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THE ROTHWELL HAIGH COLLIERIES NEAR LEEDS: ADDITIONAL NOTES ON THEIR DEVELOPMENT, TECHNOLOGY AND SOCIAL CONNOTATIONS

By John Goodchild

INTRODUCTION

The present writer's book, the Coal Kings of Yorkshire, was published in 1978 and was a study of the story and significances of the coal-based industrial empires of the successive but overlapping dynasties of the Fenton and Charlesworth families from the early eighteenth century until coal nationalisation in 1947. Those empires were Yorkshire based but spread over numbers of other English and Welsh counties and were concerned also with a variety of interests other than coal. The book recognised that further information was likely to come to light and the author has recently acquired a large collection of papers of the Yorkshire estates of the Lords Mowbray and Stourton, which throw much additional light on the development, technology and social connotations of their property at Rothwell Haigh, near Leeds, on which the Fentons and Charlesworths as lessees successively developed respectively their first large scale colliery and their other associated interests. The new material is of such a nature as to warrant a study in its own right but one which may also usefully be taken in association with the information in the Coal Kings' study of 1978. The information in this present work is derived wholly from material in the John Goodchild Collection in Wakefield.

LOCATION AND HISTORY

Rothwell Haigh lies between the south-eastern outskirts of Leeds and the village of Rothwell and was crossed anciently by the Leeds to Wakefield road (now the A61) in the west and the Leeds to Pontefract Road at the north. It is now also crossed by motorways. Today, a part remains as farmland and elsewhere has been built upon for housing or industrial units. The Haigh had been a medieval hunting park, surrounded by a pale and ditch and know as Rothwell Park or Rothwell Haigh Park. What remained in the 1780s was described as an *'Open Tract of Land or Parcel of Uninclosed Ground'* of some 289 acres, where a number of the freeholders and copyholders in the townships of Rothwell Parish (known as 'The King's Tenants') had the right to pasture horses and cattle from mid-May to mid-October subject to a small payment to the lord. At least part of the Haigh was quite wild and in 1780 proceedings were taken against several men for burning whins there, presumably to make potash for soap or glass making.

Proposals were made in 1782 to enclose this wilder part of the Haigh and the adjoining farmed area and by 1785 an agreement was reached between Lord Stourton and the tenants whereby 305 acres of surface land would be allotted to the tenants as owners, six acres for a sand gravel or stone quarry for the highway maintenance of the hamlets of the parish and the remaining 215½ acres would become Stourton's. He would also, as lord of the manor retain the mineral rights of the whole and would pay compensation for any damage caused in working the mines. An Act of Parliament was passed in

1785 to legalise the agreement. It is unclear as to whether the enclosure was primarily effected to allow coal mining but the allocation of the land to its new owners certainly coincided with new shaft sinkings on the largely waterless plateau of the Haigh, as in 1846 an old man recalled two shafts being sunk. This is borne out by the first coal rents there being paid in the half year to November 1787.

EARLY LEASES

An examination of the history and effects of coal mining on the estate, successively in the ownership of the Duke of Norfolk and the Lords Stourton, must consider a number of disparate but interconnected aspects. The working of coal by the Fentons and then by the Charlesworths was carried out from 1717 at least by means of formal leases, the provisions of which varied and changed. The depths and nature of the regional transport situation altered, new and changing coal markets were served, the uses of coal developed as did housing, social provisions, the labour market and the abilities required of management. In all the whole situation was altered in its internal and external relationships.

Coal had probably been worked in the extensive Parish of Rothwell in Roman times; in late medieval times and subsequently the growing numbers of references to coal mining suggest increasingly extensive working such that by 1717 three years remained of a coal lease of unknown length under which Mr Fenton and Mr Brook had a lease of a colliery in what was to become the Stourton estate at a substantial rent of £50 per year and a lease of some 63 acres of land with about 17 years of the land lease remaining. By ca. 1600 there were a number of manorial customs relating to coal working at Rothwell and a number of leases of surface land for the years 1661-1671 on Rothwell Haigh survive and allude to the tenants' obligation to carry coal for the landlord's use. Coal was also worked in the neighbouring townships but no other reference to such manorial customs is known.

The earliest surviving coal lease for Rothwell Haigh is dated at the end of 1768. The lessor was the 9th Duke of Norfolk, from whose mother the Rothwell Haigh and Roundhay estates derived and who held the title from 1732 until his death in 1777, childless at the age of 91. The lease was granted to William and Thomas Fenton, gentlemen and was a new lease for 21 years at £500 per year and was in lieu of one expiring in 1774. Exploitation was limited by a maximum permitted employment of 26 pitmen or master getters and by limiting to 12 working hours in 24. In 1778 this lease was replaced by one which has not survived in the original but, from other papers which refer to it, was for a further 21 years from November 1777 and was for the Upper and Lower Beds at a minimum rent of £2,600 per year. The acreages were specified and excess rents would be charged beyond these – as occurred in subsequent leases. This lease, signed in 1778, brought into the control of the Fentons the coal resources of the higher part of Rothwell Haigh, where working had begun by 1781 and which demanded the services of a Boulton and Watt steam pumping engine. The lease expired in November 1798 and from then a further 21 year lease was agreed, now with Thomas Fenton alone, although provision was made for his son William to take over in the event of his inability to continue.

