Note on the mines and minerals of the Silvermines district, Co. Tipperary.

By Arthur Russell.

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THE Silvermines mineral district is situated along the northern base of the Silvermine Mountains, five and a half miles south of the town of Nenagh in the county of Tipperary. The district is one which possesses somewhat remarkable features, of interest to both geologists and mineralogists. The mines extend over a narrow tract of country for a distance of about five miles along an extensive E. and W. line of fault, in which Silurian, Old Red Sandstone, and Carboniferous rocks are brought into juxtaposition. This line of fault has been traced for a distance of about thirty miles from Gallows Hill in co. Clare, on the west, to Toomavara in co. Tipperary, on the east. Along its course in at least two places mineralization has taken place, resulting in a somewhat complex series of contact-lodes and metasomatic deposits.

Mining operations in search of silver-lead were evidently carried on at Silvermines at a very early date, the whole district being literally honey-combed with ancient open workings, shafts, and levels. Actual records date back to the year 1600, and mining was carried on intermittently down to 1800. The mines were then taken over by the General Mining Company of Ireland, which carried on extensive operations down to 1870. Since that date, little or nothing has been done beyond the clearing up, a few years ago, of a shaft and the raising of a small quantity of calamine-ore at Ballygown South mine.

The general geology and many features of the mines of this district have been very ably described in the Explanations accompanying Sheet 134 of the Irish Geological Survey, which was published in 1861. I purpose, therefore, to deal mainly with the mineral contents of the lodes, as exemplified by specimens lately found by myself on the old mine burrows. As is usual in Ireland, the mines are mostly named after the township in which they are situated. Commencing with the most easterly of the group and going westward, we will consider any points of mineralogical interest.

Just south and close to the little village of Silvermines lies the *Ballygown South mine*. Here, along the line of fault, the Carboniferous

Limestone is brought down against the Old Red Sandstone; the former rock being converted into a hard, grey, crystalline dolomite, extending in places as a narrow strip along the north side of the fault, and passing insensibly into the surrounding Carboniferous Limestone. Running at right angles to this strip of dolomite, and dipping about 10° N. below the limestone on which the village stands, is a very remarkable bed of rusty ochreous gossan about 20 feet thick. Both the foot-wall and hanging-wall are entirely composed of dolomite, whilst the gossan itself frequently contains great irregular rounded masses of dolomite; these in all probability having resisted the general metasomatic action. The bulk of the gossan is composed of cellular and sponge-like masses of brownish-yellow limonite, the cavities and surfaces of which are often lined with drusy crusts and brilliant crystals of hemimorphite (calamine). In other cases the hemimorphite forms with galena solid, irregular lumps, often of considerable size, the exterior and cavities being studded with crystals. The calamine-ore was first discovered by Captain Thomas King, the resident manager of the mines, who in 1858 sent a sample taken from the bottom of an ancient shaft to Dublin, where it was examined by Dr. Apjohn. The latter analysed the mineral, and showed it to be basic silicate of zinc, or hemimorphite[1].

The hemimorphite crystals, though of comparatively small size (the largest noted being 2 mm. long), are wonderfully brilliant and sharp. They resemble the well-known Aix-la-Chapelle specimens, and are fairly rich in faces about the analogous pole. The crystals are tabular parallel to the brachypinacoid, b {010}, the b face being vertically striated. They are usually attached to the matrix by the antilogous pole; in a few cases, however, both poles are developed. The following forms were noted: b {010}, c {001}, m {110}, t {301}.

The deposit of calamine-ore at Silvermines is of especial interest as being the only occurrence of the kind known in the United Kingdom. In many of its features it presents great similarity to the well-known deposits at Moresnet in Belgium. From the fact that small quantities of blende and galena have from time to time been found amongst the zinc-bearing gossan, it seems probable that the metallic contents were originally deposited in the form of sulphides along the line of fault and

[1] J. Apjohn, 'On the occurrence of electric calamine at the Silver Mines, County of Tipperary.' Journ. Geol. Soc. Dublin, 1860, vol. viii, pp. 157–9. See also A. B. Wynne, 'Some remarks upon the mining district of Silvermines, County of Tipperary, with a map.' ibid., pp. 244–50; J. Beete Jukes, 'Note on the way in which the calamine occurs at Silvermines, County of Tipperary.' ibid., 1863, vol. x, pp. 11–13.

side-fissures. Subsequently, underground waters by their metasomatic action brought about the gradual substitution of the surrounding limestone by silicate of zinc and oxide of iron. The existence of large quantities of barytes would point to an intermediate stage in which the sulphur of the sulphides underwent oxidation.

