Excursion to Penrith and the north-west.

Report by the Directors,
K. C. DUNHAM, D.Sc., S.D., and S. E. HOLLINGWORTH, M.A., D.Sc.

MINERAL localities in north-western England were visited during the second excursion organized by the Society in recent years, from April 14 to 18, 1947, the headquarters being the George Hotel, Penrith. Members taking part included: The President, W. Campbell Smith (London), O. J. Adamson (Oslo, Norway), W. Anderson (Newcastle), F. A. Bannister (London), D. W. Bishopp (Dublin), C. E. N. Bromehead (London), G. F. Claringbull (London), T. Deans (London), W. A. Deer (Cambridge), K. C. Dunham (London), N. R. Goodman (Nova Scotia and Oxford), G. S. Gowing (Stockton-on-Tees), S. E. Hollingworth (London), W. Hugill (Stoke-on-Trent), H. Neumann (Oslo and Leeds), C. W. Pegg (London), F. H. Rathmann (U.S.A.), P. L. Rumsby (London), R. D. S. Shrimpton (Slough), J. H. Taylor (London), E. A. Vincent (Durham), L. R. Wager (Durham), Miss D. E. Wisden (Southampton). Dr. Claringbull undertook the administrative arrangements.

Tuesday April 15 was devoted to a visit to the Florence mine of the Millom and Askam Haematite Iron Co. Ltd., through the courtesy of Major Arthur Hibbert, D.S.O., M.C. The journey to Egremont took the party through the northern part of the Lake District, by Keswick, Bassenthwaite Lake, and Cockermouth. Dr. F. M. Trotter met the party at the mine, and explained the geological background of the West Cumberland haematite deposits, which include fault-veins and replacement ore-bodies in the Carboniferous Limestone, found where that formation is, or was formerly, directly overlain by Brockram and St. Bees Sandstone of Permo-Triassic age. Where St. Bees shale intervenes between Brockram and Limestone, ore-bodies are rarely found. Dr. Trotter mentioned the rival hypotheses of origin of these deposits[1] and pointed out: (1) that they are definitely of post-Triassic age, for haematite and associated minerals have been found by borings in the Brockram, and the mineralized faults cut Permo-Triassic strata; (2) that in addition to haematite, the deposits carry a magnetic form of specularite and small amounts of chalcopyrite, pyrite, manganite, galena,

[1] The origin of Cumberland haematite. (1) by E. E. L. Dixon; (2) by Bernard Smith. Summ. Progr. Geol. Surv., 1928, for 1927, pp. 23–36.

baryte, and fluorite. The mineral assemblage and the restriction of the mineralization to the Brockram and the limestone adjacent to it indicate solutions of magmatic origin which reached the limestone by flowing down-dip through the Brockram.[1]

Dr. G. A. Schnellmann, after explaining the geology of the mine, then conducted the party down Florence shaft and round the workings, where a thick replacement ore-body related to the north-north-west Florence fault was examined. Good cavities containing kidney haematite, specularite, dolomite, and pale blue fluorite were found. The edge of the ore-body where it dies out against limestone was also seen.

Little was seen of the west coast owing to unfavourable weather, but the sun broke through during the return journey to Penrith, and a visit was made to Lake Ullswater and to Aira Force for tea.

On Wednesday April 16, the Mungrisdale area was visited. Leaving the bus a short distance south of the fell road ford over Carrock Beck 4 miles north of Mungrisdale, the party headed west up the northern side of the Carrock Beck valley towards the outcrop workings on the Sandbeds–Driggith vein. This vein, which is believed to be the north-eastward continuation of the southern member of the Roughton Gill veins,[2] has been worked from levels on the northern (Sandbeds) side of the high ground and from the southern side (Driggith mine). Opencast workings and collapsed stopes at 1500–1600 feet O.D. show a lode up to 12 feet wide in intensely rotted Borrowdale volcanic rocks. Quartz, with massive ribs of baryte up to 2 feet wide, predominates, with lenses of decomposed country-rock. The galena and blende with some chalcopyrite tended to be concentrated in the central part of the lode. Good specimens of pyromorphite as small crystals on joint faces and as massive radiating needle-like growths were obtained.

Thick mist and a cold wind hindered observation and collecting at this stage, and with an intermediate pause for an early lunch the party moved south across heather-covered moorland to the north side of the Drygill valley, south-south-east of High Pike. Here orange and green barrel-shaped crystals of campylite occur in the mineralized east–west quartz vein which forms a prominent feature at the top of the valley side. The vein occurs on the major fault which separates the Drygill Shales on the south from the Borrowdale Volcanic Series on the north.

[1] F. M. Trotter, *in* The geology of Gosforth. Mem. Geol. Surv., 1937, pp. 64–75; and The origin of the West Cumberland haematites. Geol. Mag., 1945, vol. 82, pp. 67–80. [M.A. **9**-236.]

[2] T. Eastwood, The lead and zinc ores of the Lake District. Spec. Rep. Min. Res., Mem. Geol. Surv., 1921, vol. 25, p. 42.

