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NOTES ON IRISH MINES.

No. III.—MINES OF KENMARE VALLEY, COUNTY OF KERRY.

BY

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PROFESSOR OF GEOLOGY IN THE UNIVERSITY OF DUBLIN.

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NOTES ON IRISH MINES,

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NO. I.

SULPHUR AND COPPER MINES OF BALLYMURTAGH, COUNTY OF WICKLOW.

NO. II.

LEAD MINES OF LUGANURE, COUNTY OF WICKLOW.

NO. III.

MINES OF COPPER AND LEAD IN KENMARE VALLEY, COUNTY OF KERRY.

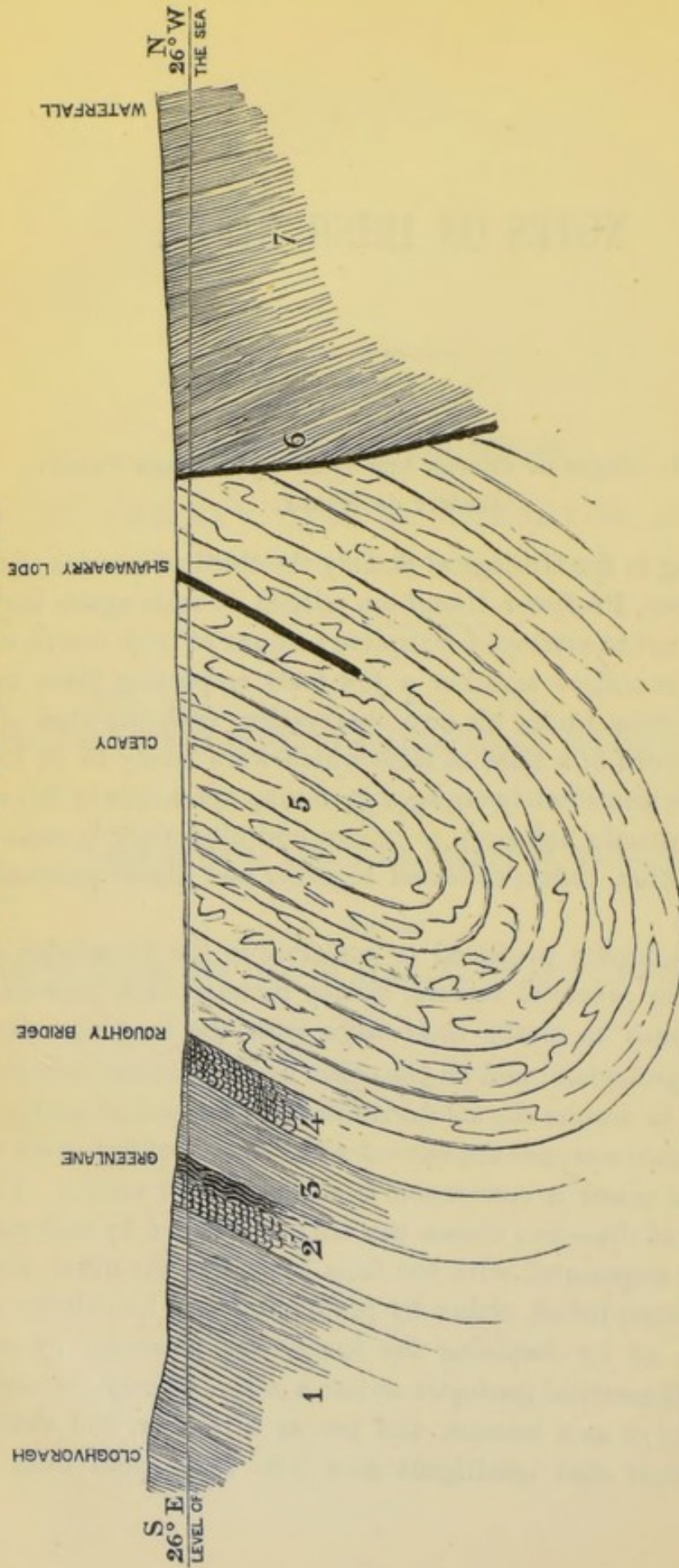
NOTES ON IRISH MINES.