MR POPE'S POTS AND THE RAPID SMELTING OF LAKE DISTRICT COPPER AND LEAD ORES – 1579-83

By Richard Smith

INTRODUCTION

The introduction of German miners into the English Lake District during the reign of Queen Elizabeth I (in 1563) has been described in detail by Collingwood[1] and Donald.[2] They brought with them their own techniques of mining and smelting and a coherent company structure which enabled the considerable project to proceed. Although continually beset by cash-flow problems, the enterprise could never be considered an unqualified success. Nevertheless, it did establish a copper, lead and silver mining industry which continued under the descendents of the original manager, Daniel Hechstetter, until 1630. Thereafter, copper mining continued, with some interruptions, at most of the main sites until the end of the nineteenth century.

THE SMELTING PROCESS AT KESWICK

Although the main shareholding was by Haug & Co. of Augsburg, most of the miners came from the town of Schwaz and the Rauritz valley in the Austrian Tyrol. Their methods of smelting copper sulphide ores and of extracting silver remained in use until the mid-nineteenth century albeit with some improvements in the scale of operation.[3] These methods have been reviewed in detail by Smith.[4] Very briefly, they relied on repeated roasting and smelting to produce a matte and slag. Sulphur was eliminated during the many roasting stages according to reactions of the type:

$$2CuFeS_2 + 3O_2 = 2CuS + 2FeO + 2SO_2$$

Iron was removed into slag during smelting by reaction with silica:

$$2FeO + SiO_2 = FeO.SiO_2$$

Copper remained as a separate matte layer after smelting (CuS together with some Cu_2S) and was then oxidised further in subsequent roasts:

$$CuS + O_2 = Cu + SO_2$$
$$CuS + 2O_2 = CuSO_4$$
$$2CuS + 3O_2 = 2CuO + SO_2$$

The product depends on the redox conditions of the roast and on temperature.

The descriptions of the roasting and smelting process in Hechstetter's diary[5] indicate that they followed the Tyrolean process described above, with an abridged method of extracting silver.[4] It took about 6-10 weeks to obtain marketable copper from the Lakeland ores and the reasons for this are plain in Agricola[6] and Ercker's[7] books. Although smelting was relatively fast in the small single-tuyere blast furnaces which they used, roasting took several days and even then was very incomplete. Ore and matte was roasted in great lumps about 150 mm in diameter on slow burning bonfires of wood or peat. Large pieces were necessary to prevent material from falling through the fire to the reducing conditions beneath. Oxidation of sulphides took place, mainly on the surface of the piece, although there is some evidence from later practice that some migration of molten copper sulphide towards the centre of the piece took place.[8] Roasting was therefore inefficient, difficult to control and slow. It was normal for a roast to require

A—Heap of cupriferous stones. B—Kindled heap. C—Stones being taken to the beds of faggots.

Figure 1. Heap roasting of copper ores or matte by the traditional method on an open fire.[6]

five fires of thirty hours each. This would be followed by smelting in a short blast furnace. Matte from the furnace would then be roasted again. In all three or four roast/smelt cycles would be needed to produce black copper which could then be refined.

The long smelting process impacted very much on the cash-flow of the operation. Considerable amounts of ore and smelting intermediates were tied up as 'work in progress' resulting in long delays in the return of funds needed for the development of the mines. An improved method of smelting was much needed and a number of investigations into this were carried out during and after 1580.

EXPERIMENTS AT QUEENSBOROUGH

Fully aware of the need to generate cash to meet the demands of the mining enterprise, Daniel Hechstetter looked around for an alternative smelting process which would reduce the long lead time in producing copper.

At the same time, the state was showing great interest in processes for the production of the raw materials essential for the manufacture of gunpowder. In 1576 letters patent were granted to Messrs. Waad and Mekins (alias Pope) for the manufacture of oil and brimstone[9] and the following year Cornelius Stephinson set up an operation for the manufacture of saltpetre in the New Forest with another proposal put forward by Leonard Englebrecht.[10] In 1583, Pope wrote to Sir Francis Walsingham, Governor of the Society of Mines Royal, describing how he had successfully made saltpetre at Fulstone from minerals he had found in the cliff and how he hoped to make a ton of saltpetre by midsummer.[11]

Henry Pope was born in Cleveland and came over to England in 1540 in the same year as Anne of Cleves came over to marry King Henry VIII. He lived in the parish of St

THE INVERNESS GOLD

By R.M. Callender

INTRODUCTION

As 1868 was ending, Robert Nelson Gilchrist discovered gold in the Strath of Kildonan, near Helmsdale in Scotland's northerly county, Sutherland. In spite of the winter weather, when the news spread throughout the region, adventurers made their way to Kildonan. This was the beginning of a gold rush, which attracted men from all parts of the United Kingdom and lasted until the Duke of Sutherland put an end to prospecting on 31 December 1869.

During the twelve months of activity, over 600 gold miners staked their claims and created a small township, which earned the name Gaelic name 'Baile an Or', meaning Town of Gold. Most of the miners relied on panning to recover their gold, but when men on leave from the goldfields of California and Australia took part, they introduced rockers and long toms to improve the throughput of gold-bearing gravel.

It cost one pound for a licence to prospect and secure an area forty feet square by the banks of the Kildonan Burn or the Suisgill Burn, but by working in teams of two, three or four, some men were able to retrieve more than an ounce of gold, which had a value of £3.50 to £4 at the time. Some gold was converted to jewellery and retained as keepsakes, some had to be sold out of necessity to the dealers who came to Baile an Or on regular visits, and some was retained for the miners' families. For this reason, the total quantity found during will never be known, even although the local newspapers frequently published estimates based on conjecture and interviews with the miners.