Good specimens were obtained from exposures of the vein and from dumps of old adits driven from the stream bed.

The sun was breaking through as the party walked southward across the moorland to the head of Brandy Gill where pyrolusite-bearing quartz strings in rotted diabase were noticed, and a short halt was made at the old dumps, half-way down Brandy Gill, from which wulfenite has been obtained from time to time.

The main objective was then the Carrock wolfram mine near the junction of Brandy Gill and Grainsgill Beck. This mine has a history of intermittent working since the 1860's. Considerable development work was done in 1941–44 by the Non-Ferrous Minerals Development Control (Ministry of Supply) and useful reserves of tungsten were proved. The mine was visited by kind permission of Mr. Anthony Wilson, M.I.M.M., the present lessee.

Wolframite, associated with scheelite, arsenopyrite, and subordinate amounts of molybdenite, occurs in a series of north–south quartz veins ranging from a few inches to 4 feet wide which are strongly developed in the greisenized granite of Grainsgill and pass northward through a narrow belt of Skiddaw Slates into the gabbro complex of Carrock Fell.

The party divided, some examining the old main level on the Harding vein and others the new low-level cross-cut. Excellent cross-sections of the vein were visible in the clean roof of the recently driven headings, and many fine bunches of wolframite with associated scheelite, ankerite, and occasional large prisms of apatite were seen. Active collecting was also carried out on the dumps.

The bus awaited the party in the Caldew valley above Swineside and after an excellent tea at Mungrisdale and a brief visit to the small quarry in Skiddaw Slates behind the school the return journey to Penrith was made.

After dinner a visit to the mineralogical collection in the Penrith Museum, kindly arranged by Dr. F. H. Day, was made by some members of the party, and the interesting collection of Mr. W. F. Davidson was also inspected.

On Thursday April 17, Silverband baryte mine and mill in Westmorland were visited at the invitation of B. Laporte & Co. (Luton). The party was met at the mill (fig. 1), situated at the foot of the western escarpment of the Pennines near Milburn Grange, by Mr. B. E. A. Vigers, Mr. Geoffrey Hickson, and Mr. W. S. Lancaster (directors of the company), Mr. Alexander Reid (consulting engineer), and Mr. Thompson

Lancaster (manager). After looking round the mill, a modern gravity plant, the 4-mile ascent of the escarpment was made in perfect weather by way of the spectacular mine-road which follows Knock Ore Gill, in a lorry provided by the company. The mine, at 2400 feet O.D., was then visited. The principal geological structure here is the east–west Dun Fell fault, downthrowing north 120–140 feet.[1] From this fault

FIG. 1. Group at Silverband baryte mill, Westmorland.
W. S. Lancaster, J. H. Taylor, N. R. Goodman, D. W. Bishopp, T. Deans, R. D. S. Shrimpton, C. E. N. Bromehead, H. Neumann, F. A. Bannister, Thompson Lancaster, W. Hugill, — Smith, G. Hickson, P. L. Rumsby, G. F. Claringbull, E. A. Vincent, C. W. Pegg, S. E. Hollingworth, Alexander Reid, G. A. Schnellmann, W. A. Deer, O. J. Adamson, W. Anderson, K. C. Dunham, W. Campbell Smith, F. H. Rathmann, Miss D. E. Wisden, G. S. Gowing, Mrs. Thompson Lancaster, L. R. Wager. (Photo. G. F. Claringbull.)

a number of smaller faults fly off on the downthrow side, diverging at a small angle at first, then turning north-eastward. These and the main fault are mineralized in the Great Limestone (Lower Carboniferous) with baryte, and smaller amounts of galena. Those portions productive of galena were worked by the London Lead Co. during the early years of the 19th century. The main production of the mine now comes from a large replacement ore-body, lying between the faults

[1] K. C. Dunham and H. G. Dines, Barium minerals in England and Wales. Geol. Surv., 1945, Wartime Pamphlet no. 46, pp. 37–41.

at the horizon of the Great Limestone. This carries baryte crystals, often water-clear, up to 2 feet long, in a matrix of clay and unreplaced limestone. The clay is probably of residual origin, and may have derived its iron-content from ankerite, pseudomorphs after which, in limonite, are found in association with the baryte. Fluorite has been found only in the deepest workings of this mine, at the horizon of the Four Fathom Limestone, reached by means of an underground shaft on the Slope vein. Narrow but laterally extensive post-mineralization caverns, developed along north-north-west joints in the limestone, and also along the north-east veins, were examined, and the ease with which the London Lead Co. had been able to convert these into useful exploratory cross-cuts was noted.

In the evening the Company entertained the Society to dinner at the King's Head Hotel, Appleby, with Mr. B. E. A. Vigers in the chair. In expressing the gratitude of members of the excursion to Messrs. Laporte, Dr. Dunham announced that he had sent a telegram of thanks to the chairman of the Company, Mr. L. P. O'Brien; and he paid tribute to the directors and staff, who had given every possible encouragement during his investigation of the geology and mineralogy of the mine for H.M. Geological Survey and had now most generously entertained the large party of visitors. The evening concluded with speeches and music.

