

## Field Meeting Report: Carrock Fell, led by Tom Shipp 17<sup>th</sup> May 1986

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DOLAMORE, L. (1987). Field Meeting Report: Carrock Fell, led by Tom Shipp 17<sup>th</sup> May 1986. *Proceedings of the Shropshire Geological Society*, **6**, 11–15. The purpose of the field meeting was to visit exposures yielding evidence of the mineralisation around Carrock Fell and the Ordovician host rocks intruded by the Silurian Skiddaw Granite.

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### INTRODUCTION

The party met at Carrock Fell Mine, a disused tungsten ore set of workings [NY 323 328], which is approached off the A66 Penrith to Keswick road, via Mungrisdale, Mosedale and Swinside.

The mine has been in production periodically since the First World War, output being regulated by the market price for tungsten, and is at present closed. The mine is located in the glacially modified Mosedale valley at the confluence of the River Caldew with Grainsgill.

### GEOLOGICAL SETTING

Immediately to the north of the mine are the gabbroic rocks of the Carrock Fell complex emplaced in Lower Ordovician mudstones of the Skiddaw Group and volcanic rocks of the Eycott Group. To the south is the Skiddaw granite pluton, emplaced in late Silurian or early Devonian times with an assigned radiometric date of between 388 and 396 Ma.

In the vicinity of Grainsgill, later alteration of the still hot granite by saline solutions has led to the development of greisen (rock rich in quartz and mica, produced by pneumatolysis of granite by fluorine-rich vapours). Temperatures of 240 to 290 degrees Celsius at 800 bars have been estimated for this phase.

The metamorphic aureole, resulting from the granite pluton at this temperature and pressure, has changed the country rock, Ordovician mudstones, into a hornfels which is fine-grained and shows no structure. The extent of the hornfels is shown on the map of the mine (Figure 1).

The mineral veins emplaced are of several types and ages, viz.:

1. A group of north-south trending quartz veins, closely associated with the greisen development (Emerson, Harding and Smith veins) Fluid inclusion studies suggest that the mineralising media were a mixture of magmatic NaCl brine and meteoric waters, occasionally charged with carbon dioxide, convected by residual heat escaping from the granite pluton. The mineral assemblages in these north-south trending veins of quartz include apatite, feldspar, pyrite, wolframite, scheelite, pyrrhotite and arsenopyrite. The date of the greisenisation and first mineralisation has been put at 381 to 389 Ma, i.e. early Devonian.

2. A group of east-west trending fissures containing carbonates and minor amounts of the sulphides of copper, iron, lead and zinc. These are younger than the north-south trending veins and are possibly of early Carboniferous age. Interaction between the two sets of mineralisation have produced a variety of unusual and rare oxysalts of heavy metals.

3. Recently, antimony mineralisation has been exposed in Wet Swine Gill, about 1.5 km south-west of the Carrock Mine, and also in a small vein parallel to the Harding vein close to the River Caldew.

It is suggested that early Devonian antimony minerals were remobilised by early Carboniferous lead-bearing fluids and recrystallised in these quartz veins.

Due to past mining operations, obtaining mineral samples from the veins is no longer practical, but

with patience the extensive spoil heaps, representing work at several periods since early this century, can yield examples of at least the more common minerals. Those ores not required for economic reasons are most easily unearthed, amongst them is the mica mineral gilbertite, also good examples of rock quartz crystals.

The list of metallic and non-metallic minerals briefly describes their appearance and properties (Table 1). *[Note: The hardness of the minerals is given on Mohs' scale. For practical purposes a geological hammer head or knife blade is about 5.5 on Mohs' scale, a 'copper' coin about 3.5 and a finger-nail about 2.5. A harder mineral will scratch a softer one unless it is very brittle.]*

### ITINERARY

The party collected samples from around the spoil heaps and collapsed mine workings in the Grainsgill area (Figure 2), then moved up the Brandy Gill looking at the remains of further mining activities until the cross veins were reached, where collecting was again possible. With the weather deteriorating rapidly, the party returned to the cars for a lunch-break. By this time it appeared that the rain has set in for the day, but after an hour or so of strong winds and lashing rain the sun reappeared.

