# Iron Ore Mines near Bigrigg (NY 002 130) and Moor Row (NY 006 145)



Mervyn Dodd

**Introduction**

The West Cumbrian iron ore field lies between the Lake District National Park and the West Cumbrian coalfield. It covers an area of about 16km x 4km from Lamplugh in the north to Calder Bridge in the south. The ore bodies are largely restricted to the Carboniferous Limestone. Iron mining locally has a long history. The earliest documented mine was working in 1134 and the last deep mine closed in 1980. Quantities of ore produced were very small until 1850 or so. There was little local demand in such a remote district and charcoal smelting of hematite struggled to get temperatures up to the 1538$^{o}$ c melting point of iron.

The Bessemer steel making process of the 1850s, the first to produce steel of a dependable quality economically, changed that. This process required iron ores of a very low phosphorus content which, as it happened, was the case for Cumbrian ores. So Cumbrian ores briefly dominated the market, starting a boom in West Cumbria between 1860 and 1880.

There was massive immigration into "new" settlements with Cleator Moor, Moor Row and Frizington springing up as mining villages. Maximum annual output was around 2.5 million tons. Later changes in technology led to newer steel making processes closer to markets using cheaper, lower grade ores which could be quarried or opencast far more cheaply than ore from the 200-300m deep West Cumbrian hematite mines. A long slow decline in iron mining began after 1890 in West Cumbria. Even so, annual output remained above 1 million tons (minute by present day worldwide standards) until around 1945. The last deep mine (at Beckermet) closed in 1980 when its reserves were small and operating costs high.

This article concerns an area of about 2 to 3km x 1km on the western edge of the iron ore field, between Whitehaven and Egremont (Figure 1). It includes Moor Row and Bigrigg (2 small villages) and the hamlet of Woodend. Production increased during the boom period of the late 19th century though it never reached that of the Cleator Moor area. It always was a marginal district for iron ore mining and consequently it never had Cleator Moor's large scale immigration. Nevertheless it is believed 1,000 to 1,200 men were employed in its mines in the latter half of the 19th century.

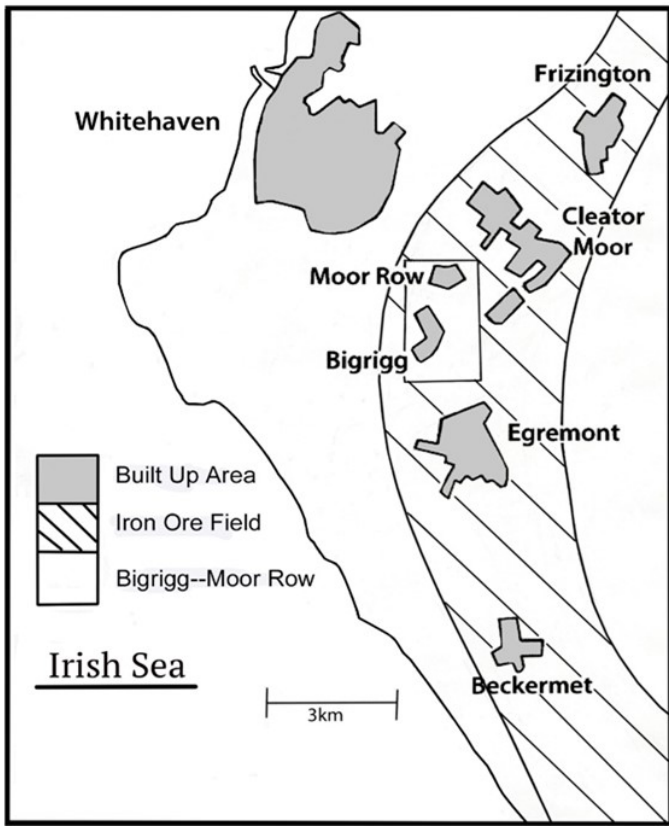



Figure 1 Location of Bigg Rigg and Moor Row

**BigRigg, Moor Row and Woodend**

Bigrigg has a particularly long history of mining iron ore which has been responsible for the many small hollows around the village. It is believed "Acknirby", the first mine of which we have documentary evidence in West Cumbria was just south of Bigrigg, at or near the much later Wyndham Pit close to Langhorn Farm (NY 002 127). Alicia de Rumelli, a member of the family of the first Norman Baron Meschines of Egremont, willed it in the middle of the 12th century to the Cistercian Holme Cultram monastery at present day Abbeytown on the Solway Plain. Figure 2 is a geological cross section of Bigrigg Mine and Wyndham Pit (where "Acknirby" may have been). Bigrigg continued to mine small quantities of ore in the late 17th century and through the 18th century. During the local iron mining boom it produced far more. There was enough of a concentration of manganese minerals such as manganite for exploratory mining of manganese to be carried out in the Bigrigg area in the 1870s.