The full story of the events in the Strath of Kildonan during the year of 1869 appears in the monograph, The Scottish Gold Rush of 1869, published in 2008.[1]

PART 1 : THE 19TH CENTURY

Not to be outdone by the gold rush which was ending in the Strath of Kildonan (Sutherland), on 16 December 1869, The Inverness Courier announced a recent discovery of gold near Inverness.[2]

The preliminary notice[3] was followed by a lengthy account one week later, which disclosed that *'the existence of gold in the county of Inverness was known to one person a month or two ago'*. The newspaper's correspondent had established that a young man with considerable experience gained during the gold rush at Kildonan, had tried his fortune in the local streams and eventually found the yellow metal in the River Nairn. At first, Alexander Simon Fraser had kept quiet about his good fortune because he was employed by Mr Macintosh of Raigmore and knew that he had to obtain permission from the proprietor of the stream before he could carry on any further operations. Once he had secured the requisite approval, he revealed his story because *'in this cold,*

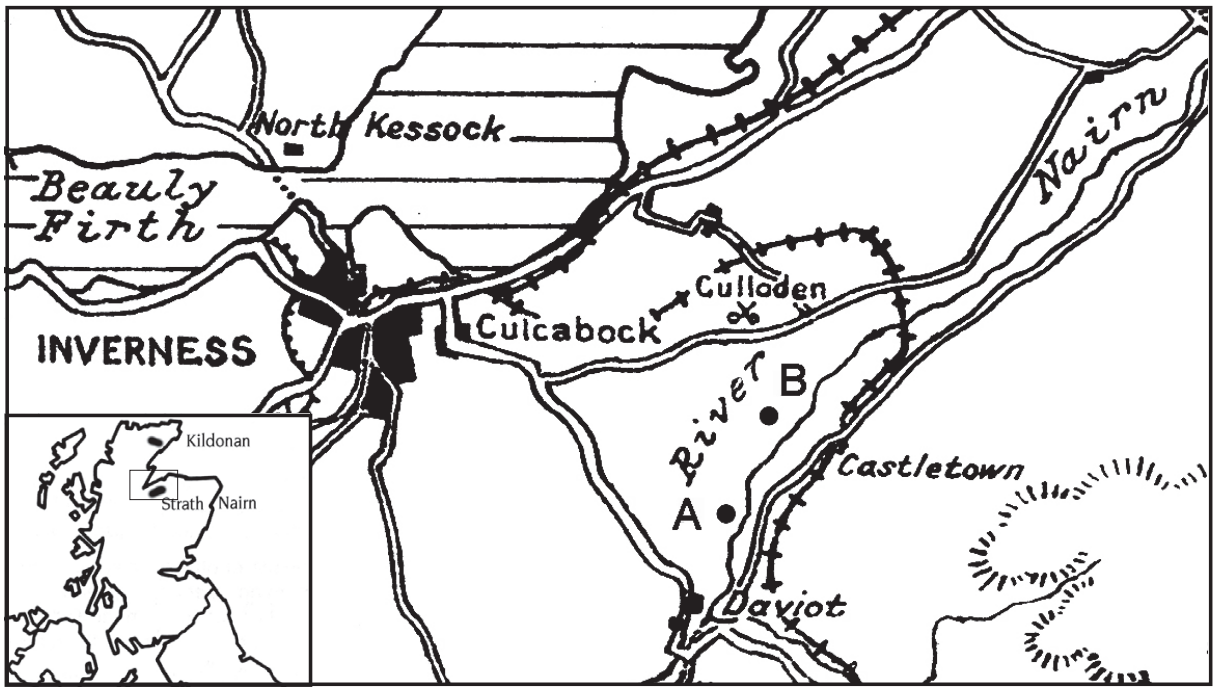

*Figure 1. The gold-producing section of the river Nairn in Inverness-shire. Note Culcabock on the edge of Inverness, and **A** the House of Daviot, and **B** Nairnside, places which feature in the 19th century texts. A farm, The Mains of Daltulich, is very close to Castletown.*

frosty weather it is impossible to work ... the digger has no inducement to undergo the hardships of exposure in a severe winter'.

The landowner had strictly prohibited an indiscriminate search but agreed to take steps to ascertain whether gold existed in sufficient quantities to pay the working. Everyone expected the landowner to make a proper investigation and evaluate the discovery in the spring, but in the meantime, he introduced a licence system for *'properly qualified persons'*, who would be engaged to prospect and test the discovery. The previous year, The Inverness Courier had carried many informative reports on the activities at Kildonan but now confidently predicted there would be *'no recurrence of the excitement, which prevailed when the Sutherland diggings were opened.'* The reasoning was to the point, *'Most people interested in the work have learned by this time that the occupation of a digger is one of the most tedious and laborious which it is possible to adopt, while the returns very frequently do not yield any fair remuneration for the labour expended.'* [3]

Respecting the need for a degree of confidentiality concerning the location, the description simply stated, *'the discovery was made in the parish of Daviot'*. However, an important Inverness jeweller, Mr Ferguson of Union Street, received permission to explore the area and the Courier's correspondent received an invitation to accompany him. Near the hamlet of Craggie, the gentlemen met up with the gold prospector Alex Fraser, who took them to *'a quiet glen, sheltered and protected by high hills, and watered by the river Nairn and a number of mountain torrents. There are several comfortable farm-steadings in the district and a few handsome mansion-houses'*. The Courier's

TRACING THE TRACES

By R.M. Callender

INTRODUCTION

As the evidence of the great gold rushes of the 19th century disappears from view, the author has made a point of visiting many of the locations in an endeavour to substantiate his reading and, in the process, to bring a different slant to his investigations. Too often, there is little to see but by dint of enquiries, talking to people and using some native wit, he has been able to develop a personal collection of photographs and souvenirs, which supplement the historical background.