Before setting off for Wet Swine Gill, a little time was spent looking at the remains of the ore crushing and separating plant in the old mine sheds. Although somewhat vandalised, it was possible to follow the relatively up-to-date crushing, separating and ore concentrating process by examining the machinery which still remained.

On the way up to Wet Swine Gill a small exposure, reputed to contain the mineral jamesonite, was examined but revealed little. Jamesonite is a lead-iron-antimony sulphide ( $\text{Pb}_4\text{FeSb}_6\text{S}_{14}$ ) having a feathery or needle-like appearance. It is monoclinic in structure and cleaves in one direction; hardness 2.5 and s.g. 5.67.

The vein in Wet Swine Gill provided some reasonable samples of the antimony mineral stibnite ( $\text{Sb}_2\text{S}_3$ ), having orthorhombic needle-like metallic grey crystals of hardness 2.0, s.g. 4.63. Also present was the secondary mineral bindheimite, a lead-antimony oxide, ( $\text{Pb}_2\text{Sb}_2\text{O}_6$ ), which is yellow in colour.

In the whole Carrock Fell complex it is said that more than fifty different minerals have been identified. However, it would take considerably longer than a one-day exercise to collect even a quarter of this number.

### ACKNOWLEDGEMENTS

On behalf of the Shropshire Geological Society and the Russell Society for leading the joint field trip, Tom Shipp was thanked for making this a most interesting and instructive outing; one which has whetted our appetites to return to the area and resume the search.

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*Disclaimer - The information contained in this account has been prepared from notes taken during the field meeting. Its sole aim is to provide a record of what was seen and provide an insight into the diversity of geology exposed around Carrock Fell. It should not be used for any other purpose or construed as permission or an invitation to visit the sites or localities mentioned.*

Table 1

<i>Galena</i> , PbS	Blue-grey, cubic cleavage; hardness 2.5; heavy
<i>Pyrite</i> , FeS <sub>2</sub>	Pale brassy-yellow; hardness 6-6.5
<i>Chalcopyrite</i> , CuFeS <sub>2</sub>	Brassy yellow; hardness 3.5-4
<i>Pyrrhotite</i> , Fe <sub>7</sub> S <sub>8</sub>	Bronze tarnish; magnetic: hardness 4
<i>Arsenopyrite</i> , FeAsS	Tin-white, often tarnished black; garlic odour when hammered, hardness 5.5-6
<i>Sphalerite</i> , ZnS	Usually the dark ferrous variety, Fe substituting for some of the Zn; glistening black sub-metallic to resinous lustre; pale streak; hardness 3.5-4
<i>Molybdenite</i> , MoS <sub>2</sub>	Steel-blue flakes; soft and flexible; hardness 1-1.5
<i>Wolfram</i> , (Fe,Mn)WO <sub>4</sub>	Coal-black sub-metallic lustre; tabular; heavy; hardness 5
<i>Bismuth</i> , Bi	Granular; silvery, with characteristic reddish tint; brittle; hardness 2-2.5
<i>Bismuthinite</i> , Bi <sub>2</sub> S <sub>3</sub>	Steel-grey, acicular crystals; fragile; yellow tarnish; hardness 2
<i>Joseite</i> , Bi <sub>4</sub> TeS <sub>2</sub>	(Formerly identified as <i>Tetradymite</i> ). Brilliant silvery white, with perfect cleavage; hardness 1.5-2

The bismuth minerals are generally rare.

*Non-metallic minerals* are also numerous but often less easy to pick out. The following may be looked for:

<i>Quartz</i> , SiO <sub>2</sub>	Generally milky-white and abundant, but good small hexagonal crystals should be looked for; hardness 7
<i>Calcite</i> , CaCO <sub>3</sub>	Also milky-white and crystalline; hardness 3; it cleaves into rhombs and fizzes with acid
<i>Dolomite</i> , (Ca,Mg)(CO <sub>3</sub> ) <sub>2</sub>	Usually pinkish-cream in colour; satiny lustre; hardness 3.5-4
<i>Ankerite</i> , 2CaCO <sub>3</sub> .MgCO <sub>3</sub> .FeCO <sub>3</sub>	Largely fills the 'ankerite veins', weathering dull brown to produce umber; hardness 3.5
<i>Apatite</i> , Ca <sub>3</sub> F(PO <sub>4</sub> ) <sub>3</sub>	Usually in pale green hexagonal prisms on quartz; hardness 5
<i>Fluorite</i> , CaF <sub>2</sub>	Small amounts in quartz; generally purple colour; hardness 4
<i>Scheelite</i> , CaWO <sub>4</sub>	Creamy brown, sometimes showing tetrahedral faces; associated with wolfram; gives violet fluorescence with ultraviolet lamp in the dark; hardness 4.5-5
<i>Gilbertite</i>	A white, hydrous mica found as glistening crystals usually along the selvages of quartz veins in greisen; hardness 2-2.5