In addition to the hemimorphite, the gossan often contains irregular masses of galena, partially altered to cerussite, and occasionally small quantities of blende. The galena was said to contain 80 ounces of silver to the ton. Barytes is also of frequent occurrence either in curious radiating and stalactitic masses, the exterior coated with pale yellow, earthy limonite, or in aggregations of simple wedge-shaped crystals ($c\,\{001\}, m\,\{110\}$) grouped in parallel position. Smithsonite (zinc carbonate) is said to have occurred in the gossan, but I failed to detect this mineral.

Adjoining the Ballygown South mine, and a little to the south, is a large contact-lode, composed mainly of pyrite, known as the *Sulphur mine*. Old Red Sandstone forms the southern wall, whilst the northern is composed of dolomite. Large quantities of pyrite were formerly raised here, but nothing of mineralogical interest presents itself.

At the *Gortshaneroe* or *Ballynoe mine*, chalcopyrite, galena, and barytes form a lode between walls of Silurian and Carboniferous Limestone rocks. Close to this spot in the bed of a stream is a remarkable deposit of barytes said to contain spots of pyrite and orpiment. This occurrence of orpiment was recorded in 1860 by Mr. Alphonse Gages[1].

At the *Gorteenadiha* or *Gortnadyne mine*, very extensive mining operations were formerly carried on, principally for copper, although a considerable quantity of lead was also raised. The principal lode lies between Old Red Sandstone and Carboniferous Limestone. The vein-stuff consists of a hard quartz-sandstone-breccia, containing irregular patches of chalcopyrite, whilst in places argentiferous tetrahedrite is abundant, and may be found on the old burrows associated with large masses of white barytes. The barytes is particularly abundant at this mine, and is often very pure. Good specimens of white acicular cerussite (called by the miners 'cat-tooth-ore'), often stained with malachite or azurite, are common.

The once important mines of *Shallee East* and *Shallee West* form the limit on the west on which mining operations have been carried out.

[1] A. Gages, 'On the formation of orpiment in a mass of sulphate of barytes, found interstratified in the Carboniferous Limestone near Silvermines, County of Tipperary.' Journ. Geol. Soc. Dublin, 1860, vol. viii, pp. 243–4.

The Shallee East mine presents a very remarkable appearance, the whole base of the mountain-side being furrowed with a very extensive series of open workings made in search of lead-ore. These open workings vary in width from 3 to 6 feet, and occasionally extend for a distance of 80 yards; they average about 30 feet in depth. Their direction is more or less at right angles to the main line of fault, and they evidently represent a series of side fissures in which mineralization has taken place from a common source. The enclosing rock is a dirty grey, quartzose sandstone. The galena occurred more or less intimately associated with white, massive barytes, the latter mineral forming a large portion of the vein-stuff. Argentiferous tetrahedrite and cerussite are also present in small quantities.

The compact nature of the vein-stuff and the absence of vugs have precluded the formation of crystallized minerals, which, with the exception of hemimorphite and barytes at Ballygown South mine, appear to have been of extremely rare occurrence in this district.

List of Minerals occurring in the Silvermines district, co. Tipperary.

Ballygown South mine (Calamine mine):—
Hemimorphite (Calamine), Smithsonite ? Blende, Galena, Cerussite, Pyrite, Limonite, Barytes.

" " " (Sulphur mine):—
Pyrite, Galena, Blende.

Gortshaneroe or Ballynoe mine:—
Galena, Chalcopyrite, Pyrite, Orpiment, Barytes.

Garryard West mine:—
Galena, Cerussite, Pyrite.

Gorteenadiha or Gortnadyne mine:—
Chalcopyrite, Tetrahedrite, Malachite, Azurite, Galena, Cerussite, Blende, Hemimorphite, Pyrite, Barytes.

Shallee East or Shallee Coughlan mine:—
Galena, Cerussite, Tetrahedrite, Barytes.

Shallee West or Shallee White mine:—
Galena, Barytes.

The following additional minerals from this district are mentioned by Townshend M. Hall in his 'Mineralogist's Directory', 1868:—Erythrite at Silvermines; Pyromorphite at Shallee Mountain.