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ALFRED WILLIAMS, LEO DAFT AND 'THE ELECTRICAL ORE-FINDING COMPANY LIMITED'.

By Robert W. Vernon

INTRODUCTION

The early history of geophysical prospection for minerals is poorly recorded and only a fleeting sentence, if at all, mentions the names of Williams and Daft. One of the few works that deals with this subject, 'The History of Geophysical Prospecting', for example states: *'In 1900 Leo Daft and Alfred Williams proposed the use of alternating currents and telephone receivers (for geophysical prospection).'*[1] However, not only did they propose and patent this geophysical method, they actually put it to work on a number of British mine sites and later their technique was employed on mine prospects in Spain and Australia. In the latter country the use of their equipment is recognised as the first geophysical survey conducted there. Daft and Williams, both British by birth but naturalised Americans, established in Britain what was probably the first geophysical prospecting company in the world - The Electrical Ore-Finding Company Ltd. and although this company only operated for six years, it can be regarded as the forerunner of what is today a multi-million pound industry. Geophysical prospection is used extensively in the oil and gas, and mining industries, and for civil engineering and archaeological investigations.

WILLIAMS AND DAFT: THE EARLY YEARS

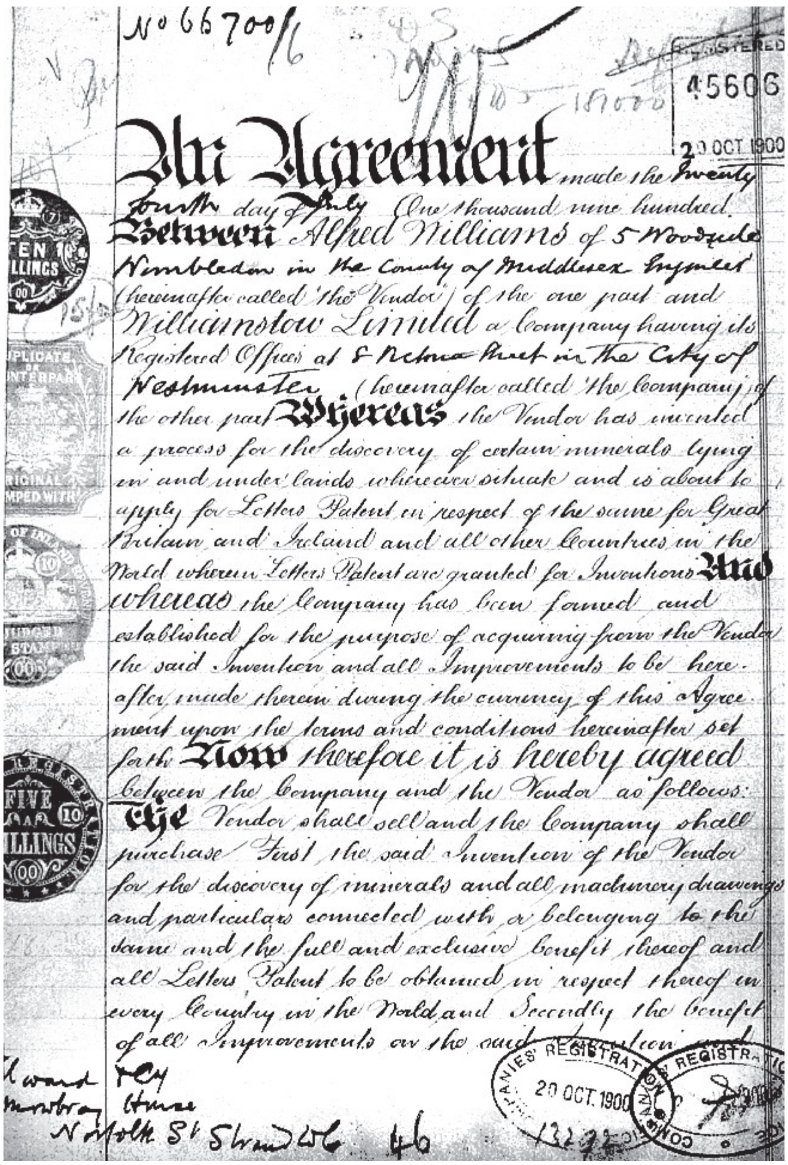
Leo Daft was born at Birmingham, England on 13 November 1843. His father was a prominent civil engineer. In 1859 he entered the engineering class at University College London as a special student. A few years after graduating, he went to the United States in 1866 where he was engaged as a railway engineer with the Louisville and Nashville Railroad.[2] By 1871 he had moved to New Jersey, and had married Catherine Flansburgh. They had four children. Daft became involved with electrical engineering and in 1882 he had formed the Daft Electric Light and Electric Power Company in New Jersey.[3] Daft experimented with electric powered railways and is credited with inventing the third rail system that provided electricity to an electric motor.[4] The system was perfected in August 1885 with the establishment of the first passenger electric train service in the USA between Baltimore and Hampden.[5] By the 1890s the family were established in Seattle, Washington State.