CALIFORNIA

Any serious study of gold discovery has to start in California. In the place now known as Sacramento, William Sutter of Switzerland built a fort (which still survives) and relied on supplies of timber from his water-powered sawmill on the American River at Coloma, which is about 30 miles further east. The wheel race continually jammed and investigation showed that chunks of gold were blocking the mechanism. Fearful for his regular supplies of wood, Sutter advised his man at Coloma to keep the discovery quiet, but when news leaked out, the stampede began and to this day, California benefits from its advantageous start in life.

Nowadays Coloma is a huge national park, which commemorates both the find in 1848 and James Marshall, with a huge statue of him pointing to the spot where he discovered the gold. The park still boasts a sawmill as well as a church, museum and 19th century buildings; volunteers in period clothes create an atmosphere which is very authentic. A day in the James Marshall Gold Discovery Park in Coloma provides a concentrated briefing for exploring the rest of the state. The park service also preserves Bodie, a deserted gold rush township in the Sierra Nevada Mountains. One initiative, for example, has linked all the roads, south to north, which are associated with the gold rush of 1849. By following Route 49, it is easy to choose the towns worth a visit or to pass through the ones with evocative names: Rough & Ready, Jenny Lind, Murphys, Old Hangtown, El Dorado, Drytown, Fiddle Town, Yankee Jim's, Angel's Camp and Prairie City.

Auburn in Placer County is in the very heart of the gold rush country and honours Claude Chana, who found gold here in May 1848, when the place was called North Fork (of the American River). His statue takes the form of a kneeling prospector and, nearby, there is a similar tribute dedicated to the Chinese who provided valuable labour and services.

To augment the informative maps, the state has conscientiously maintained 'historical landmarks' in every county, from Alameda to Yuba and uses a special symbol for 'the gold rush related landmarks'. In this way, it is easy to find obscure locations, and although there may not be much to see, there is always an informative plaque, and an opportunity for a photograph.

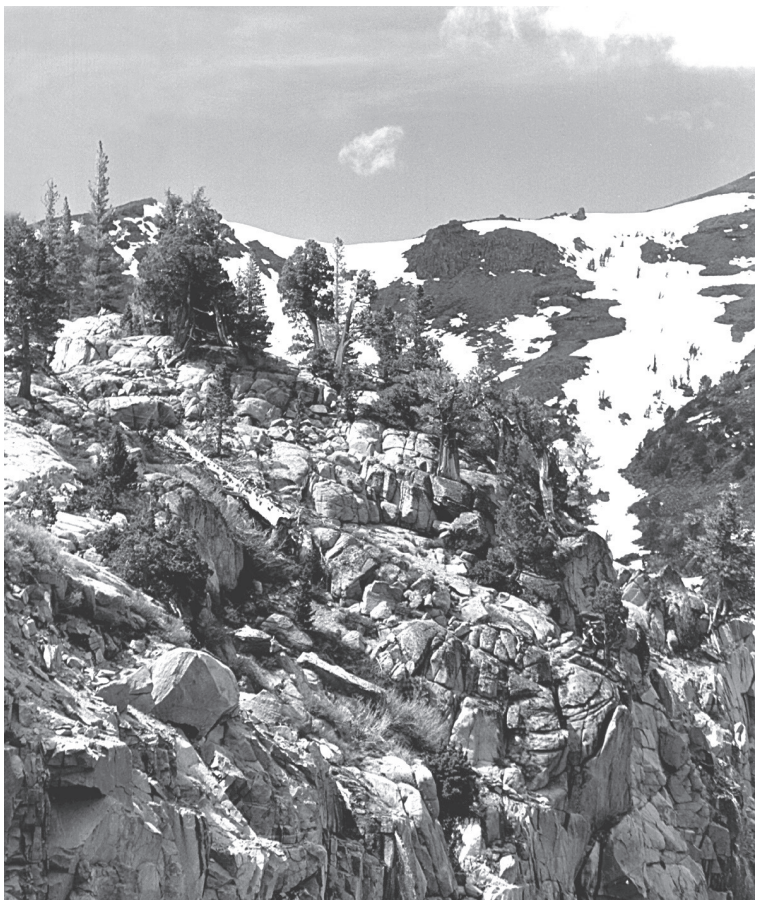

Figure 1 (left). To reach California, the pioneers faced one final obstacle, which entailed crossing the Sierra Nevada mountains, where they had to make tripods for hauling their wagons and animals up the steep snow-covered slopes, piece by piece.

Figure 2 (below). On the Emigrant Trail, El Dorado County. The inscription reads: 'When the Mormon Battalion camped here they noticed arrows and a newly-made mound. It contained the mutilated bodies of three friends and after reburial, the men built a cairn. They also found 'Allen's gold pouch, filled with gold dust' which they passed on to his widow in Iowa'.