Bigrigg had its Springfield Terrace, (locally known as "Skid Row"), of 2 up and 2 down miners' houses long after 1860, when it shared in the prosperity of Cleator

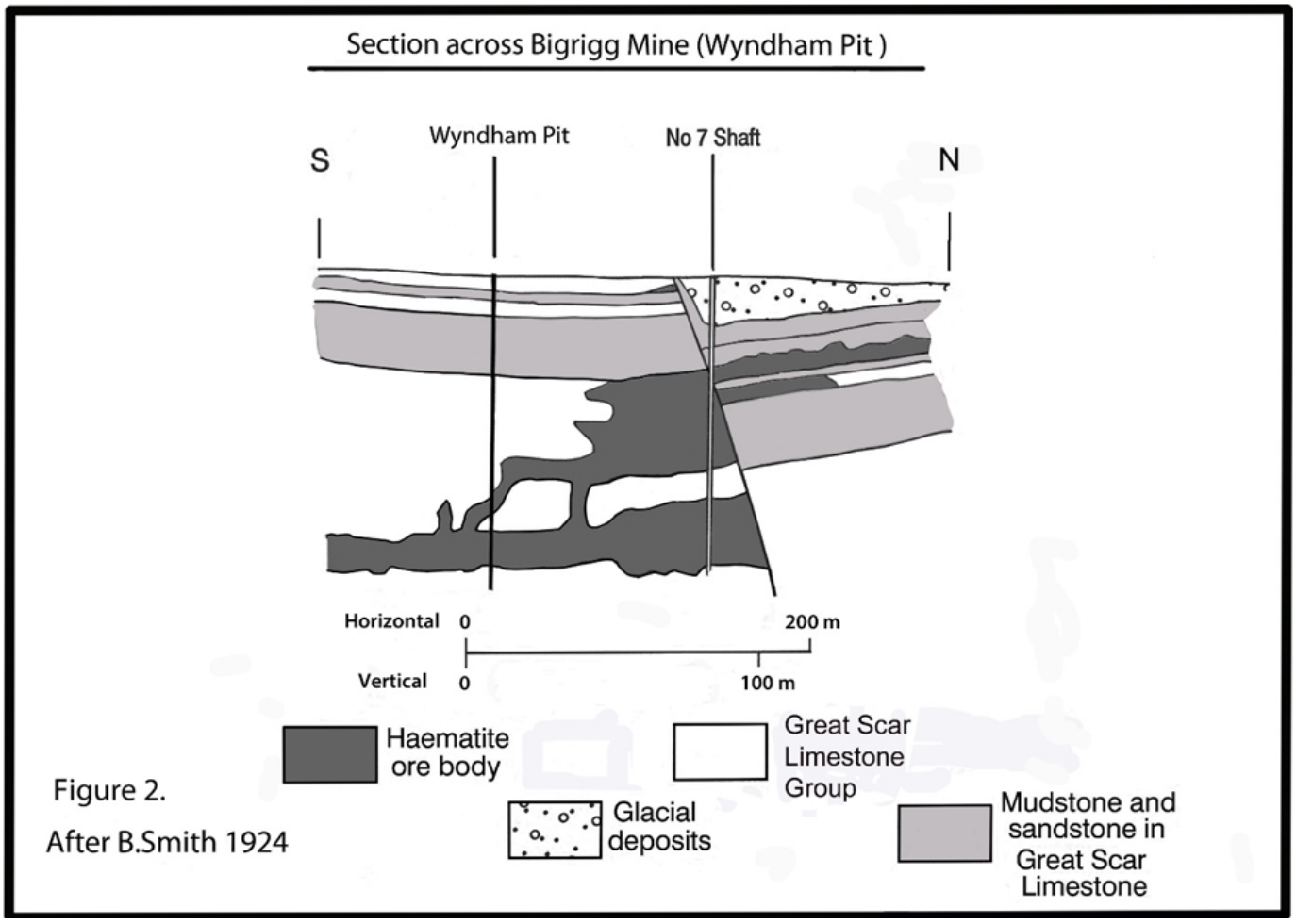



Figure 2 Section across Biggrigg Mine

Moor. Moor Row has in Dalzell Street a terrace of 2 up and 2 down houses dating from 1859. 2 other terraces also in Moor Row have long since been demolished. Names like Penzance Street recall the immigration there of Cornish miners.

**The Geology**

Carboniferous Limestones dip gently (around 7-10 degrees) to the west or southwest and have a narrow outcrop in West Cumbria where they are mainly covered by various Quaternary deposits, particularly till and glacifluvial outwash. The only large local exposure of limestone is in Clints Quarry (NY 008 123). The sequence of limestones in the study area is only about 200m thick. It spans a much shorter time period and is much thinner than in either South or East Cumbria. This is because West Cumbria was then part of the the shallow Ramsey-Whitehaven Ridge in a warm sea, where waters were shallower and less material was deposited. The sequence of the limestone beds around Bigrigg may be as follows, (Table 1). The base of the Limestone sequence, the Seventh, is in the Holkerian substage of the Visean Great Scar Limestone Group. Its top, the First, the youngest, is in the Pendlean substage of the Namurian. The Second to the Sixth Limestones are in the Late Asbian and Brigantian of the Great Scar Limestone Group. The First to Seventh Limestone relate to the order in

| Stage | Substage | Group | Limestone Bed |
|---|---|---|---|
| Namurian | Pendleian | Yoredale (Millstone Grit) | First |
| Visean | Brigantian | Great Scar Limestone | Second to Fourth (Upper) |
| | Late Asbian | | Fourth (Lower) to Sixth |
| | Holkerian | | Seventh |