Alfred Williams was born at Oswestry, Shropshire in December 1871. Nothing has been discovered about his early years but it is probable that he had some training in electrical engineering. In 1888 he went to live in Seattle, USA, where he married Matilda Juliet Daft, the eldest daughter of Leo Daft, on 3 November 1893.[2,6] It is apparent that Williams and his new father-in-law got on very well together and from about 1896 they commenced experiments in electrical ore-finding at Seattle. Their experiments met with some success and this work was soon followed by field trials in southeast Alaska. In 1899, Williams and Daft moved their headquarters to London.[2] By this time both men were naturalised Americans. Williams came to England that year with his young family, and Daft appears to have followed them sometime in 1900.

WILLIAMSTOW LTD. 1900

It is Alfred Williams who is credited as the inventor of the electrical ore-finding equipment and it seems likely that he had the assistance of Leo Daft to perfect it, although patents were filed under both Daft and Williams. The Board of Trade file for the Electrical Ore-Finding Company in the National Archives, Kew provides an insight to the formation of the company.[7]

Alfred Williams formed a company called Williamstow Ltd, which was registered on the 20 July 1900. The nominal capital of the company was set at £125,000 comprising of 120,000 'A' shares at £1 each, and 5,000 'B' shares also at £1, with different conditions assigned to them. Williams was the Managing Director. The company name was probably a combination of Williams's surname with that of another Director, Edward Kenyon Stow.



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20 OCT 1900

An Agreement made the Twenty fourth day of July One thousand nine hundred Between Alfred Williams of 5 Woodside Wimbledon in the County of Middlesex Engineer (hereinafter called 'the Vendor') of the one part and Williamstow Limited a Company having its Registered Offices at 8 Victoria Street in the City of Westminster (hereinafter called 'the Company') of the other part Whereas the Vendor has invented a process for the discovery of certain minerals lying in and under lands wheresoever situate and is about to apply for Letters Patent in respect of the same for Great Britain and Ireland and all other Countries in the World wherein Letters Patent are granted for Inventions And whereas the Company has been formed and established for the purpose of acquiring from the Vendor the said Invention and all Improvements to be hereafter made therein during the currency of this Agreement upon the terms and conditions hereinafter set forth Now therefore it is hereby agreed between the Company and the Vendor as follows: The Vendor shall sell and the Company shall purchase First the said Invention of the Vendor for the discovery of minerals and all machinery drawings and particulars connected with or belonging to the same and the full and exclusive benefit thereof and all Letters Patent to be obtained in respect thereof in every Country in the World and Secondly the benefit of all Improvements on the said Invention

Mowbray House Norfolk St Strand WC 46

20 OCT 1900

Figure 1. Williamstow Ltd. The Agreement between Williams and the company citing Williams as the inventor of the ore-finder. [National Archives, London BT31 /9016 /66700].

The purpose of the company had its roots in an Agreement (See Figure 1) dated 24 July 1900 between Williams (the Vendor) and Williamstow Ltd, (the Company). It refers to the Vendor having *'invented a process for the discovery of certain minerals lying in and under lands wherever situate and is about to apply for Letters Patent in respect of the same for Great Britain and Ireland and all other Countries in the World wherein Letter Patents are granted for Inventions'*. The Agreement goes on to confirm that the Company, *'has been formed and established for the purpose of acquiring from the Vendor the said Invention and all Improvements to be hereafter made therein….'*.

EXCAVATION OF A SEVENTEENTH-CENTURY LIME KILN AT KILNSEY, NORTH YORKSHIRE

By David Johnson

LOCATION

The lime kiln in question was excavated by members of the Ingleborough Archaeology Group and Upper Wharfedale Heritage Group in September 2007 with this writer as project leader. The excavation was undertaken within a field now known as Kilnsey Green but marked as 'Town's Piece' on the 1845 Kilnsey Tithe Award. The field is owned by the Conistone and Kilnsey Parish Meeting, and lies between the fish ponds of Kilnsey Park and the modern line of Mastiles Lane. The excavation site lies at the north end of the field, at NGR SD 97282 67795 at 195m AOD.