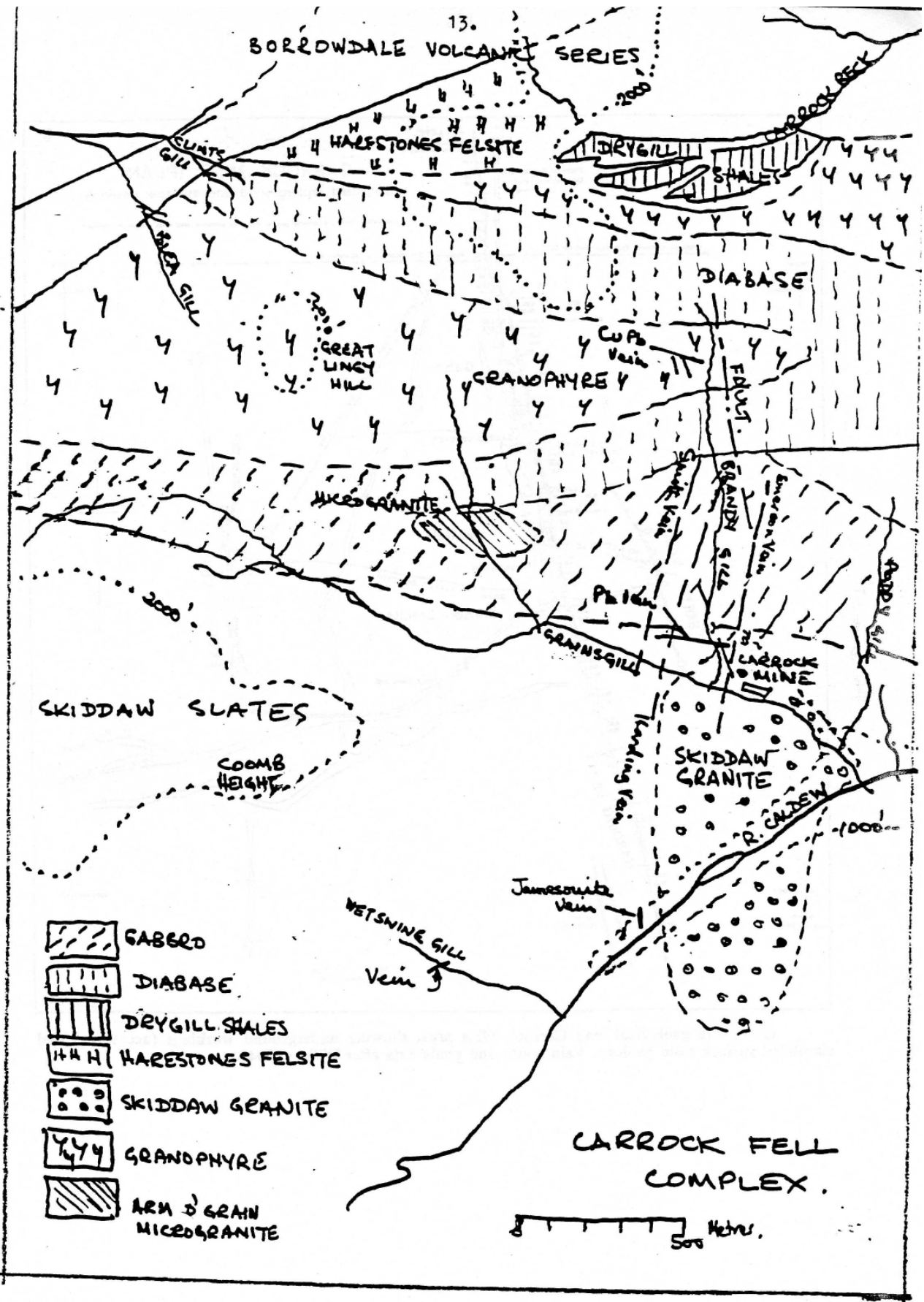


Figure 1: Locality map.

