, in small tufts of minute, radiating white acicular crystals. This uncommon habit gave rise to the mistaken reports of natrolite and mesolite occurring here, and it was undoubtedly also responsible for leading J. H. Collins

to make the totally unfounded and unconfirmed suggestion that it was tavistockite and not wavellite which occurred at Stennagwynn accompanying fluellite. This misleading report of the supposed occurrence of tavistockite has unfortunately been re-iterated and repeated in most of the literature (including Volume II of the 7th Edition of Dana's System of Mineralogy), but it can be most definitely stated that tavistockite has never occurred or been found at Stennagwynn mine.

It will be recalled that fluellite was first noticed from Stennagwynn, by the Rev. William Gregor (see Russell 1955, pp. 617-624) about the year 1805 (and not by A. Lévy in 1824 as usually stated) and was figured and described by Sowerby in Vol. III, 1809, Pl. 243, and pp. 85-86. None of these early examples have survived, and it was not found again till 1847 when Talling obtained a large block of matrix from which came all the specimens of Cornish fluellite hitherto preserved in collections. The re-discovery in 1948, after the lapse of a hundred years, of a few more specimens of fluellite at Stennagwynn, and its finding at a new locality, the Goonvean china-clay pit, in the same area, not long afterwards, were described a few years ago. (Kingsbury 1954, pp. 397-398, and 1959, pp. 42-51). At this new locality, the paragenesis of the fluellite was, almost for the first time, clearly shown, indicating that it was not primary, as suggested by Collins, but a late-stage, secondary supergene mineral.

The discovery of the metal titanium by the Rev. William Gregor has been dealt with by Sir Arthur in his paper referred to above, but it may be mentioned, in addition, that a sample of the menaccanite, or "Ferriferous oxide of Titanium" as it was called, in which Gregor discovered the element, was figured by Sowerby in Volume III, 1809, Pl. 277, and described on pp. 155-6.

Passing to Volume IV of Sowerby's work, published in 1811, there is another rather interesting plate, No. 331, and description on pp. 53-4. This is of what he describes as "White Tourmaline" and is, he says, "almost new to the whole mineralogical world". The specimen, which was said to have been found in a mine in St. Just, was sent to him in 1804, and there is not the slightest doubt that the mineral was phenakite, described as a new mineral by Nordenskiöld in 1833! A reproduction of the plate is shown in Fig. 2.

This plate was referred to by Sir Arthur Russell (1920, p. 19) when he described a new occurrence of phenakite from Stamps and Jowl Zawn, St. Just, in 1920, but the forms and associations of his crystals were entirely different.

Just over five years ago, the present writer made another discovery of phenakite in the St. Just area, at the Wheal Edward section of Wheal Owles. The mineral occurred on quartz and crystallised orthoclase of adularia habit in cavities in veins of the latter in hornfelsed slate from close to the granite margin, and on the six specimens collected there were approximately 300 crystals of phenakite. The crystals were all of the long prismatic habit, clear and brilliant, and ranged from about 8 mm. in length down to 1 mm.; they showed the prism a ($11\bar{2}0$) with narrow faces of a second prism m ($10\bar{1}0$), terminated by large faces of r ($10\bar{1}1$) and narrow faces of d ($10\bar{1}2$), and are identical, in both appearance and forms present, with