NO. III.—MINES OF COPPER AND LEAD IN KENMARE VALLEY, COUNTY OF KERRY.

IN presenting to the Geological Society the third of a series of notes on Irish mines, Professor Haughton wished to state again that his object was, not to attempt a complete account of Irish mines, but to endeavour to collect together a few facts respecting these mines, which had come under his own observation, with the view of preserving a record of a class of facts which were likely to be known only to those immediately engaged in mining operations in this country, and to remain unknown to others, and ultimately become altogether forgotten, unless collected together and placed permanently on record.

Some geologists professed to undervalue the knowledge to be obtained from practical miners, simply because such persons were not accustomed to clothe their facts with the language used by theoretical geologists; and on the other hand, practical miners were accustomed to despise the aid derivable from theoretical geology, because geologists were not acquainted with the class of facts with which the practical miner is conversant from his earliest youth. The reconciliation of these two classes can only be effected by each making itself better acquainted with the facts known to the other, and can never be accomplished, either by pretending to a knowledge we do not possess, or by despising the knowledge possessed by others. When the theoretical geologist enters a mine, quarry, or coal-pit, he should do so as a learner, and not as a teacher, and should be ready to admit that intelligent men who have spent their lives,

CROSS SECTION OF KENMARE VALLEY.



- 1, 3, 6, 7. Red and Brown fissile Slate.
5. Carboniferous Limestone occupying the valley in a synclinal fold.
4. Red micaceous Slates and calcareous Sandstones.
2. Band of calcareous Slate of pale colour, containing veins of gray and yellow Copper ore, and green and blue Carbonates of Copper.

and made their fortunes, by sinking shafts and driving levels, are likely to know more of such matters than an amateur. On the other hand, the practical miner must and does derive much useful information from the scientific geologist, and would derive much more if the two classes understood each other's language better.

The mines hitherto described by Mr. Haughton have been long and successfully at work, but the present note is a description of a mining valley rather than of a particular mine, and which will require a large outlay of capital and skill before it can be brought into full working order, although it already appears to afford promise of becoming an important mining district.

Mr. Haughton proposed to divide the subject of his note into two parts, viz.: the geological description of Glenrough or Kenmare valley, and the mines already at work or being opened up in this valley.

Geological Description of Kenmare Valley.—The valley of Kenmare extends eastward from the town of Kenmare to the village of Kilgarvan, a distance of about eight miles, and varies in breadth from half a mile to one mile. It is formed of a synclinal fold of lower Carboniferous limestone, the fold or bending of the strata having passed the vertical, forming a case of inversion of strata similar to those occurring in the south of Waterford and Cork, in Cornwall, and the Eifel, as described by Sedgwick and Murchison, and other geologists.

In consequence of this inversion of strata, the arenaceous, red micaceous, and calcareous slates to the south of the Roughty, appear to overlie the limestone of the valley.

The average strike of the limestone and other beds in Kenmare valley is very constant, lying always between the limits E. 27° N. and E. 12° N. At the southern junction of the limestone and slaty beds, which is well seen at Roughty bridge, and at a point to the eastward, south of the river, both rocks are divided by two sets of planes: one, the true bedding, dip 70° S., and the other, of cleavage, dip 70° N. to 90°, both classes of planes being intersected by joint planes, making a solid angle of 90° with the cleavage planes.

The position of the planes of bedding is decisively shown in the shaft which is being sunk on the copper vein at Greenlane, where there is a highly characteristic bed of calcareo-argillaceous slate, of which an analysis is here given of an average specimen:—

Calcareo-argillaceous Slate, accompanying Veins of Copper Ore, Green-lane, county of Kerry.