Table 1 The Carboniferous Limestone sequence in the vicinity of Bigrigg (using the local stratigraphy)

which they occur below the surface in mine boreholes. Each represents a major cycle from deposition in clear warm shallow water to emergence and return. Clints Quarry has very clearly developed shallow water shales and even palaeosols. In the Bigrigg district the hematite does not occur below the base of the Limestones as both the underlying Borrowdale Volcanic Group and Skiddaw Group rocks below are barren. The Limestones are overlain conformably by the Namurian and Westphalian but are separated from the Permian Brockram and the Triassic St Bees Sandstone by an angular unconformity seen in the cross section of the Moss Bay Mine (Figure 3).

The rocks are heavily faulted, but post-mineralization faulting is of little significance. The faults are the conduits along which hematite bearing solutions may have entered the limestones from offshore (Irish Sea) beds of St Bees Sandstone or alternatively from the Eskdale Granite. There are 2 main fault trends in the limestones. One is the pre-Triassic WSW to ENE trending group, called the Coal faults which generally have downthrows to the NW. The other is the group of post Triassic WNW to ESE trending faults which usually downthrow northwards. The Coal Faults often mark the western limit of economic mining of the hematite. The cross sections (Figures 3 and 4) show the effect of some of these faults. Unusually this area does not have the large ore masses in the 4th Limestone that were found at Cleator Moor and Frizington so the local mines did not have any economies of scale. A possible reason is there may have been beds of impermeable shale near Bigrigg above the limestones which the hematite bearing solutions could not penetrate. Thus usually it was wiser and often cheaper to sink boreholes to prove where the hematite was before extending workings underground.

Hematite is an oxide of iron ($Fe_2O_3$) which has formed in oxidizing conditions. The hematite ore has a high percentage of iron by weight, typically around 45-60%. The best ore is compact, massive, hard, brittle and slightly purple or blue. Indifferent quality ore is often soft, clayey and stains red anything in contact. The hematite occurs usually in a massive form. These are of three types, “flats” which follow the bedding of the limestone: “veins”, which are steeply inclined, often following faults; “vugs” which are irregular masses, varying in size and shape. Unfortunately none of these types give rise near Bigrigg/Moor Row to extensive, easily worked deposits.

‘Showy’ kidney and pencil specimens are found in dolomite-rich ore. The most common ‘gangue’ or waste minerals are quartz (5-15% by weight), and calcite. Criss-crossing blades of dolomite occur in much smaller quantities. Dense, tabular barite, sometimes the blue; and occasionally colourless to