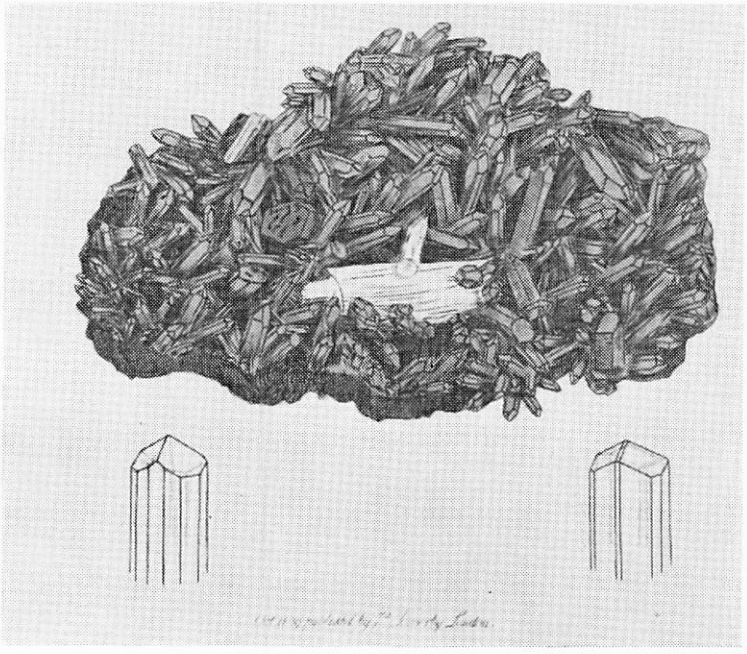

Fig. 2. Reproduction of Pl. 331 from Sowerby's British Mineralogy, Vol. IV, 1811, showing specimen of "White Tourmaline" in quartz.

the crystal shown in the small right-hand drawing below the specimen on Sowerby's plate. The Wheal Owles group of mines is a very ancient one, and it seems not unlikely that this Wheal Edward section may well have been the locality from which Sowerby's specimen was obtained.

Three more specimens figured by Sowerby remain to be mentioned, and these are the magnificent crystals of tourmaline and apatite from the classic locality in Devon usually referred to as "Bovey Tracey". They were discovered early last century, about the time this Society was founded, in a small pocket of reddish, altered granite, near Bovey Tracey in Devon, and are some of the finest and most unusual crystals of tourmaline and apatite that have been found, at any rate in the British Isles. Not long afterwards, in 1817, James Sowerby figured and described two fine specimens of this tourmaline and one of the apatite in Volume V of his British Mineralogy, Pl. 548 and 549, and pages 277-279. On page 277 he mentioned that the locality, as he was "informed by Mr. Brooke", was a "small quarry of red granite near Chudleigh" and that "a barn was built with some of the largest and finest specimens before it was observed by a Gentlemen in the neighbourhood"[1]; On the next page, however, in a footnote, Sowerby quotes a Mr. Loscombe (who had supplied several specimens to John Mawe, the dealer) as saying that the specimens were found on the northern declivity of a hill, about a mile and a quarter north of the famous Bovey coal pit. Vague as these descriptions of the locality really were, they were also, on the face of it, rather confusing and this confusion became perpetuated in some of the later literature. The Bovey "coal-pit" lay one mile S.S.W. of Bovey Tracey and the description given by Loscombe indicated (much more correctly in actual fact) that the locality was at or near the margin of the granite to the north-west of Bovey Tracey; Chudleigh, on the other hand, lies 3½ miles east-north-east of Bovey, in the opposite direction, and is, in fact, due east of and some three miles from the nearest granite. Traces of altered, reddish granite did occur in another, larger quarry at Whitestone, just under half a mile north by west of Bovey Tracey, but no similar occurrences of tourmaline and apatite have been found there or elsewhere in the area.

Many specimens of the tourmaline, and rather fewer of the apatite, have been preserved in collections, and the occurrence is not only one of the best known but has been mentioned in nearly all the mineralogical textbooks and handbooks, and in various other works and catalogues. The locality in most of these books was given as "Bovey Tracey" or "near Bovey Tracey", but one or two continued to confuse matters. Greg and Lettsom in their Manual of Mineralogy, 1858, gave the locality on p. 78, under apatite, as "a quarry at Bovey Tracey near Chudleigh", but on p. 227, under tourmaline, gave it as "a granite quarry at Chudleigh near Bovey Tracey", while J. H. Collins, in his Handbook to the Mineralogy of Cornwall and Devon, 1871, stated that tourmaline occurred in a quarry of red granite at Chudleigh, and (as a second occurrence), with white and translucent apatite near Bovey Tracey, adding Bovey Heathfield as yet a third locality; under apatite he

[1] The barn was, in fact, pulled down for the sake of the specimens, and some were occasionally to be seen in collections with traces of mortar remaining on them!

gives " Bovey Heathfield ", " Chudleigh ", and " near Bovey Tracey " as separate localities. Collins was subsequently followed by the classic work of Hintze, Handbuch der Mineralogie, where, both under apatite and under tourmaline, all Collins' localities are given. Miers' Mineralogy also refers to this occurrence of tourmaline and apatite, but in both editions, of 1902 and 1929, again rather curiously, gives the locality as " Chudleigh near Bovey Tracey ".