The gold rush was an east to west migration and by deduction, other significant locations can be tracked down. Wagon trains needed to tackle the Sierra Nevada mountains and then determine their best descent into California. At the summit, the snow lingers until June but at the foot of the mountains, Hope Valley still provides a grassy meadow and a welcome respite for all travellers. In 1849, it was news from the goldfields or the shrewdness of the guides which influenced the decisions.

THE DYLIFFE AND DYNGWM MINES, POWYS, WALES A REVISION OF LODE GEOMETRY AND THE SIGNIFICANCE OF LODE INTERFERENCE WITH PRE-EXISTING JOINTS

By David M. D. James

SUMMARY

Surface geological mapping, combined with surveys of all accessible adits and integration of the results with the mine plans have resulted in locally substantial modifications to previous maps of lode geometry, notably in the nature and location of the junction of the Castle/Esgairgaled Lode System with the Dyliffe and the Llechwedd Du Lodes, the easterly extents of the lode systems beyond the main Dylife workings and the workings at Cafartha Castle. Detailed plans of key adit control are given. Lode geometry is locally appreciably more angular than previously shown and this is ascribed to interference of the lodes with the regional a-c joint system, the mechanics and significance of which is briefly discussed. It is suggested that progressive unroofing and episodic fracture of fluid seals by joint development was responsible for the distinct sequence of early mineral assemblages.

INTRODUCTION

The Dylife mines are amongst the most famous and successful in the Central Wales Orefield, despite their remote location far removed from the principal centres of production in Cardiganshire (Figure 1). The association with mid-Victorian social reformers Cobden and Bright, the first use in the orefield of colliery-style winding cages and the operations of the gigantic 63ft Red Wheel (the largest waterwheel erected in Mid-Wales) have stimulated extensive research on industrial archaeology and mining history which will ever be associated with the late David Bick.[1,2,3] The nearby Dyfngwm mines which share two of the three principal lode systems at Dylife are, by contrast, notorious for their mid-Victorian mismanagement and were the site of short-lived unsuccessful re-opening by Hirnant Minerals Ltd. in the 1930s.[2,4] Between the magnificently exposed lode at Castle Rock in the upper reaches of Afon Clywedog and the spectacular 'hanging valley' and gorge of Afon Twymyn, a distance of about 3.5 kilometres, the hills are riddled with workings and trials of which most are still visible and many still accessible. The principal workings in this area, at Pencerrig, Esgairgaled, Llechwedd Du and Pen Dylife in the Dylife sett and Castle Rock, Cafartha Castle and Dyfngwm in the Dyfngwm sett, are herein respectively termed the Dylife and the Dyfngwm mines. As so often in mid-Wales, knowledge of the geological setting and the lode geometry at the mines is, even today, based on the work of O.T.Jones carried out during the first World War and published in 1922.[5]

Recent work by Brown has not only considerably augmented the previous socio-historical studies but revealed and made accessible several adits either unknown to Jones or not fully utilised in his mapping.[6,7] This new subsurface control has warranted

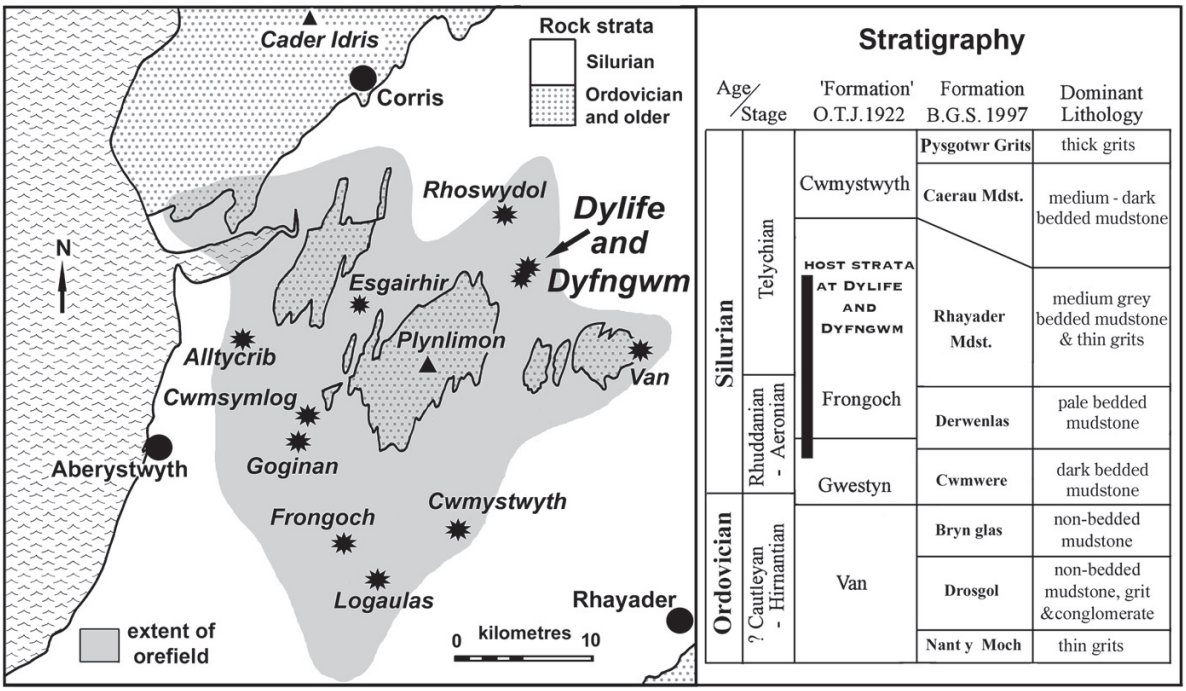

Figure 1. Location map and host stratigraphy for the Dylife and Dyfngwm mines within the Central Wales Orefield. Also shown are a selection of other historically important mines.