Argillum,	49·25
Peroxide of iron and alumina,	2·03
Carbonate of lime,	38·74
Carbonate of magnesia,	7·83
Water,	1·26
	<hr/>
	99·11

It is worthy of remark, that if this limestone consisted only of the pure carbonates of lime and magnesia, they would exist in the proportions of 83·18, and 16·82 per cent., i.e. in the atomic proportion of 4·16 : 1—a composition which, although not that of dolomite, approaches to it.

The mention of these calcareous beds in the micaceous red slate, associated with veins of copper, reminds me of a fact to which my attention was drawn by Mr. Charles P. Cotton, of the occurrence of similar veins of copper ore, in the neighbourhood of Ardmore, county Waterford. On examining Mr. Cotton's section of the limestone and associated beds, at Ardmore, it becomes evident that the copper veins occupy the same position in his section, and my own at Kenmare; and on inspecting and submitting to analysis his specimens of the calcareo-argillaceous rock, in which the copper veins occur, the identity of composition appears as striking as the similarity of position:—

Calcareo-argillaceous Slate, accompanying Veins of Copper Ore, at Whiting Bay, Ardmore, County Waterford.

Argillum,	55·21
Peroxide of iron and alumina,	1·87
Carbonate of lime,	22·31
Carbonate of magnesia,	15·09
Water,	1·92
	<hr/>
	96·40

Besides the constituents above given, the rock contained a quantity of green carbonate of copper, in thin sheets disseminated through the specimen. This limestone, if pure, would contain in one hundred parts 59·65 of carbonate of lime, and 40·35 of carbonate of magnesia;

being in the atomic proportion of 5 : 4, and thus constituting a true dolomite.

This identification of the copper vein in position would be sufficient, if other evidence were wanting, to prove that the limestone beds of Kenmare valley belong to the lowest group of Carboniferous limestone. Notwithstanding a careful search, several times repeated, I was unable to procure the slightest trace of fossils in the limestone of this district.*

The bedding of the limestone and slate, south of the Roughty, is conformable, and the limestone maintains nearly the same high dip as we proceed northwards, becoming, however, more nearly vertical near its junction with the slate beds on the northern slope of the valley. This junction is not visible, and appears as if it coincided with a line of fault, for immediately north of the junction the slate beds dip to the south at angles varying from 45° to 70° ; this opinion is further confirmed by the facts, which will be presently stated with reference to Ardtully mine, a few miles east of the line of section.

The limestone of this district is uniform in character, highly crystalline, and with a slaty structure, exhibiting frequently planes of bedding and cleavage. The inverted beds south of the limestone consist near the junction of a series of micaceous coarse thickly-bedded sandstones, dark-coloured and slaty beds, and calcareous slates, containing nodules of clay ironstone and iron pyrites; and farther to the south than the section extends they are interstratified with thick beds of green grit, some of which are well exhibited in the road cuttings on the way to Bantry from Kenmare. To the north of this section the beds nearest the limestone, and unconformable to it, are soft yellowish slates, with quartzose veins containing micaceous iron in abundance, and under those lie the red slaty beds, denominated "red killas" by the Cornish miner.

Although the limestone of Kenmare valley is in general confined to the narrow strip shown in the section, it is occasionally found in outliers, forming small patches, lying upon the highly inclined beds of red slate; one of these outliers occurs at a point about one quarter of a mile N. W. of Ardtully mine, with a strike N. W., dip, 22° N. E.

Besides the outliers of limestone in Kenmare valley, there are

* I am informed by Dr. Griffith that he has found in the slate adjoining the limestone in the Roughty valley specimens of *Fenestella antiqua* and impressions of plants.

some remarkable boulders, both of limestone and green grit: the most striking of which are the limestone boulders called Cloughvorragh and Carrig-a-Cappeen. The former lies at an elevation of 260 feet to the south of Roughty bridge. I have attempted a rough calculation of its weight, which I estimate at 132 tons. This limestone boulder is covered on one side with shrubs, holly, hawthorn, arbutus, ivy, mountain ash, several kinds of ferns, &c. On the opposite side of the valley, just inside the limestone boundary, occurs the curious green grit boulder, called Carrig-a-cappeen; it is a greenish quartzite, resting upon a pinnacle of limestone, and has the appearance of a large fungus, of which the limestone pinnacle is the stem.