Collins' locality of Bovey Heathfield for both tourmaline and apatite seems very unlikely, as it is the middle of an area of Eocene clays, etc., but it may have been taken from some old label which was meant to refer to this well-known occurrence. Apart from this, there is no doubt that whichever locality is given in the literature, one and the same occurrence is referred to.

Although the exact position of the occurrence must have been known to a number of people at one time, it is curious that it never appears to have been recorded in the literature, but it was, in fact, a small quarry, apparently opened for purely local building purposes, in a pocket of reddish, altered granite at Woolley Farm (spelt Wolleigh on some maps) just over one mile north-west of Bovey Tracey. In relation to the old Bovey " coal-pit ", the position of the quarry is just over a mile and a half north by west, which is not very far out of the approximate position as given by Loscombe, referred to by Sowerby in 1817.

In 1858, Greg and Lettsom had mentioned that the locality had long since been exhausted, as had Collins in 1871. Since then, for many years, the site of the quarry had evidently become obscured and largely forgotten, and it is probable that at the present time there are not many people who know of its existence or situation. Sir Arthur Russell had visited it some time ago, and even then there was little to be seen except for some traces of reddish feldspar and a few small but very damaged crystals of tourmaline in a wall of one of the buildings. Some of the crystals were still visible nearly thirty years ago, but by now these and other traces may well have disappeared, and the present occasion, nearly 150 years after the original discovery of those unusual crystals, would seem to be an appropriate opportunity for placing on record the correct situation of this classic locality before it is entirely forgotten.

THE RE-DISCOVERY OF RHABDOPHANE IN CORNWALL

Among these many rare and unusual minerals of special interest first recorded in Cornwall, there is one more which had been found there long before its true identity was recognised, and this is the rare-earth phosphate rhabdophane. Only a small number of specimens were apparently found in the first place, while rather fewer have been preserved, and until recently the original locality had remained entirely unknown. Although it was not actually described as a new mineral till 1878, all that had been known about the specimens, then only few in number, was that they had been collected prior to 1820 and had been thought to be blende (sphalerite). Its rediscovery at what is without much doubt the original locality, with some historical and other hitherto unrecorded details about the old specimens, seems to be a suitable subject with which to close this account of unusual Cornish

minerals on the occasion of the Society's 150th anniversary.

Rhabdophane is a hydrated phosphate of cerium, with some yttrium, lanthanum and other rare-earths, and was first described in 1878 by W. G. Lettsom (1879, p. 191 and 1882, pp. 105-108). Lettsom's own words about his examination of the specimen are, perhaps, worth quoting:

> " Having a suspicion that possibly it might not be a blende, I submitted it for " examination to that Grand Inquisitor the spectroscope.
> " Letting a bright light fall on the specimen, I looked at it with a pocket- " spectroscope, when immediately the bands due to the presence of didymium " became apparent. I had thus come across what, at least, was no ordinary " blende."

Not long afterwards, in 1883, J. G. Brush and S. L. Penfield (1883, pp. 459-463, and 1884, pp. 200-1) recorded under the name of scovillite, a second occurrence of what was subsequently held to be the same mineral, from the Scoville iron-deposit near Salisbury, Connecticut, U.S.A. The analysis of this material, however, showed a much higher proportion of yttrium earths but this can now probably be attributed to the fact that most specimens of scovillite have more recently been found to consist largely of a mixture of rhabdophane with the yttrium phosphate churchite. No further occurrences have since been recorded, but rhabdophane has been identified recently by the Geological Survey of Great Britain from several African localities.[1] Rhapdophane can be indexed on a hexagonal lattice, and shows close relations to hexagonal modification of lanthanum, cerium and neodymium phosphates prepared artificially by R. C. L. Mooney (1950, pp. 337-340). The mineral has been found to be slightly, and variably, radioactive, but the true nature of some of the rare-earths present is still somewhat obscure, and the proportions and nature of the radioactive elements have yet to be determined.