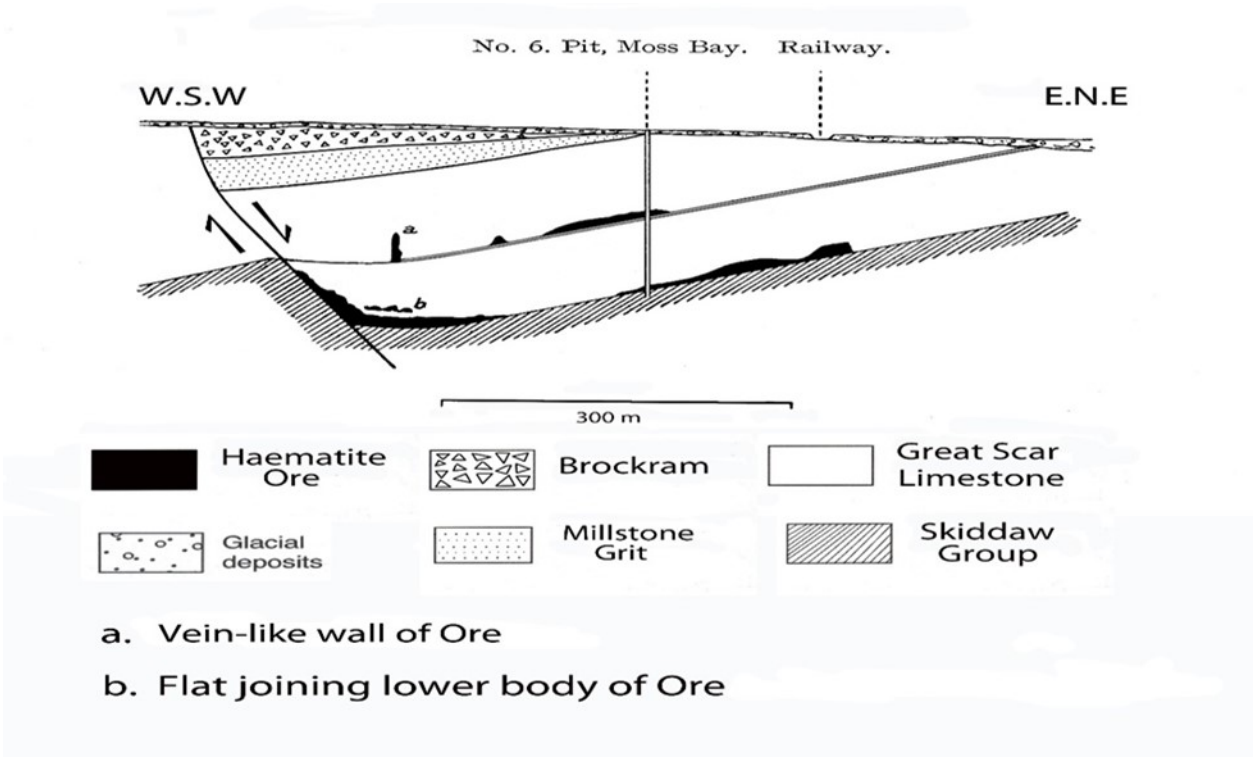



Figure 3 Section across the Sir John Walsh Fault, Moss Bay Mine, after B Smith (1924) figure 13

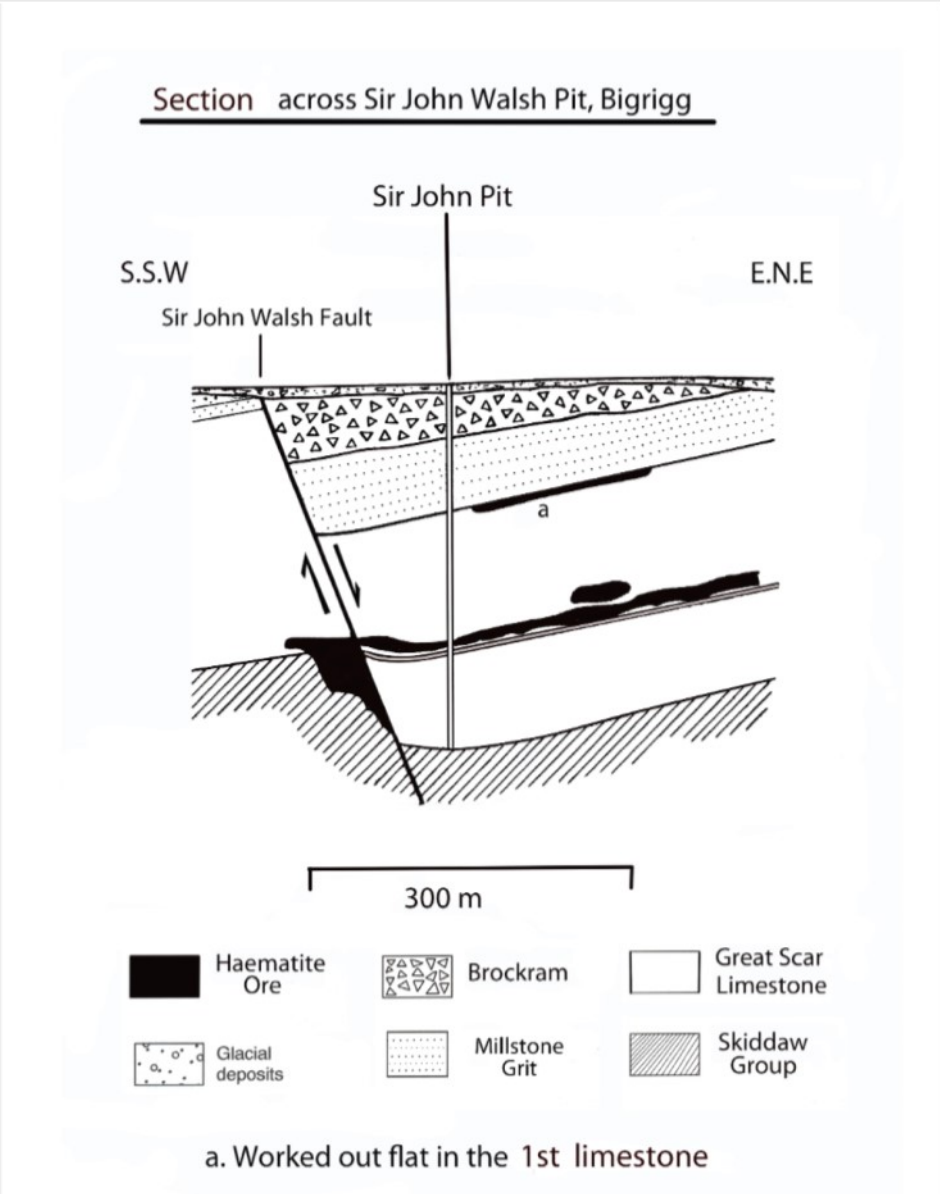



Figure 4 Section across Sir John Walsh Pit, Biggrigg, after B. Smith(1924) figure 11

**The Mines**

Local researchers in the late 20th century, (the Rowbottoms from Moor Row), discovered there had been at least 31 pits in the area between Moor Row, Bigrigg and Woodend. Pits normally have one shaft or an adit (a gently sloping entrance). A mine may have several shafts and adits. Figure 5 is a simplified version of their work, showing the mines referred to in this article. Most of these remains are quite small with the Sir John Walsh Mine the only relatively large one.