AIMS AND OBJECTIVES

Excavation of this kiln followed on from the IAG's two-year Sow Kiln Project which aimed to investigate the form and operational methods of clamp lime kilns across Craven in the southern Yorkshire Dales, using a sample of six widely spread sites.[1] Added to these was a further clamp kiln excavated by the Group during its Broadwood Project in 2003.[2]

Five of the six sites excavated were proven to be lime kilns, with the last site being a probable prehistoric storage pit. In each case excavation was able to provide sufficient evidence of form and structure and a model of technological development of clamp kilns has since been suggested by this writer.[3] A technical report was published, and an article commissioned by a popular archaeology magazine.[4] In addition, the project was a finalist at the 2006 Awards for the Presentation of Heritage Research in Norwich and in August 2007 the project leader was invited to the national conference of the Association for Industrial Archaeology in Preston to receive their Fieldwork and Recording Initiative Award on behalf of the Group.

The Kilnsey site was an add-on to the main project with the specific aim of investigating the possibility that the feature might be contemporary with either the rebuilding of Kilnsey Old Hall in 1648 or with monastic occupation of this important Fountains Abbey grange. If a firm dating were achievable, the detailed form of the kiln could enable this writer's provisional clamp kiln model to be refined.

SITE TOPOGRAPHY

Kilnsey Green lies on a gently sloping incline, dipping down from north-west to south-east, at the foot of the steep, scree-covered slopes. The earthwork was cut into a low natural bank, now edged with a partly mortared stone wall, that extends north-west from the kiln through a small paddock. A narrow and shallow linear depression runs in a direct line from the base of the scree towards the north-west wall of this paddock, with the hint of low banking parallel to the depression on its eastern side. Below the kiln site the incline is minimal for 50 metres or so before dropping off more steeply down to an undated rectangular enclosure shown by earthworks.

A track runs alongside the kiln, on its southern flank, from Kilnsey Old Hall into a small wood and this may be the original line of the monastic Mastiles Lane, part of the major artery from Fountains Abbey across the Dales. No archaeological surveying had been undertaken, prior to excavation of the earthwork, of the various ground features that can be made out within the field, representing possible building platforms and the footprints of actual built structures such as a lead smelting mill and a putative corn drying kiln.[5] However, a programme of topographical and geophysical surveying was carried out prior to the dig.[6]

HISTORICAL CONTEXT

Following the Act of Dissolution of monastic foundations in 1536, all Fountains' properties, including Kilnsey, were sold to Sir Richard Gresham, a rich London merchant, who probably saw his purchase as a lucrative but temporary investment opportunity and much of value was quickly sold off. In 1547 the property here was sold on to the Yorke family. By the middle of the following century, however, Christopher Wade was in possession of Kilnsey and it was he who rebuilt the monastic hall in 1648. Three generations of Wades occupied the hall until 1693 but after that it was let out until 1745 when the last of the male line, Cuthbert III, died without issue. The hall then fell into disuse as a residence and was consigned to use as a slowly decaying agricultural building until being rescued in 1999 and returned it to its former residential status following the lines of the original layout of the 1648 rebuilding.

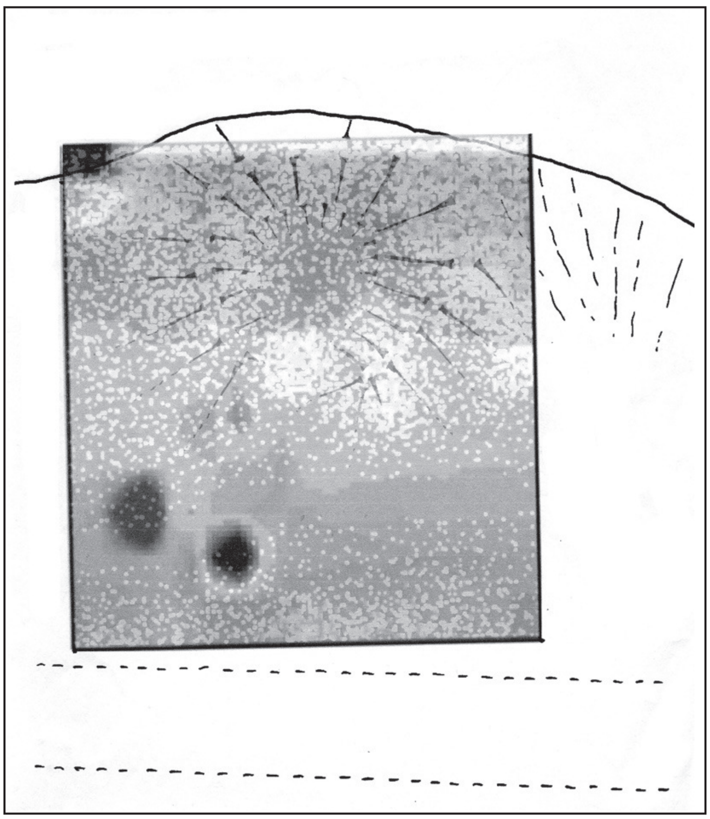

Figure 1. Resistivity trace. The lighter shades emphasise the stone-covered areas which are more resistant to electric currents.