The whole valley near Kenmare is full of these travelled boulders, many of which, particularly the red sandstones, are grooved and striated, as if they had been held while being pushed along a sharp surface, which has cut and polished them.

The Mineral Lodes of Kenmare Valley.—The mineral lodes which occur in this district are lodes of copper and lead, the copper being developed at or near the boundary of the limestone, both north and south, the plane of the lode coinciding *nearly* with the bedding of the slate rock. The lead lodes are confined exclusively to the limestone, throughout which they are developed in several parallel bands, principally, however, near the northern boundary. The lead lodes are, like the copper, *nearly* conformable to the bedding of the limestone, both in strike and dip. This conformability is, however, not complete, either in strike or dip, as will be shown in the description of each lode. I shall describe the lodes in the order of their occurrence, from north to south in the valley.

No. I. *Ardtully Lode—Copper.*—This lode occurs at the northern junction of the limestone and red slate, in the townland of Ardtully, about five miles east of Kenmare. It has been worked to a depth of sixty-six fathoms from the surface, and near the engine shaft has the limestone for its south wall, and the red slate for its north wall; and appears, in fact, to have been formed along the line of fault, separating the limestone from the slate to the north of it. The slate in contact with the north wall of the lode is much softer than at a distance from it, probably owing to the readier percolation of water through the lode. As the lode is traced westward, it leaves the junction of the limestone and slate, and becomes less productive; and it

has been found most metalliferous in that portion of it which lies between the limestone and slate. The width of this lode varies from three to ten feet, and is conformable to the strata; it consists of a series of smooth polished sheets or secondary walls lying within the main walls. The south wall of the lode does not come into contact directly with the limestone, but is separated from it, as the north wall is separated from the red slate, by a remarkable black shining slate, coated with fibrous streaks of a mineral resembling some of the hornblendes, and this black slate forms the north and south walls of the lode.

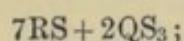
The direction of the lode is very nearly due east and west; it underlies south, for forty fathoms, about two feet in six; it then becomes vertical for sixteen fathoms, and ultimately acquires a small underlay to the north.

The ore varies considerably in character and quality, but consists principally of argentiferous arsenical gray copper, of an ordinary specimen of which an analysis, made by Mr. Corrigan, in the Laboratory of Trinity College, is here given.

Analysis of Gray Copper Ore from Ardtully Mine.

	Per Cent.	Atomic Quotients.
Silica,	5.29	
Sulphur,	25.32	1.582 13
Arsenic,	16.07	0.214
Antimony,	3.70	0.029
Copper,	40.26	1.270
Iron,	4.54	0.162
Zinc,	3.18	0.098
Silver,	0.15	0.001
Sulphuret of Mercury?	0.56	
	<hr/> 99.07	

From this analysis we may deduce the rational formula,



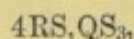
in which

R = Cu₂, Fe, Zn, Ag.

Q = As, Sb.

* Found on the supposition that two atoms of copper are isomorphous with one of iron, zinc, or silver.

This formula approaches the well-known formula for Fahlerz



with which it would coincide, if there were eight atoms of basic sulphurets instead of seven.

In addition to the gray ore just described, the purple or horseflesh copper ore, and the ordinary yellow ore or copper pyrites, occur; particularly in the deeper levels. A cross course of calcareous spar intersects the lode near the engine-house, underlaying west, and with a direction N. 17° W. This cross course does not appear to heave the lode, which, however, becomes poor to the eastward of the cross course, and is particularly rich at the intersection westward.

No. 2. *Forge Lode—Copper.*—At a distance of 108 fathoms, south of the Ardtully lode, there occurs another lode of copper, which has not yet been much worked; it lies altogether in the limestone, and so far as it has been worked, contains exclusively horseflesh or purple copper ore; its direction is parallel, or nearly so, to that of the Ardtully lode.