a complete remapping of the Dylife and Dyfngwm mines and, for the first time, allowed the integration of such data with the mine plans which, inexplicably, were not available to Jones. The geological mapping has been carried into a sufficiently large surrounding area to allow full appreciation of the structural setting, again for the first time. The objectives of this paper are hence twofold; to present and justify the new mapping utilising new surveys of key adits and to briefly discuss the implications of the conclusion that lode geometry was influenced powerfully by interaction of lodes with the pre-existing regional joint system which is particularly well developed in this area.

The mines were worked almost exclusively for lead and appreciable reserves of zinc ore were left standing. Since returns began in 1835, Dylife produced 36,684 tons of lead concentrates with 2,571 tons in 1862 as its best year; analogous figures for Dyfngwm are 4,930 tons and 541 tons, again in 1862.1 When abandoned both mines reportedly still had good runs of lead ore; below 125 fathoms (fm) at Dylife and below 100 fm at Dyfngwm although there was a general increase of zinc ore with depth. The Mining Journal for 1883 claims that there was a rib of lead a foot wide in the sole of the 125 fm level near Bradford's Shaft. The Esgairgaled Lode was not worked below 45 fm, in part owing to its hardness (high quartz content) but also to its high content of zinc at this depth.

PREVIOUS WORK

Regional geological setting

A summary of the geological evolution of the orefield has been given recently[8] in this journal with full supporting references and is not repeated here; the mineral parageneses

WOMEN'S PLACE IN LEAD MINING AT GRASSINGTON, YORKSHIRE

By Mike Gill

Because of its generally small scale, most early mining was suitable for proto-industrialisation, so the presence of female workers is not surprising. Women commonly found employment washing and dressing metalliferous ores at British mines until the early nineteenth century, when a variety of factors began to displace them in some areas.[1] Unlike the coal industry, however, where their employment underground was eventually prohibited by the Coal Mines Act of 1842, the writer has found nothing to suggest that women worked underground at British lead mines.[2] Nevertheless, in small, family-run mines, there was seemingly nothing to prevent wives and daughters helping their male relatives, which was presumably also the reason for their presence in coal pits. The need for cheap haulage, as coal mines became larger, was a significant factor in women's retention in that industry. However, because ore was less bulky and of far higher value than coal, haulage costs were not a major problem at most lead mines but women often provided cheaper labour on dressing floors.

This paper examines the situation at one group of lead mines at Grassington, in Wharfedale, Yorkshire, where the modern phase of working began in 1604 and lasted, with varying fortunes, until 1880, when the mines closed.[3,4] Nevertheless, with the exception of Mary Hudson in 1841, women with mining occupations are invisible in the parish records or census returns for the Grassington area, unless they were a lead miner's wife or widow.[5] The position in Swaledale and Arkengarthdale is a little better, however, as Table 1 shows:[6]

Table 1. Average age of women working at Swaledale and Arkengarthdale lead mines from census returns.

	1841		1851		1861		1871		1881	
	No.	Age	No.	Age	No.	Age	No.	Age	No.	Age
Swaledale										
Lead Ore Dressers	8	17 1/2	33	25 1/2	24	22 3/4	-	-	2	41
Lead Ore Washers	4	26 1/4	4	27 1/2	-	-	-	-	-	-
Lead Mine Labourer	-	-	1	30	2	14	-	-	-	-
Carrier of Ore & Lead	-	-	-	-	1	40	-	-	-	-
Arkengarthdale										
Lead Ore Dressers	4	32 1/2	-	-	-	-	2	40	-	-
Lead Ore Washers	-	-	16	36	13	34 3/4	6	25 1/4	3	45

Practically all of the above were either single girls or widows. In 1871 the price of lead was low and many mines were struggling or had closed.

ONSHORE OIL AND GASFIELDS IN THE UK

By Mike Gill

INTRODUCTION

Since World War One drilling on geological structures thought likely to yield oil and/or gas proved a series of reservoirs in the area to the east of the Pennines, including North Yorkshire, Derbyshire, Lincolnshire and Nottinghamshire. Here the oil originated in early Namurian shales, and the gas came from Westphalian coals, but then seeped upwards into traps within newer rocks.[1] In south-east England, however, the producing area of the Wessex and Weald basins runs from the southern edge of London to Bournemouth. Here the oil and some gas originated in Lower Lias shales and migrated within Jurassic strata into carbonate reservoirs at the margins of both basins.

Other reservoirs have been tapped in the Formby area of Lancashire, where oil had migrated into Triassic reservoirs. In the Cleveland and West Lancashire (Fylde) basins rocks, probably older than Westphalian, generated gas which has been mainly trapped in Permian reservoirs in an extension of the Southern Gas Basin of the North Sea and the East Irish Sea Basin respectively.[2]

The Scottish Midland Valley, to the south-east of Edinburgh, has Dinantian oil shale source rocks and interbedded clastic reservoirs. Some gas was generated from near the base of the Upper Carboniferous sequence. Migration has occurred into adjacent anticlines, which are reverse-fault controlled.