The Gutterby mine and Peel pits are representative of the small enterprises that worked hematite close to the surface. These pits were opened relatively early and had short working lives as their small deposits were soon exhausted.

pale blue cubic fluorspar are also found. Specularite, blade like in shape and often black and shiny, is an uncommon crystalline form of hematite which formed in “vugs” - air spaces which allowed crystallization to happen. Very rarely copper/iron pyrites and siderite (iron carbonate] occur. Gangue minerals are also found in vugs. In places the hematite is a direct (molecule by molecule) replacement for the limestone, often preserving sedimentary features like bedding and fossils. This metasomatic replacement is most marked in coarsely crystalline, sparry layers, particularly in the 1st, 4th and 7th Limestone beds. Recently mine explorers have set themselves up as small scale entrepreneurs, selling specimens they have collected from Gutterby and Pallaflat mine (just west of this area). These specimens include various forms of calcite, barite on hematite and fluorspar.

The Gutterby Mine was initially developed by small scale local businessmen like Richard Barker, a Whitehaven soap boiler, about 1825, but the first documented raising of ore was not until 1834. The ore was said to be 3-4m thick in the 2nd Limestone. (Mervyn Dodd remembers descending a ladder in the 1990s for about 6m into the Namurian 1st limestone and seeing flooded workings in the 2nd Limestone below). Later the Lindow family took over the lease, deepening one shaft to install a water box for drainage. Gutterby produced 10,000 tons in 1889 but closed 2 years later, possibly due to exhaustion of the orebody or to a catastrophic drop in the price of ore. There is still a small surface installation there. Recently mine explorers and mineral collectors have posted photos on the Internet, suggesting that workings in places remain accessible and in good condition. The Gutterby Mine (NY 007 137) was close

| Geological System | The main rock formations |
|---|---|
| Pleistocene | Glacial and fluviglacial deposits |
| Unconformity | |
| Triassic | Sherwood Sandstone Gp (St Bees Sandstone Formation) |
| Unconformity | |
| Permian | Brockram (a breccia) |
| Unconformity | |
| Carboniferous | Pennine Coal Measures Gp Yoredale Gp (Millstone Grit) Great Scar Limestone Group |
| Unconformity | |
| Ordovician | Borrowdale Volcanic Group Skiddaw Group |

Table 2 The rock succession around Bigrigg

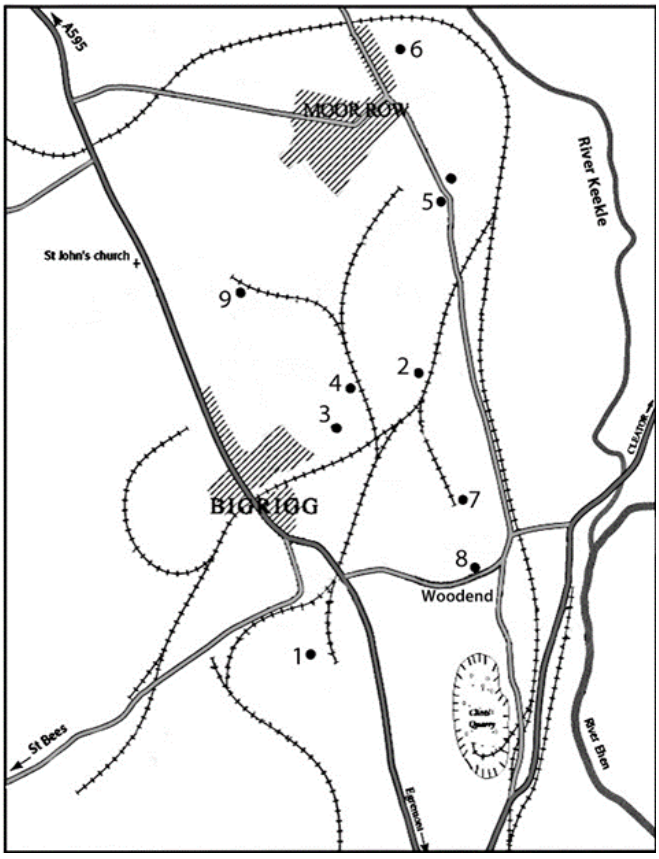



Figure 5 A selection of some of the Iron Ore Mines in the Bigrigg area that are mentioned in the text scale 5cm to 1km

| Mine | Map No. | Grid Ref. | Period of working |
|---|---|---|---|
| Acknirby | 1 | NY 002 127 | Before 1138 to unknown date |
| Gutterby | 2 | NY 007 137 | 1834-1891 |
| Peel pits | 3 | NY 003 134 | After 1860-1914 |
| Fletcher pit | 4 | NY 004 135 | After 1860 -1914 |
| Dalzell | 5 | NY 007 143 | 1880-1925 |
| Montreal pits 8 & 10 | 6 | NY 008 143 | 1882-1925 |
| Moss Bay | 7 | NY 007 132 | 1890-1931 |
| Woodend | 8 | NY 004 129 | 1860-1931 |
| Sir John Walsh | 9 | NY 002 137 | 1882-1939 |