On the last day of the excursion, the gypsum mines of Thos. McGhie & Sons Ltd. in the Kirkby Thore-Long Marton area were visited during the morning by kind permission of the resident manager, Mr. K. Boazman.

Gypsum occurs at three main horizons in the 500 feet of red and grey shales and marls that lie between the Permian Penrith Sandstone below and the Triassic St. Bees Sandstone above.[1]

The lithological characters of the 'B' bed in the middle of the shale-marl sequence were first examined in the disused and partially flooded McGhie's quarry. The distinctive 'porphyritic' selenite occurring as scattered crystals or concentrated in certain bands in a fine-grained granular gypsum matrix was noted as a feature which is found to persist at depth, where the fine-grained mass of the rock is present as anhydrite. After a brief visit to the nearby mill to see the 'boiling' of the finely powdered gypsum during calcination in the kettles, the party proceeded to New Stamp Hill mine a mile south of the mill where they were welcomed by Mr. Boazman and the mine manager, Mr. W. Hunter.

[1] S. E. Hollingworth, *in* Gypsum and anhydrite. Spec. Rep. Min. Res., Mem. Geol. Surv., 3rd edit., 1938, vol. 3, pp. 12–13.

Here the thick 'A' seam at the base of the shale-marl group is mined pillar-and-stall with galleries reaching 25–30 feet in height. One of the principal lithological characters of this seam is the abundance of 'satin spar' bands along bedding planes. Each band is bordered above and below by a thin film of grey shale which is perhaps due to segregation of argillaceous material on recrystallization of massive somewhat marly gypsum to the fibrous form. The 'Daisy bed', a 5-inch band made up

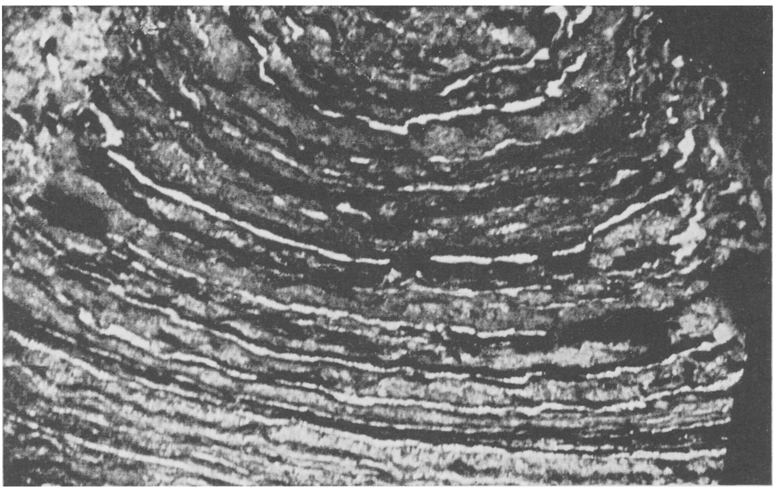

FIG. 2. View of part of roof and wall of natural cavern formed by solution in banded gypsum ('A' bed), New Stamp Hill mine, Kirkby Thore. (Photo. E. A. Vincent.)

of a contorted layer of orange-pink selenite spherulites each $1\frac{1}{4}$ inch diameter, attracted much attention among collectors.

Before leaving the mine a large natural cavern formed by solution of the gypsum was entered (fig. 2). It is 20 feet high, and of beehive form and shows the effects of differential solution of the gypsum beds. It is a unique occurrence in this country and the suggestion that every effort should be made to preserve it from destruction by mining was sympathetically received by the company's officials.

It was found that time allowed a hurried visit to the Birks mine a mile to the east. Here the 'B' bed, considerably disturbed by a series of sharp folds, is exploited from an inclined adit. The main haulage way crosses a series of folds so that shale below the 'B' bed and the shales above are alternately exposed. In the keels of the synclines sharp infolds of the 'C' bed 10–14 feet above the 'B' bed were also examined. Since the abandonment of the Acorn Bank mine these are the only accessible exposures of the 'C' seam.

In the deeper part of the mine the progressive increase in the thickness of anhydrite at the expense of the gypsum was studied in detail. Before leaving Birks mine, Dr. Campbell Smith expressed the thanks of the Society to the owners and to Mr. Boazman and Mr. Hunter for facilitating the visit to the gypsum workings.

In the afternoon the bus was taken to Hilton and (by skilful driving) up the Scordale valley to visit, by permission of Mr. W. Wharton, the old Hilton and Murton lead mines, famous for their amber fluorite. Here flat replacement deposits at the top of the Melmerby Scar Limestone, beneath the Whin Sill, were formerly worked for lead by the London Lead Co., and have more recently furnished baryte and a little witherite. Typical examples were seen in Dowscar high level; here the deposits vary up to 6 feet thick and consist of amber fluorite, galena, and coarse baryte. Good crystals of amber fluorite were obtained from clay-filled cavities.