OWNERSHIP OF THE OIL

Because there was no legislation on this matter in the 1920s, the Duke of Devonshire, as owner of the first site exploited near Tibshelf in Derbyshire (see below), remains the only individual entitled to oil under his land. Since 1934, however, all oil and gas discovered in the UK is Crown property and they are worked under licences which are normally only issued in Licensing Rounds (usually annual) by the government.

HISTORY

Oil seepages are sometime encountered in collieries and one of the first to be exploited was a seepage of natural bitumen into workings at Coalport in Shropshire. This curio is still accessible as the Tar Tunnel, which is part of the Ironbridge Museum's attractions. More seepages were found at several collieries around Mansfield in Derbyshire.

In 1848 Dr James Young (1811-1883) began refining oil that seeped naturally into a colliery at Alfreton in Derbyshire. He also experimented on extracting oil from cannel coal and, in 1850, he had a share in a patent for the resulting process. The Derbyshire oil soon ran out, however, and Young found an alternative supply of suitable cannel coal at Boghead Colliery (NS 971 680) at Bathgate in Linlithgowshire, Scotland. By 1851 Young had set up the world's first oil refinery producing crude oil, paraffin oil,

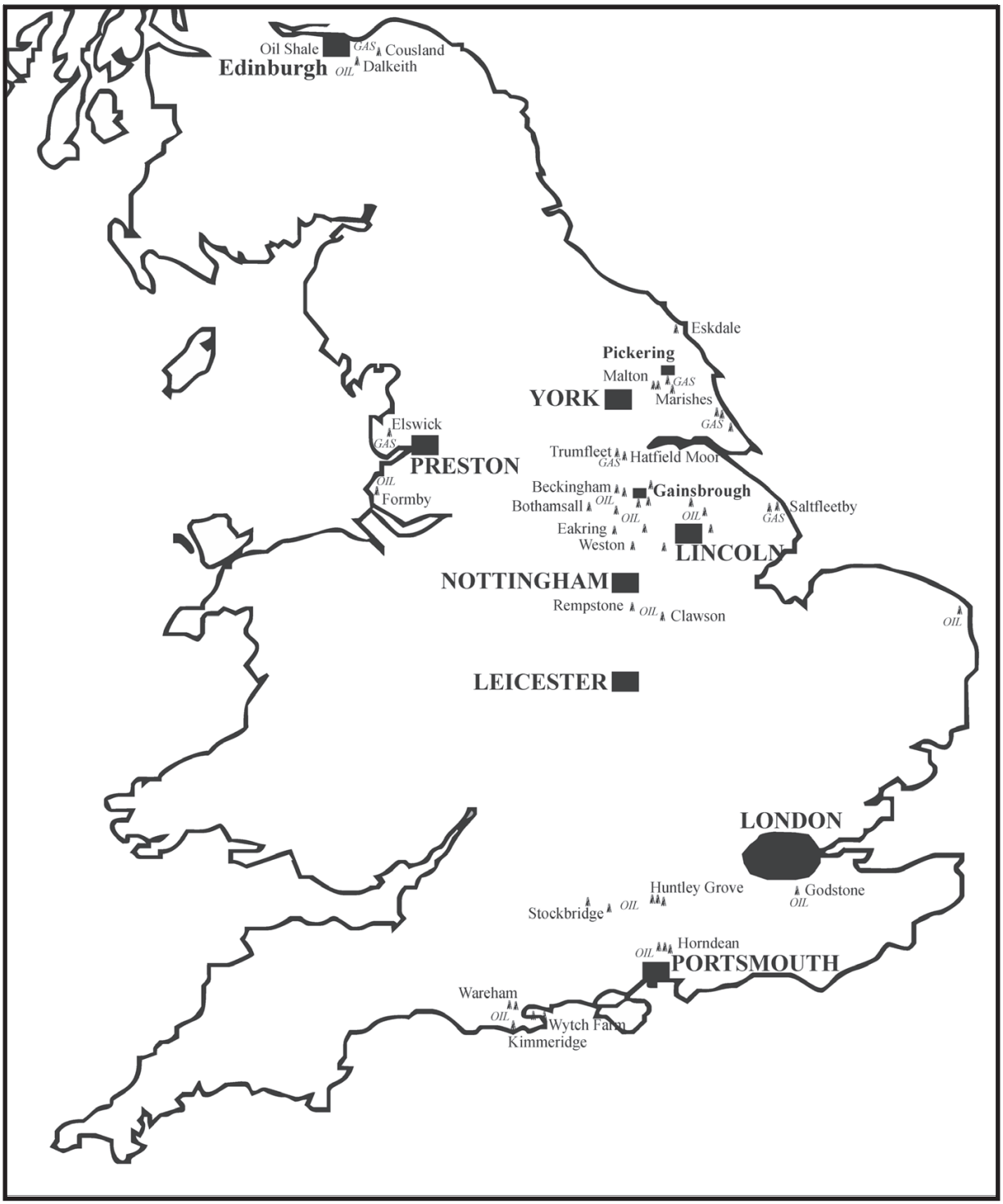

Figure.1 Map of Britain's onshore oil and gas fields.

paraffin wax, naptha, gas, coke, and ammonium sulphate fertiliser, all products which were in high demand and which returned high profits. By the time that this coal was exhausted, Young had discovered the area's oil shale which, although giving lower yields of oil than cannel coal, was cheap and easy to extract. Thus, in 1862, the oil-shale mining industry began. Large refineries were built, where the shale was heated in retorts to release the hydro-carbon content.