Kilnsey's industrial functions prospered in early modern times. In 1735 a lead smelt mill was commissioned for the Duke of Devonshire within Town's Piece, to the south-west, to work ores mined to the north-west of the village and in Littondale. This mill closed down in the mid-nineteenth century. The Tithe Map (dated 1845) shows a corn drying mill within Town's Piece, again south-west of the kiln site. The most recent – and most intrusive – element of the village's industrial past is Cool Scar Quarry which produced crushed limestone from sometime in the nineteenth century (the first definite date is 1880) until closure in 1998, and the tarred road past Kilnsey Old Hall was created as the quarry access road.

LEAD SMELTING MILL AT SCARGILL, CO. DURHAM

By Richard Smith

INTRODUCTION

In 2007, the author and his wife were walking with Tim Laurie and Alan Mills looking at ancient burnt mounds in the countryside north of the Yorkshire Dales National Park near Spanham Farm. Tim pointed out an area which was profusely covered with slag on the south bank of Eller Beck and about which he had known for many years. The slags were variable in appearance, most were black and vitreous, others were superficially stained red-brown. Closer inspection revealed inclusions of lead, lead prills and some sparse occurrences of galena. The site was surprising in that no smelt mill had been reported in this area to the author's knowledge nor had one been recorded in the Northern Mine Research Society records. Since then the site has been surveyed, the slags analysed and historical records traced. The site is without doubt that of a lead smelting mill which would have derived its main source of ore from the Spanham and Eller Beck mines and hushes, which lie within the Manor of Scargill.

There are two groups of lead mines in the area, all at approximately the same horizon below the boundary with Arkengarthdale:

Spanham Mines-west of Spanham Farm and consisting of shafts, levels and a large hush.

Eller Beck Mines-on the west end of Scargill Out Moor on the upper reaches of Eller Beck and consisting of shafts, levels and a large hush.

HISTORY

The manor of Scargill lies in the parish of Barningham, Co. Durham (previously in the old North Riding of Yorkshire) on the northern side of Stang Forest. In the mid-sixteenth century the manor was owned by Francis Tunstall of Thurland Castle, Lancashire and remained in that family for more than two centuries. The family seat moved to Wycliffe, (then) Yorkshire some time after Francis Tunstall married the heiress Catherine Wycliffe in 1606. Their grandson Francis married Cecily Constable, the eldest daughter of Viscount Dunbar of Burton Constable in the East Riding of Yorkshire. Their first son, Marmaduke, an eminent ornithologist, died a bachelor in 1760 at the age of 89 and the estate passed to his brother Cuthbert. Cuthbert had changed his name to Constable, presumably to perpetuate that name and in order to inherit the rich Constable estates. Marmaduke pointed out that upon his death Cuthbert would also inherit the considerable Wycliffe estate. He was concerned that the Tunstall name would die out and stipulated that the inheritance would pass to Cuthbert but no further unless the recipient changed his name to Tunstall. Cuthbert had married Amey, the daughter of Hugh, Lord Clifford and had two children (William, d. 1772 and Cecily). He then married Elizabeth Heneage of Hainton, Lincolnshire and their son Marmaduke became the heir.[1]

It is not clear what resulted from Marmaduke Tunstall's conditions. A note suggests that Marmaduke Constable, the heir, died in 1788 and in 1791 several valuations