The original type-specimen of rhabdophane examined by Lettsom was known to have been an old Cornish specimen and had been sent to him as " botryoidal blende " by Henry Ludlam who, a short time previously, had acquired the well-known mineral collection made by Charles Hampden Turner. This " Turner Collection " as it was subsequently referred to, had formerly belonged to John Henry Heuland (1778-1856) (See Russell 1950, pp. 395-405) and the basis of it was an extensive collection made on the Continent by his uncle, Jacob Forster, between the years 1776 and 1806. Heuland acquired his uncle's collection about 1806, and between then and 1820, when he sold it to C. H. Turner, had himself added to it considerably. Shortly before the sale, Heuland had decided to publish the catalogue in the form of an extensive " *catalogue rainsonné* ", and had commissioned Armand Lévy[2] to prepare the descriptions, but owing to various delays and difficulties the

[1] Through the courtesy of the Director, and of the Chief Geologist of the Atomic Energy Division of the Geological Survey, Mr. J. E. T. Horne most kindly examined the new material found in Cornwall and has given much relevant information concerning it.

[2] Armand Lévy named the mineral " turnerite " (=monazite) after C. H. Turner in 1823. and " forsterite " after Jacob Forster in 1824.

final publication did not take place till 1837 (Lévy 1837), when the collection had already been in Turner's possession for some years.

The specimen of " botryoidal blende " (alias rhabdophane) sent to Lettsom by Ludlam, formed part of the " Turner Collection " and constituted item No. 75 among the specimens of blende described on p.215 of Vol.III of the catalogue, the locality being given simply as Cornwall; it was, therefore, already in the collection in 1820 when Turner acquired it from Heuland, and was almost certainly among the material added by Heuland himself.

Lettsom also recorded (*loc. cit.*) that a second specimen of rhabdophane had been found in the " Turner Collection " and that two further examples, labelled " Blende from Cornwall ", had been found in the old collection at Oxford, adding, in a foot-note, that there was a small specimen, without label, in the Brooke Collection at Cambridge. No original labels, the handwriting on which might have provided a clue to their origin, can now be traced, so far as the two Oxford specimens are concerned, in spite of repeated searching. and there are no recorded data of any kind regarding them. There is a brief note in the old Register to the effect that a fragment off one of them had been sent to W. F. Ferrier in Toronto, about 1897-8, but Lettsom's paper clearly suggests that he had obtained samples from them as well, and what are now preserved in the Mineral Collection in the University Museum at Oxford presumably represent the remaining portions. In addition to these two specimens, there is also in the Oxford Collection a tube of small fragments of rhabdophane which was found in a collection formerly belonging to W. H. Müller[1], and is stated, in Müller's handwriting, to be "from Lettsom's original specimen ". Müller's collection had been presented to the University in 1915 by his widow, but had been virtually forgotten till 1949 when it was gone through by the present writer. It may perhaps be mentioned that a larger specimen in the Oxford Collection, previously labelled and exhibited as rhabdophane, but about which there were no data whatever, was proved on recent examination, as indeed its appearance suggested, to be merely botryoidal chalcedony, the specimen, in fact, being very characteristic of Trevascus Mine, in the parish of Gwinear, Cornwall.

Henry Ludlam's collection (including the " Turner Collection ") was later bequeathed by him to the old Museum of Practical Geology in Jermyn Street, London, and now forms part of the Geological Survey's Collections in the Geological Museum in Exhibition Road, being separately known as the Ludlam Collection; it is curious, however, that when F. W. Rudler (the former Curator of the Jermyn Street Museum) compiled his " Handbook to a Collection of the Minerals of the British Islands mostly selected from the Ludlam Collection . . . ", which was published in 1905[2], he omitted all reference to rhabdophane as a British mineral.

[1] President of the Mineralogical Society from 1901 to 1904.

[2] H.M. Stationery Office, London, 1905.