No. 3. *Shanagarry Lode—Lead.*—The Shanagarry lode lies in the limestone, at a distance of about 130 fathoms from its northern boundary. It is being worked at two points, at Shanagarry and Cleady. The direction of this lode is accurately E. 22° N., and it is very nearly, but not quite, coincident with the strike of the limestone in which it occurs; the strike of the latter being E. 17° N.

This lode has been worked at Shanagarry, by the Lansdowne Mining Company, on a pipe vein, to the depth of 42 fathoms from surface; it underlies for 30 fathoms about 2 feet in 6, when it becomes more perpendicular, and the rock also is softer. The average dip of the lode is 70° S., and of the limestone, 75° S. The metalliferous part of the lode lies in sheets between thin partings of limestone and dips with them, but seems at intervals, as for example in the 39 fathom, to cut through the limestone sheets to the south, reappearing in other beds further south.

Near the surface this lode produced considerable quantities of iron pyrites and blende, but in the bottom levels, the argentiferous lead-ore is free from these substances.

At Cleady a shaft has been sunk to the depth of 10 fathoms, by the Trinity Mining Company, on the course of the same lode, 620 fathoms west of Shanagarry, in very favourable ground, containing

iron pyrites in abundance, with leaders and occasional large stones of lead ore.

No. 4. *Shanagarry South Lode—Argentiferous Lead.*—This lode has been opened at a point called Crean's Shaft, south-east of Old Shanagarry Castle, and is 63 fathoms south of Shanagarry lode, to which it is parallel in direction; and it has been traced westward to a distance of more than a quarter of a mile across the River Cleady; it contains a considerable quantity of blende, mixed with the argentiferous galena.

No. 5. *Killowen Lode—Argentiferous Lead.*—Proceeding southwards, we next come to the Killowen lode, which lies due east and west (magnetic), and has been traced from the road opposite Killowen House to the garden belonging to Kenmare Chapel, close to the town, a distance of one statute mile; it contains iron pyrites and veins of lead at Killowen, and a promising vein of lead at the garden near Kenmare. This lode is about 285 fathoms south of the main Shanagarry lode; it does not appear to have been developed to the extent which its importance would seem to require.

No. 6. *Trinity Lode—Copper.*—This lode lies in the red micaceous slates, south of the Roughty, and is accompanied by the remarkable beds of impure magnesian calcareous slate, described at p. 5; it was first discovered at Greenlane, on the College property, and has since been traced westward to Kenmare suspension bridge, a distance of $2\frac{1}{2}$ miles. At Greenlane a shaft has been commenced, on the underlay of the lode, in which purple and gray copper ores have been discovered. The ore at the north side of Kenmare bridge, in this lode, consists of copper pyrites, which has been found near Cromwell's fort, in sufficient quantity to promise a return for a judicious outlay of capital.

No. 7. *Trinity South Lode—Copper.*—This lode runs E. W. (mag.) parallel to the Trinity lode, and at a distance 38 fathoms south of it; it has been traced from Greenlane to Kenmare bridge (south side), at which latter place a rich bunch of gray ore has been discovered.

The seven lodes just described are the principal lodes hitherto discovered in Kenmare valley, and none of them have yet been worked on a scale sufficient to develop their resources. Of these lodes, four are copper, and three lead; the copper lodes occurring two and two, at the northern and southern junctions of the lower carboniferous limestone with the underlying red slates and sandstones; the lead

lodes are confined exclusively to the limestone, while the copper lodes, particularly on the south side, occur in the underlying calcareous slates. It is worthy of remark, in speculating on the position of these copper lodes, to observe that they occur in the same geological position as some of the best lodes in Ireland; for instance, the Gurtnadyne lode at Silvermines, and Bearhaven mine, county of Cork, which latter mine may, in fact, be considered as occurring in part of the same valley, and in the red slates south of, and older than, the Carboniferous limestone of Kenmare valley.