Key to Figure 5 Durham Mining Museum is the main source for these dates.

to where the Biggrigg to Cleator footpath crosses the Moor Row to Woodend road near the site of the red sandstone Gutterby Cottages, occupied between 1690 and 1960.

The Peel Pits are the second group of the small mines. The Peel royalty was originally granted to Anthony Powell of the Plymouth Company from South Wales in 1824 but mining did not begin until 1860, after the lease had been renewed. The Lindows, active at Gutterby, later took over the mine leases. There were at least 2 court cases in the 19th Century concerning safety lapses and quarrels over ownership of these pits. These pits worked small, shallow deposits, a small flat following the bedding of the 2nd Limestone. Pit No 1 still has small remains of surface installations (Figure 6). No 2 pit, which was more productive is now below a wooded tip. Nearby is the fenced off shaft of Fletcher Pit which subsided in 2017. Some of these Mines have been capped as at the Moss Bay pit No 2 (Figure 7). The Peel (NY 003 134) and Fletcher Pits are close to the same footpath



Figure 6 Surface installations remaining at Peel Pit No 1

the workable ore. The ore was the massive hard blue variety with 56-57% metallic iron content, of very good quality but reserves were limited and output per miner was low. The deposit continued to the northeast of the village where it was worked by the Stirling Company (which was so crucial to Cleator Moor), from shallow deposits in Montreal pit No 8 and deeper ones in pit No 10. These pits have quite large tips overlooking the Egremont section of the Whitehaven Cleator and Egremont railway, the main artery for the iron ore trade.

as the Gutterby Mine but about 200m from the A595 at Bigrigg, east of a 1970s housing estate.

The later, rather larger mines date from the boom years of West Cumbria iron mining after the development of the Bessemer steel making process in the 1850s. All were much deeper, up to 300m and focused on the 4th and 6th Limestones. Understandably they needed much larger capital investment, thus the bigger local mining and steel making companies were involved. Three mines illustrate their variety and difficulties, these being the Moor Row (Dalzell) Mine, the Moss Bay Mine at Woodend and the Sir John Walsh Mine near Bigrigg Church.

Thomas Dalzell opened three pits in 1880 near Moor Row, which were almost immediately taken over in 1881 by the Maryport Haematite Iron Company. They worked guts (irregular masses of ore) and steeply sloping veins mainly in the 4th with some in the 3rd Limestone, at depths of up to 130m. In 1924, just before it was abandoned, it employed about 40 men. A Coal fault just west of the village limited the extent of

The Dalzell pits (NY 007 143) were east and southeast of Moor Row village close to the minor road between Moor Row and Woodend.

The Moss Bay Mines, just north of Woodend, were opened in 1890 by the Workington firm, the Moss Bay Company, part of the United Steel Companies, to safeguard their ore supply. In the 1930s the Bigrigg Mining Company worked it on behalf of the Workington firm and was making heavy losses then. Moss Bay Mine's (NY 007 132) No 6 pit, its tips and overgrown surface installation can be seen from a



Figure 7 David Powell standing on the capped Moss Bay Pit No 2



Figure 8 Moss Bay Mine Pit No 6

field gate on the west side of the Moor Row to Woodend Road.

Its ore masses, as shown in the cross section (Figure 3) were not continuous and were expensive to work. They consisted of flats (following the bedding) in the 6th Limestone, the basal limestone locally immediately above barren Skiddaw Group rocks, veins on the downthrown side of the Sir John Walsh Fault and small flats in the 4th Limestone. The photograph (Figure 8) is of pit No 6. At 47% the ore was not high grade but was plentiful and therefore it was economic to work. Production was significant, around 100,000 tons in 1917. It employed up to 380 men in the 1890s. It was a wet mine as it drained the older, shallower Woodend Mine just to the northwest. There has been a recent collapse of the shaft of the small William Pit, a little to the west.

The Sir John Walsh Mine (Figure 4) is difficult to access. Interesting remains there include winding gear attachments, a substantial red sandstone retaining wall and a tall narrow tip seemingly little changed since the mine was abandoned between 1936 and 1939, the last of the mines to close in this area. At that time it drained all the workings in the area.