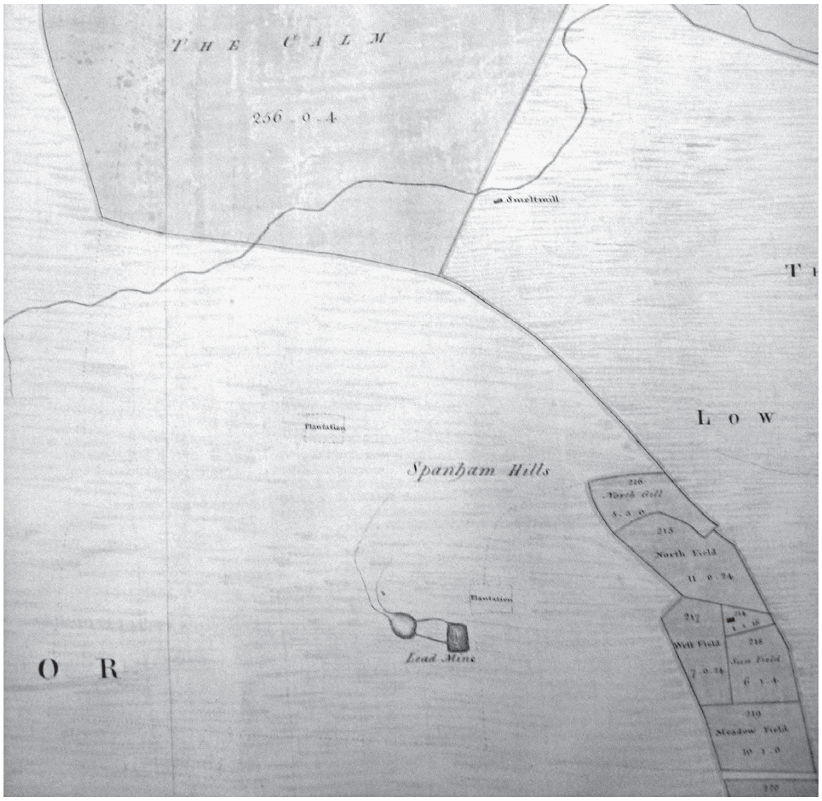

Figure 1. Smelt mill and lead mines at Spanham, Scargill.[3]

were carried out. The Scargill estate was put up for sale on 12 May 1802 and appears to have been bought by Francis Constable of Burton Constable. A handwritten note on the printed form states that the annual rent was £1,060 and that the estate had been bought for *'the considerable and unexpected price of £43,700'*.[2] Francis Constable died in October 1820 leaving bequests to the poor of Scargill in his will. The manor next appears in the late 1820s under the ownership of Sir Thomas Aston Clifford Constable of Burton Constable.

SCARGILL MINES

The first reference to lead mining is an early 17th century lease (no date available) from Francis Tunstall to Christopher Wall, Ambrose Appleby, Christopher Pearson and John Colepitts for 17 years. Unfortunately this document has suffered water damage, has become glued together and is now awaiting conservation before it can be opened.[3] Francis Tunstall (1643-1713) was the son of William Tunstall (1613-1667) and Mary Radcliffe (or Ratcliffe) the daughter of Sir Francis Radcliffe of Dilston (1625-1697) and later the first Earl of Derwentwater. The lease is probably late rather than early 17th century, both from the birth date of Francis Tunstall and from the lessees who can be recognised from other documents. (Christopher Wall, a yeoman of Peakfield took a lease of Green Mines in Lunedale from Sir William Bowes of Streatlam Castle, Co. Durham on 22 April1679 [4] and a lease of 5 November 1687 from Sir William Bowes refers to *'a shaft or pit lately wrought by John Colpitts on ye west side of Carsey Gill'*.[5] The Colepitts family were active miners in the Lunedale area of (then) Yorkshire until the mid-nineteenth century. An Ambrose Appleby applied for a lease of Murton Mines on 26 January 1748 and was a regular bidder for ore and sold lead during the 1750s on behalf of Lord Lonsdale.[6] He appears to have had a father of the same name).

Simon Scrope of Danby obtained a lease of the Spanham Mines for 21 years from Francis Tunstall on 27 February 1704/5 (old calendar convention) at a duty of $^1/_8$th in ore for the first three years and then at $^1/_6$th thereafter. Scrope was to be allowed to build a smelt mill at a place suitable to Mr Tunstall, who was to supply the necessary

PHOTOGRAPHY UNDERGROUND

THE EARLY DAYS

Although William Henry Fox Talbot devised a way of producing his 'photogenic drawings' in 1839, photography did not settle down to today's system until the dry plate evolved in 1876. That is, we load an emulsion into the camera, give an accurate exposure and process it to a negative, prior to making final prints.

The forerunner of the dry plate was the wet plate, which the user had to sensitise and expose, whilst it was still in a moist state. Enterprising photographers soon exploited the virtues of dry plates and the manufacturers responded by improving the sensitivity. Astronomy emerged as an important application and in spite of the inherent difficulties, the successes made important contributions to science. Another challenge was the need to record underground mine workings. Very often, such photographs promoted successes and companies used them to coax speculators to invest in the undertaking. At other times, local managers commissioned photographs to demonstrate progress (and difficulties) to company boards.