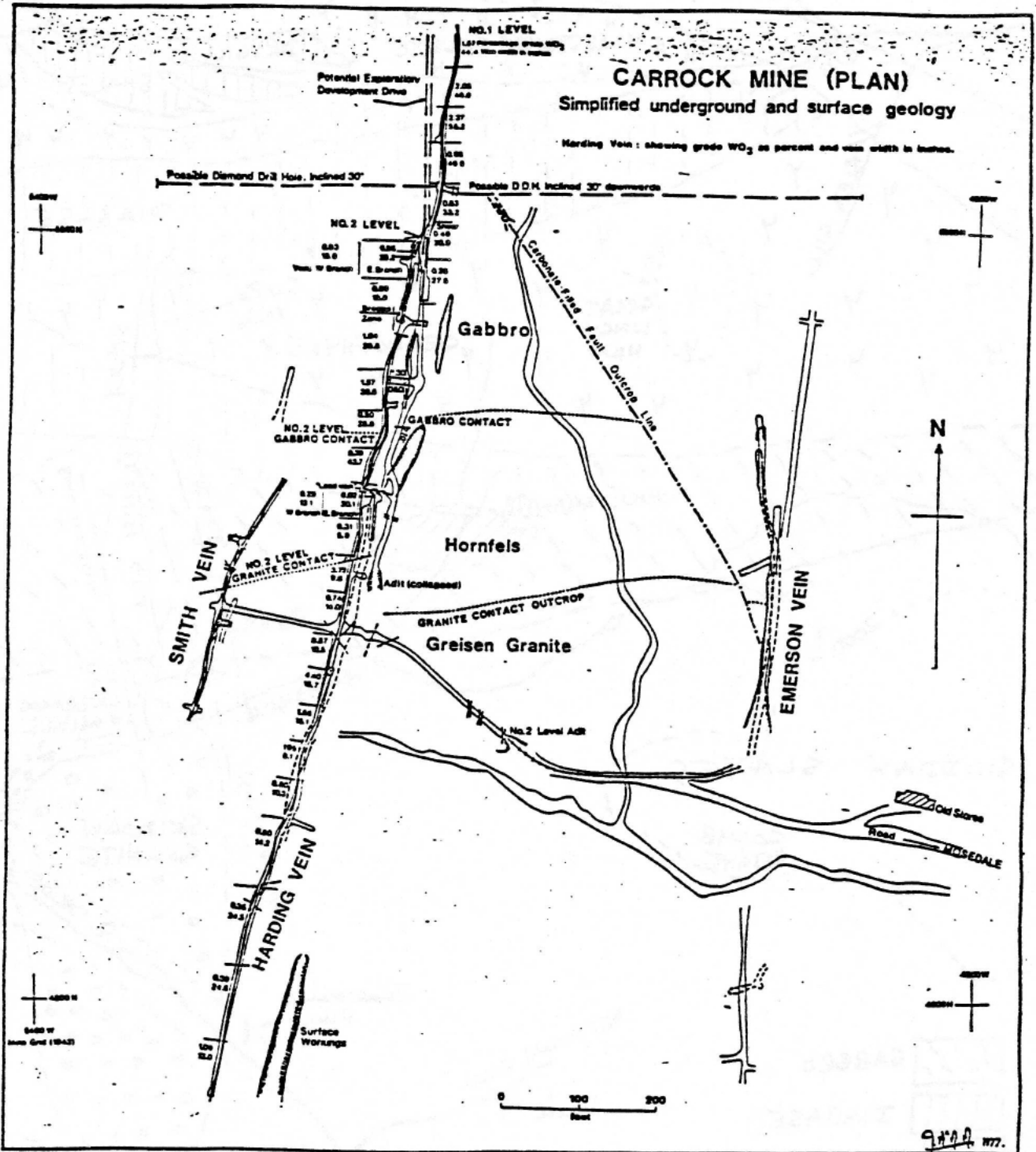


Figure 2: Composite geological map of the Carrock Mine area, showing underground workings (accessible) and simplified surface solid geology. Vein width and grade data after Willson, 1943.

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