Permian Brockrams and the St Bees Sandstone overlie the limestones unconformably here. The mine worked three separate ore bodies, a quickly exhausted flat in the 1st Limestone, major flats in the 4th Limestone and a small vein like body on the downthrown side of the SSW-NNE trending post-Triassic Sir John Walsh Fault at depths of almost 300m. Its workings to the northwest are limited by the St John's Church Coal Fault (Not to be confused with the Sir John Walsh Fault). To the west of this fault the hematite is too deep to be economic to work. These ore bodies are shown on the cross section (Figure 4). This mine employed 300 men in 1929 and produced 80,000 tons in 1923, a year when trade was not good.

Unusually the mine was worked by the Leconfield Estate, the royalty owners, through its Bigrigg Mining Company, as normally royalty owners employed mining firms to take the financial risks. An illustration of this is the 21 year lease at Moor Row offered to the Moss Bay Haematite Iron and Steel Company by Baron Ormathwaite, from 1st January 1924 (the Moss Bay Haematite Iron and Steel Company acted as agents for the United Steel Companies in negotiations with the Leconfield Estate through its Biggrigg Mining Company). An annual rent of £500 (£300,000 in present day prices) was charged besides a royalty of 1/8 of the selling price per ton mined, besides a wayleave on any ore crossing the leased area and a charge on every ton of ore brought to the surface, a supplementary charge on any ore over 50% iron content, an annual ground rent and charges for each borehole drilled.

In the event the Biggrigg Mining Company did not develop the area to be leased as 1924 began years of very poor trade in the iron and steel industry. In the 1990s there was a major subsidence which made

recapping of the shaft necessary. Fortunately there were no fatalities as there were no settlements nearby.

Sir John Walsh Mine (NY 002 137) is close to a footpath from A595 near Bigrigg Church to Moor Row but a barbed wire fence makes it difficult to approach.

**Conclusion**

Patchy and unpredictable geology prevented the Bigrigg/Moor Row/Woodend area becoming a large producer of ore but local entrepreneurs made the best of their opportunities until the 1930s, in Bigrigg before the Industrial Revolution and in the boom years around all 3 settlements. Scars due to mining are not so obvious now as Nature has largely hidden the damage and the ugly, hurriedly built terrace houses put up to accommodate incoming miners have largely been demolished. The local communities still remember that mines are dangerous. Accidents in ore mines usually affected far fewer than in coal pits as there was rarely a problem with gas or fire, 5 men at most were involved in individual accidents. Lists show us that at Sir John Walsh Mine 13 men died underground between 1859 and 1904. Almost all died when the mine roof collapsed without warning, as the hematite was brittle and unpredictable in its behaviour. The risks were accepted due to the absence of alternative work for the large number of men employed in the mines. Sadly there were hardly any jobs for women then to supplement family income.

**Acknowledgements**

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**References**

Akhurst et al, (1997). Geology of the west Cumbria district. Memoir *British Geological Survey*

Banks D, (1991). West Cumbria Mines Research Group, Review No 9

Crowley S. F. et al, (2014). Palaeomagnetic evidence for the age of the Cumbrian and Manx hematites. *Journal of The Geological Society,* 171.

Crowley S. F., (2015). Towards an integrated model for hematite mineralization at the margins of the East Irish Sea Basin. *Proceedings of the Cumberland Geological Society,* Volume 8, part 3

Dodd M et al, (2010). The story of Iron Ore mining in West Cumbria. Cumberland Geological Society.

Dunham K C, 1984. The genesis of the Cumbrian hematite deposits. *Proceedings of the Yorkshire Geological Society*, Volume 45.

Eastwood C et al, 1931. The Geology of the Whitehaven and Workington District. *Memoir of the Geological Survey,* Sheet 28.

Kelly D, 1993.The Red Hills, *Red Earth Publications*.

Johnson W. H., (1939). Survey of the iron ore resources of West Cumberland. *Cumberland Development Council Ltd.*

Leconfield Estate papers, 1924. Held in Cumbria County Archives, Whitehaven

Powell et al, 2014. (unpublished excursion handout) Iron ore mines around Bigrigg.

Rowbottom R. & L., (Undated) List of iron Ore Mine Shafts. *Friends of Whitehaven Museum.*

Shepherd T. J. et al, (1993). Cumbrian hematite deposits, North West England, Mineralization of the British Isles.

Smith B, (1924). Iron ores: hematites of West Cumberland and the Lake District. Special report on the Mineral Resources of Great Britain. *Memoir Geological Survey.* Volume 8

Trotter F. M., (1945). The origin of the west Cumbrian hematites. *Geological Magazine*. Volume 69.

Jack Soper, Ian Kelly (Quarries Manager, Burlington Stone Ltd.), Clive Boulter .