Irrespective of the purpose, the task was far from easy. The most suitable equipment was heavy and the photographer had to handle his glass plates with great care. The available cameras were bulky and he needed to assemble the body, the lens, the viewing screen and the shutter mechanism at the location. The use of a tripod was a necessity and the exposure must have been difficult to calculate. Because the plates (either wet or dry) were intended for conventional use in daylight, many practitioners relied on 'rule of thumb'. That is, guesswork.

When tackling very difficult subjects, sensible photographers preferred to make a trial exposure, process the plate immediately and use the negative to determine the correct exposure. Photographers with experience often continued to use wet plates but modified their methods to suit the occasion.

WET PLATES PREFERRED

One such *'skilful manipulator of the camera'* was Mr Frederick Brown of Walsall who was engaged by a firm of Walsall solicitors, Messrs Duignam & Co, in 1876 *'to illustrate a question of practical mining'* at Bradford Colliery, Bentley (near Walsall).[1] Brown made a reconnaissance with his client, Mr Chiddey and very sensibly carried out a test with magnesium light, from which he concluded that *'photography would be perfectly possible under conditions which exclude sunlight altogether'*.

Brown's brief was to obtain *'an accurate picture of some underground workings'* and on the day, he used *'the oxyhydrogen light, generally known as lime-light, in combination with magnesium riband in combustion'*; the latter was the forerunner of flashbulbs Accompanied by one of the proprietors of the mine and his deputies, the photographer's activities surprised *'the colliers at seeing so brilliant a light in the mine, where nothing but the light of a halfpenny candle had ever been seen before'*. There was general agreement that the finished photographs *'are not only themselves*

THE GREAT DALES COALFIELD, EASTERN AREAS

By M.C. Gill

Old coal pits are ubiquitous throughout the Yorkshire Dales (See appendix 1) but until recently, their extent, longevity and local importance has received little attention. Indeed, given that a modern colliery would cut more coal in one year than was ever produced from all the hundreds of pits and levels concerned, many might consider such coalfields to be so highly marginal as to be of little interest. Nevertheless, it must be remembered that workable coal seams were found at, at least, eight geological horizons on the Askrigg Block, and another six or so seams occur in adjoining areas. As part of the symbiotic relationship between coal mining, lime-quarrying and burning and farming, they often supported mines of significant local importance.

It is not the purpose of this paper to identify every single pit and level but, as Mike Kelly's recent monograph on the Geology of the Lune and Upper Ribble Coalfields has shown, it is useful to have 'an up-to-date geological basis for the further study by others'. Kelly concentrated on the western-draining catchments of the Lune and Ribble, which are on the Askrigg Block, as well as including those coalfields within the Lune drainage which are not. This paper, therefore, uses a similar approach to study the eastern-draining areas of the Askrigg Block (broadly the Yorkshire Dales) but includes the Craven Basin and South Craven to the south and goes as far as the Permian outcrop to the east.

As no specific geographical or geological name exists to unite these disparate coalfields, the writer who had for some time been toying with the concept of 'The Great Dales Coalfield' to describe them as a unit, has adopted that name here. The component coalfields are then discussed within the context of their geological horizons.

PREVIOUS AND CURRENT WORK

Almost all the early references to coal mining in the area come from the work of geologists. In 1928, however, Arthur Raistrick wrote a general paper on 'Coal and iron working in the Millstone Grit and Yoredale rocks of West Yorkshire' which, despite its title, covered most of the area being discussed here.[1]

The subject once again became the province of geological surveyors until the early 1990s, when the writer included details of coal workings in his accounts of lead mining in Wharfedale and Nidderdale. He has also covered coal mining in South Craven. Les Tyson has published a detailed history of collieries in Colsterdale and is working on those around Tan Hill. Ian Spensley is also working on coal mines within Wensleydale.

In adjoining areas, to the south and north respectively. John Barnatt and other members of the Peak District Mines Historical Society are studying the Namurian coal workings on the western fringe of the Derbyshire Peak District, from New Mills to a little south-west of Buxton, and on its eastern fringe, from Totley Moor south the Beeley Warren.[2] Work was restricted to a small number of seams, and no significant coal was found in the limestone areas.

No similar work is known to be in progress in the North Pennines, where coal was worked at a number of horizons. The Little Limestone seam (it is actually in the Great Limestone cyclothem) has been an important source of coal and was worked until recently. The latter seam was 18 inches thick in the Alston area, where it was classed as semi-anthracite but was around 66 inches thick near Haltwhistle. The area can also boast Britain's highest coal pits on Cross Fell at 2150 feet AOD.