Present whereabouts of old specimens

Of the five original specimens referred to by Lettsom, four have been traced and are now still extant. These comprise the two specimens at Oxford, the one in the Brooke Collection at Cambridge (for details of which the writer is indebted to Dr. S. O. Agrell) and one in the Ludlam Collection (Ludlam 7186), this latter almost certainly being the second of the two "Turner Collection" specimens mentioned by Lettsom, though the original label appears to have got misplaced and lost: details regarding this last specimen were kindly given by Mr. A. E. Jobbins and Mr. J. E. T. Horne.

A few further old examples, five in all to the writer's knowledge, of Cornish rhabdophane have been identified and preserved elsewhere; there are two specimens in the British Museum (Natural History) Mineral Collection (B.M.53846-7) which were purchased from Lettsom and had originally been in Heuland's possession, particulars of which through the courtesy of the Keeper of the Minerals, Dr. G. F. Claringbull, were given by Miss J. M. Sweet and Mr. P. G. Embrey; two more specimens were recognised by Sir Arthur Russell about 50 years ago in a collection belonging to W. Semmons[1], who had labelled them as "arseniate of lead", and were acquired by Sir Arthur and are now in his collection: some years ago the present writer found another small specimen, also labelled as blende, in an old family collection dating back to the early part of last century. It is possible that originally there were other specimens of rhabdophane in existence, but that they have been lost sight of through not having been recognised.

In addition to the two specimens (B.M.53846-7) mentioned above and a fragment (B.M.92576) probably off one of them, there are in the British Museum Collection some fragments (B.M. 1916, 46) presented by Sir William Crookes and given to him by Lettsom: the Geological Survey Collection also includes a very small fragment (Dick 370) which is labelled "Rabdophane (Crookes)" (sic.). It seems very likely that both these Crookes specimens are portions of the original type-specimen (from the "Turner Collection") examined by Lettsom, and that they and the small fragments in the Müller collection at Oxford are all that now remains of it. Apart from these fragments, which were undoubtedly taken from the other larger specimens, — there may be a few others in collections abroad[2]— the nine major specimens mentioned above, whose existence and present whereabouts it has been possible to trace, are now probably all the known specimens of the original Cornish rhabdophane which have survived and been preserved.

The sixth edition of Dana's System of Mineralogy, published in 1892, refers, on p.820, to rhabdophane as being "known only in a few specimens obtained from Cornwall prior to 1820" and this is the only reference to the date of the specimens

[1] See Min. Mag. 1916, Vol.17, p.369 for obituary notice.

[2] According to Sir Arthur Russell there was a thin slice of rhabdophane in the Mineral Collection at the University of Toronto; this must have been taken from one of the old specimens, but whether this is part of or additional to the fragment sent to W. F. Ferrier is not known.

made in any of the text-books or literature since Lettsom's original paper. At the time this sixth edition of Dana was compiled, not all the known specimens of rabdophane had been identified[1] but there is little doubt that all these old Cornish specimens were obtained before 1820 and that they probably all originally came from Heuland. Nothing in the text-books or records has shed any light on the original locality, and the matrix of the old specimens, often such a characteristic feature of Cornish minerals, does not in itself give any certain clue; however, the specimens are sufficiently alike to suggest that they were all obtained from the same source.

The absence of rhabdophane from the Rashleigh Collection

Owing to the absence of any more conclusive data, no suggestion has so far been forthcoming as to when, or how long before 1820, these old specimens may have been found. It is, nevertheless, significant, as Sir Arthur Russell had also suggested in discussion with the writer, that Rashleigh's catalogue contains no reference to any comparable specimens and that the collection itself, which included so many other specimens of minerals at that time not yet described or named, surprisingly enough contains no similar examples of rhabdophane.

It seems very unlikely that if these unusual specimens had been found in Cornwall during his life-time, Rashleigh would not have heard of them and acquired at least some of them; Philip Rashleigh was collecting and acquired minerals for his collection up to the time of his death in June 1811, and this strongly suggests that the old specimens of rhabdophane were not found till after his death, which accordingly would limit the period of their discovery to the years between 1811 and 1820.