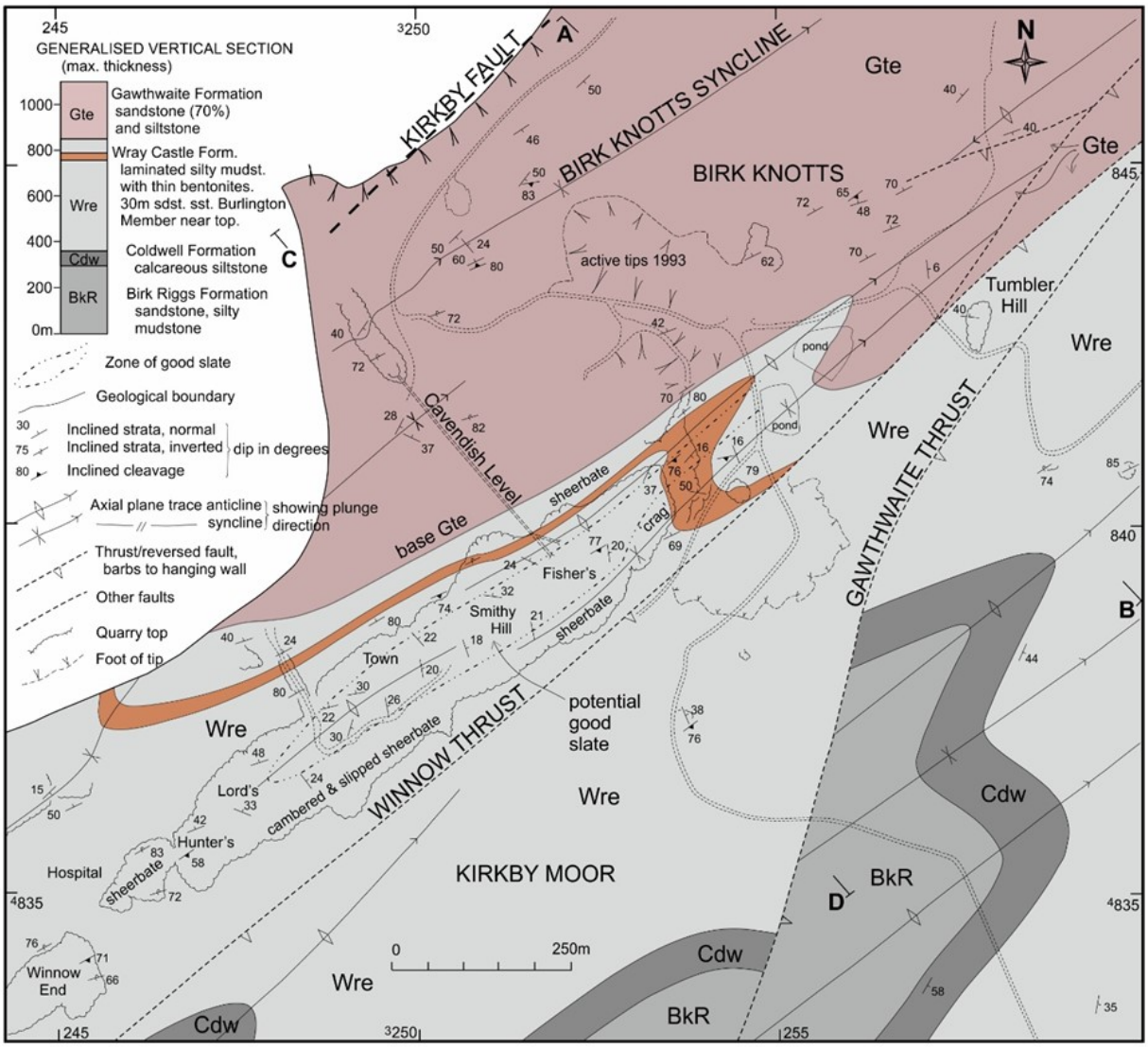



Figure 1 Geological Map of the Kirkby Moor Quarry

Slate has been used since Roman times for roofing and flooring and has long been exploited in the Kirkby Moor district. There are numerous trials and abandoned quarries in the area of map sheet SD28 but the main slate quarries in this district are situated to the north-east of Kirkby-in-Furness. The quarries on Kirkby Moor remain the most productive in England and are worked by Burlington Slate, the first commercially established slate company, founded in 1843. Slates not used locally were shipped out by sea but construction of the railway in 1846 began the major productive period, which lasted until the second world war. Production peaked in 1900 when Burlington Slate produced 8100 tonnes of roofing slate, but thereafter production gradually declined (Stephens Associates, 1988). The declining demand for roofing slate during the 20th century has in part been offset by a more recent growth in demand for monumental and architectural purposes; much of this slate is now exported. There is also a demand for random walling stone which is met by the trimmings from sawn blocks. In 1990, Burlington Slate produced some 5000 tonnes of roofing slate, most of which was the 'blue-grey' type from Kirkby Quarry, and 2000 tonnes of structural and architectural products; the latter were predominantly 'green slates' from the Borrowdale Volcanic Group. Current extraction rates of saleable materials at Kirkby Quarry are typically in the region of 100,000 tonnes per annum and can be categorised as follows:

- Slate sales – 3,300 tonnes per annum
- Stone (tiles) sales – 1,000 tonnes per annum
- Aggregates (combined landscaping and construction) sales – 79,000 tonnes per annum
- Others (walling, paving, off-cuts, lintels and waste) sales – 16,700 tonnes per annum