GEOLOGICAL OUTLINE

The following description is intended to give the general reader an outline of the region's geological development. Anyone seeking a fuller account should refer to 'The Geology and Mineral Resources of Yorkshire' and 'The Pennines and adjacent areas'.[3-5] While it covers the Lower Coal Measures, Iain Williamson's paper on the Burnley Coalfield discusses the formation of thin coal seams and the geological features associated with them.[6]

The Carboniferous strata (325.4 to 316 million years ago) of the Yorkshire Dales are laid on highly folded rocks of Ordovician and Silurian age, with a small, granite batholith at a depth of 495 metres near Semer Water. The latter was detected by geophysics between 1965 and 1967 and was proved by boring in 1973. Together, these form the Askrigg Block, which is bounded to the south, west and north by the Middle Craven, Dent and Stainmore Faults respectively.[7] This block, though slowly subsiding, provided a stable base on which sediments accumulated, whereas in the Craven and the Stainmore Basins the sediments are much thicker because those areas subsided more quickly during deposition.

From the Arundian until the end of the Asbian stages (time subdivisions of the Carboniferous Period) there was a long, almost unbroken, period of limestone formation in warm, shallow, clear seas. This was followed by the Brigantian and early Pendleian stages in which rivers, eroding a landmass to the north, formed deltas and dropped muds and sands into those seas. Changes in sea depth and delta activity, caused by periodic earth movements during these times, led to rhythmic successions of deposits, or cyclothems, of limestone, shale and sandstone, sometimes overlain by thin coal seams. A total of eleven cyclothems, from the Hawes Limestone up to the Crow Limestone, formed what are known collectively as Yoredale type rocks, named from their dominance in Wensleydale (= Yoredale).

The thin coal seams developed where the water had become shallow enough for swamps to form. Rather than the very extensive bogs formed during Coal Measures times, however, one must envisage an active paleo-surface of river channels, sand banks, flood plains and lagoons, in which coal swamps formed on sand or mud substrates. It is possible, therefore, for seams to be broadly coeval but not necessarily conjoined. Periodic incursions of sediment-rich water into the lagoons from the river channels,

THE EAST VAN FAILURE, POWYS, WALES: A NEW LOOK AT THE GEOLOGY AND THE ARCHIVAL RECORD

By David. M. D. James

SUMMARY

East Van tested only a portion of the main Van Lode before this was relayed into the NE Van Lode (new name). The latter lies too far N of the main lode seen around Tempest Shaft and its cutoff portion seen around the engine shaft to have been reached by the exploratory crosscuts from the adit and 25 fathom levels. The relay fault/ramp itself was untested. The footwall of both the main lode and its relay lies in a relatively ductile host rock, in contrast to the situation at Van where a more brittle host rock was favourable for ore-hosting brecciation in the lode. The failure of the operation is thus only partially a failure to explore in the right place and primarily due to the unfavourable geology. The idea that the main Van Lode lies largely S of the workings and was thus missed is not supported.

INTRODUCTION

The Van Mine was the largest lead producer in the Central Wales Orefield and lies at its eastern margin about 4 kilometres WNW of Llanidloes (Figure 1). Production began in 1866 and within four years was exceeding 4,000 tons of lead concentrates annually, yielding spectacular dividends to the original shareholders.[1] It was thus hardly surprising that by 1871 an East Van Mining Company had been formed to work the presumed easterly continuation of the Van Lode and that there was every expectation of similar success. Sadly, by 1878 the Mining Journal was recording that *'with £90,000 of paid capital the mine has never sold a pound of mineral'*. As East Van lies only 500-800 metres NE of the productive area at Van, the failure of the operation was difficult to accept or understand and trials persisted with an increasing air of desperation until operations ceased in 1882. The progress of this venture is recorded in detail within the Mining Journal.

There are three plausible geometrical explanations for the results at East Van. First that the fracture system found was a simple extension of the Van Lode (that is of similar orientation, thickness and internal zonation to that at Van) but was barren. Second that the fracture system found is a result of a lateral change of fracture density, zonation and throw in the Van Lode system ENE of Van; again the exploration would have yielded a conclusive, albeit negative test. Third that the true Van Lode was never seen, presumably as a result of a considerable change in orientation, the fracture system found being genetically unrelated to it. In this last case the Van Lode system may or may not have been prospective elsewhere in the sett.