The early confusion of rhabdophane with other minerals is understandable; in addition to resembling botryoidal blende, rhabdophane could have been confused with some types of smithsonite, hemimorphite, chalcedony, and chalybite. Buff-to brown botryoidal blende occurred at a number of localities in Cornwall, including Relistian Mine in the parish of Gwinear and the better known localities of Wheal Unity in the parish of Gwennap and Fowey Consols Mine and Lanescot in the parish of Tywardreath. Lanescot was really a separate mine taken over by Fowey Consols in 1836, and formed the southern section of the combined undertaking: the name Lanescot, however, was sometimes given to the whole group. Relistian Mine was working as far back as 1718, and Wheal Unity was started some years before 1800 and was a classic locality for minerals for many years. Fowey Consols Mine, however, first started in 1913, the undertaking incorporating several older mines already in operation, and worked till 1819. It then remained inactive for three years and was re-started again in 1822. The old specimens of rhabdophane could have come from one of these three mines mentioned above, but the recent rediscovery and identification of rhabdophane at Fowey Consols

[1] Lettsom, *loc.cit.*, had stated that at that time (1878) there were no specimens in the British Museum Collection.

Mine, suggests that the period of its early working, from 1813 to 1819, has unusual significance, and the close correspondence of this period with that during which the original specimens of rhabdophane as suggested above, may have been found, namely between 1811 and 1820, may be more than coincidence.

The new occurrence at Fowey Consols Mine

The occurrence of rhabdophane at Fowey Consols Mine, which lies just over a mile north-east of St. Blazey, has now recently been confirmed and is the first in Cornwall of which the locality is certain. The material, which was not readily recognisable at the time of collection, (and the presence here of rhabdophane was not, in fact, suspected), was obtained by the present writer on a visit to this mine in 1943; it was found that some of the old dumps were being dug into and levelled in connection with the building of a camp, thus exposing large amounts of vein and other material from which a number of various specimens were collected. The mine was at one time notable for the many fine specimens of chalybite and francolite obtained there, much of the latter investing chalybite: several such specimens were found in 1943 and the rhabdophane, at first sight, showed a much closer resemblance to them. Considerable amounts of francolite were also present at Wheal Maudlin, again largely investing chalybite, and the presence of unusual amounts of this phosphate in the area is noteworthy. It was during x-ray examination of some of this material collected from Fowey Consols Mine, that one specimen was found to give an unrecognised powder-pattern which in due course was matched exactly with a photograph that had already been taken of a fragment of rhabdophane from one of the old Oxford specimens, both photographs being found to show traces of blende in addition.

This rhabdophane from Fowey Consols Mine is not, at first sight, as characteristic as most of the old specimens, being pale to yellowish brown in colour and showing little of the more usual reddish tinge and it lacks the greasy lustre; these differences, however, may be due to prolonged exposure. The older specimens, with their much bolder botryoidal or globular form, would, when first found, have been more distinctive and likely to have been preserved by a miner as something unusual. The newly found material is now rather weathered and iron-stained, but whilst showing a general resemblance to some of the old specimens, the rhabdophane itself is less noticeable, being in smaller aggregations, some of which have an almost drusy appearance; it forms small stalactitic or spherical concretions, partly on ribs of quartz and/or a compact dark mineral which suggests goethite but is, in fact, blende, in cavities in a comby, skeletal quartz-chlorite matrix which is very characteristic of this mine. Other minerals present are chalcopyrite and arsenopyrite, traces of which were visible in some of the broken matrix. Chalcopyrite is present on most of the old specimens and traces of what is almost certainly arsenopyrite as well: other old specimens also contain some blende. The quartz-chlorite matrix of some of the old specimens, especially those with the associated chalcopyrite, bears a strong resemblance to the same type of matrix found on many specimens of other minerals from this mine, and there is also a marked similarity

with that of the new material; these similarities by themselves are not conclusive, but they are, nevertheless, also suggestive.