THE 'IRON MAN' COAL CUTTER

by Mike Gill

Jim Thorp's monograph on Coal Mining in Morley discussed the introduction of an innovative 'swinging pick' coal cutting machine at West Ardsley Colliery, near Leeds.[1] At least two examples of this machine, which was designed to emulate the picking action of a collier, have survived, so it is possible to compare them with the patent drawings. One is at the National Coal Mining Museum of Wales and the other is at the German Mining Museum, in Bochum. The following notes about this important, but ultimately dead-end, innovation are taken from the patent documents, submitted by George Edmund Donisthorpe and William Firth, both of Leeds, Merchants, and Robert Ridley, also of Leeds, Engineer, on 26 November 1861.[2] The dual prizes awaiting the developer of an effective coal cutting machine were reduced labour costs for getting coal and an increased rate of production. An additional benefit, though probably of little consideration, was one of safety. Men would no longer have to lay on their sides under-cutting the coal, which frequently led to their being crushed when it fell on them.

From what the writer has been able to discover of the patentees, the story appears much more complex than an 'ideas man' being backed by local entrepreneurs. Eagar attributed the invention of the 'iron-man' to Firth who, according to Thorp, was connected with the colliery's owners, whereas both he and Donisthorpe were members of a partnership which traded as the West Ardsley Coal Company.[3, 4] Moreover, Robert Ridley and Joseph Rothery, a Colliery Viewer from West Ardsley, took out a patent for what was basically the same machine on 30 March 1861.[5] This suggests that the original idea was Ridley's but, as will be seen, his two partners, besides being substantial local business men, were inventors in their own right.

By 1844 Donisthorpe had moved from Bosworth in Leicestershire, where his family was involved in wool combing, to Leeds. He met his wife, Elizabeth Wordsworth, in Leeds and they were married in 1844. She was a great-niece of the poet after whom their eldest son was named.[6] He was still in Leeds in 1867, when he patented *'improvements in machinery for combing wool and other fibres'* and was described as a Top and Noil Manufacturer.[7] Woolcombing was by then one of the least mechanized parts of the textile industry, causing a bottleneck in the supply of fibres for spinning. Donisthorpe's combing machine was regarded as a significant improvement but it could only comb the coarser wools. In collaboration with Samuel Cunliffe-Lister of Manningham Mills in Bradford, further improvements were made which resulted in a machine that would comb softer and finer wools both efficiently and reliably.[8]

Donisthorpe was living with his family on Shadwell Road, Chapel Allerton in Leeds by 1861 and was still in Leeds in 1865 when further *'improvements in machinery employed when getting coal and other minerals'* were patented on 15 December.[9, 10] By 1871, however, he was living at West Park Belvedere, Bilton with Harrogate and described himself as a colliery proprietor.[11] He died there, aged 64, in the first quarter of 1875.

THE EAST CUMBERLAND COALFIELD

By Graham Brooks

INTRODUCTION

East Cumberland is dominated by the Pennine escarpment which is formed by the Pennine Fault. This fault separates the Carboniferous sediments of the Alston Block from the Permo-Triassic rocks of the Vale of Eden. The Alston Block consists of a series Yoredale cycles or cyclothems. Each cyclothem consists of a limestone overlain by a series of sandstones and shales. Occasionally a thin seam of coal is found below the limestone layer and takes its name from the overlying limestone.[1] In the area of this article this ranges from the Melmerby Scar Limestone to Fell Top Limestones.[2]

Along the North Cumberland Pennine escarpment coal has been mined at a number of places where these thin seams outcrop and usually range from 0.15m to 0.5m in thickness. The two most frequently worked coals are the Little Limestone Coals which are usually split into layers, frequently two but occasionally coming together to form a single seam. There is however, never more than one seam workable in a district and it is usually called the Little Limestone Seam.[3] Another seam which was worked is known as the Four Fathom Limestone Coal.[4]

In the north of the region around Tindale and Geltsdale the coals are usually of a higher quality and were worked on an industrial scale by the Earl of Carlisle and the subsequent lessees of his mineral rights in the Barony of Gilsland. To the south of the Barony the coals are of much poorer quality and were worked on a smaller scale. It is these mines between the Croglin Water and Hartside that are the subject of this article.

The poor quality of the coals in this area is shown by numerous references, which usually state that they were only used for burning lime.[5] The nearest area of settlement, Penrith, obtained the majority of its coal from Warnell Fell approximately 16 miles west of Penrith, compared with a distance of about 12 miles to the collieries at Renwick and Hartside.[6] However some of the coal was sold locally, for although Edenhall (home of the Musgrave family) obtained the majority of its coal supplies from Lord Carlisle's collieries at Tindale, occasional deliveries from the Renwick Colliery are recorded.[7] The day book for Hartside Colliery shows that over a three-year period approximately an eighth of the production was used in their own limekilns with rest being sold. Unfortunately the destination of the other coal is not stated.[8]

Due to the poor quality of the coal and the low intensity at which the mines were worked, the archival material for these collieries in some cases is non-existent or very limited and the only evidence is the remains on the ground.

BURNT EDGE COLLIERY

The site today consists of a single dry-stone lined adit, which is now collapsed with a waste heap at NY 5969 4686; the waste heap has some dry walling around it. The