During the course of making enquiries regarding the original specimens in the Ludlam Collection at the Geological Museum, it transpired that the Atomic Energy Division of the Geological Survey had already carried out some investigations of Cornish rhabdophane mainly on their Ludlam Collection specimen (Ludlam 7186). With the concurrence of the Director of the Survey and of Mr. S. H. U. Bowie, the Chief Geologist of this Division, Mr. J. E. T. Horne was able to give some details relating to the old specimens which had a very direct bearing on the new material and he further very generously offered to carry out certain additional examination of the new Fowey Consols mineral. The results of this examination show remarkable agreement in several aspects between the original Ludlam specimens and the new Fowey Consols material.

An X-ray powder-photograph of the new material shows rhabdophane with a trace of blende and quartz. The spectrum is almost identical with that of the rhabdophane from the Ludlam Collection (Ludlam 7186), the rare-earths principally present being cerium, with yttrium and lanthanum. A radiometric assay gave 0.13% of eU_3O_8 compared with 0.18% eU_3O_8 for the Ludlam specimen, but as the Fowey Consols material had been on the dumps for something like 130 years this slight variation is probably hardly significant. A polished section of the matrix shows it to consist mainly of blende enclosing spheroidal pyrite with lesser amounts of chalcopyrite, arsenopyrite, and quartz, and most of these phases could be distinguished on a powder-photograph. This is in good agreement with the matrix of the Ludlam specimen shown previously to contain predominent blende and pyrite, with minor chalcopyrite, arsenopyrite and some covellite. These data would seem to afford yet more convincing confirmation that Fowey Consols Mine is almost certainly the original locality.

The writer must express to the Director of the Survey, to Mr. Bowie, and to Mr. Horne, and also to other members of the staff of the Division, Mr. C. O. Harvey, Mr. D. Atkin and Mr. K. Taylor, his appreciation of their help and co-operation in investigating this rare and interesting Cornish mineral.

This new occurrence is of interest not only in view of the rarity of the mineral, but also so far as the locality is concerned, regarding which there may be another, perhaps significant, point. Records of other yttrium-cerium minerals in Cornwall are, at present, confined to two species, both exceedingly uncommon. One of these, the phosphate monazite, has been found (in distinct, well-formed, free crystals, as opposed to its occurrence as a micro-accessory mineral in rocks) only at the Lanterdan and an adjoining quarry near Tintagel, where, in an entirely different environment, small crystals occur very sparingly, generally on albite, in joints or cavities in somewhat alpine-type veins in phyllite, accompanied, as it so frequently is, by titanium minerals, in this case rutile and anatase. The other Cornish rare-earth mineral, churchite, the hydrated yttrium phosphate, was re-discovered as mentioned previously at Tretoil Mine, Lanivet, a mine which also lies within the aureole of and close to the margin of the same eastern part, the earliest phase, of

the St. Austell granite, and only 6 miles north-north-west of Fowey Consols.. There may be some significance in the fact that these two rare-earth phosphates occur in the same close proximity to this particular granite.

In conclusion, it may be fitting to recall the words in which Cornwall was described in the Preface to the first volume of the Society's Transactions, published in 1818;

> " a district so inexhaustibly rich in the varied treasures
> " of the mineral kingdom, and so singularly adapted, both
> " from the natural structure and artificial excavations,
> " for the examination of natural phenomena."

It was due to the diversity of these mineral riches that at an early date Cornwall, with Devon, became one of the classic areas for the study of minerals and of ore-genesis. Today, one hundred and fifty years after the Society's foundation, these words of 1818 are still substantially true, though with the greatly diminished number of " artificial excavations " opportunities for finding new occurrences of minerals are fewer than they were. During this period much has been discovered not only about the granite masses themselves, but also about the complex processes of mineralisation and ore-deposition associated with them; and with the improvement in methods and techniques available, more has been learned about the concentration and distribution of the rarer elements and the associations of the minerals. Careful and methodical search in the field is still essential if the rarer and more unusual minerals are to be found and even commoner species are not to be overlooked. A great deal has been added to our knowledge of the minerals of the south-west, but many of the problems concerning their formation are still largely unsolved. Minerals of unusual interest no doubt remain to be discovered, but their interest may not only concern the mineralogist. An occurence may appear insignificant or of little import at the time, but it may one day provide some essential link or clue, not only in the field of mineralogy or ore-genesis, but even in the causes of disease or in some wider application of science.

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