It is very unlikely that the Van Lode dies out before reaching the East Van sett as this would require a throw of ca. 170 metres at Van to die out laterally very rapidly and the mine plans prove the lode to be present in depth immediately N of the Central

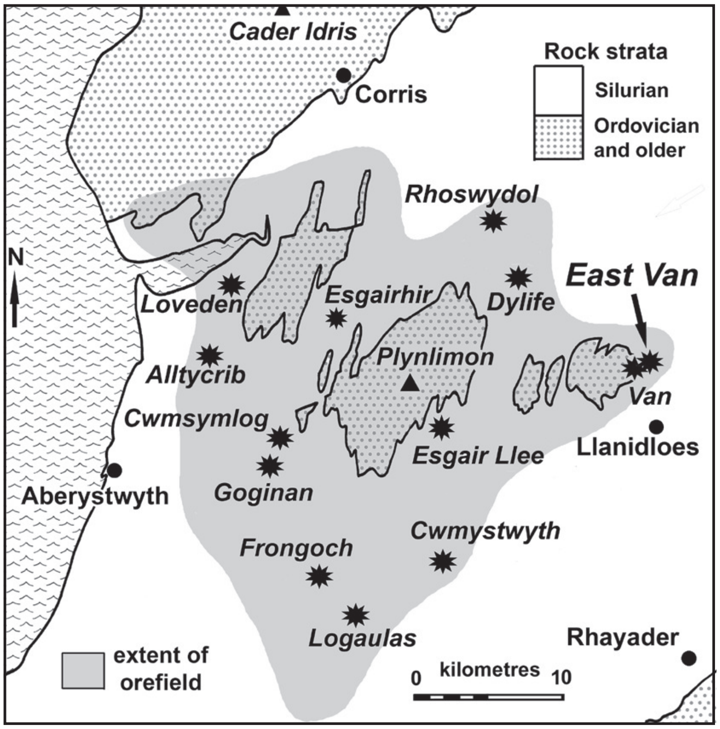

Figure 1. Location map for the Central Wales Orefield showing the position of East Van.

Van shaft, only 550 metres WSW of Tempest Shaft at East Van. Moreover, although not worked despite a 'discovery' in a small winze, the Van Lode was followed far E of Van from an adit at SN 9418 8808 to ca. 30 metres ENE of the air shaft at SN 9443 8820, at which point it is only ca. 150 metres from Tempest Shaft at East Van. This adit, and that higher at SN 9424 8810, driven ENE for ca. 96 metres, lie E of the area shown on the main plans of Van but are illustrated in E. Hamer's section of 1870, figured by Hughes.[2] Neither adit is now accessible.

Van itself is extensively documented,[2-5] most recently in some detail by Chapman.[1] However the only geological discussion of East Van (together with Van) remains that given in 1922 by O.T. Jones.[6] The area was remapped by W.D.V. Jones[7] in 1944 as part of a regional study of stratigraphy and structure but no discussion of the mineralisation was given and no mention made of the differences between his map and that of his father. It has been noted recently[1] that *'modern geological wisdom'* suggests the shaft (sic) to have been sunk in the wrong place and that the levels *'completely missed the continuation of the Van Lode'*. This reading is based on the analysis of O.T. Jones and needs revision as Jones' account is not entirely internally consistent and contains several errors.

THE ANALYSIS BY O.T. JONES

In his memoir Jones wrily observes that the course of the Van Lode in the direction of East Van is *'of some interest'* and his plate XXII provides a map of the key area with some superposed data from the East Van Mine plans. The map, summarised in Figure 2, shows the Van Lode persisting well to NE of the engine shaft. Jones concludes that over most of the trials the Van Lode was not found and that it is a *'reasonable suggestion'*, that it lies *'everywhere S of the 25 Fathom Level'*, also that save around the engine shaft the lode followed at this level lies *'everywhere N of the outcrop'*. He does, however, point out that the first conclusion depends on the assumption that the lode followed maintains a similar magnitude and sense of dip to that proven at Van, ie. ca. 65° to 73° to the SE. Should the lode become near vertical or dip steeply to the NW at East Van, Jones' map indicates that it would have been seen in the adit and the 25 Fathom Level NE of Pwll-yr-ebol but he clearly considered this 'extremely unlikely'. As Jones reports no underground observations it seems that he did not, or was not able to, inspect the Adit Level.

THE NEWCOMEN ENGINE AND THE ACCOUNT BOOK OF EDWARD SHORT: A DETAILED REAPPRAISAL

By Richard P.H. Lamb

INTRODUCTION

In 1712, during the reign of Queen Anne, Thomas Newcomen, 1664-1729, a native of Dartmouth in Devon and ironmonger by trade, erected his first documented engine in Staffordshire, within sight of Dudley Castle, to drain a coal mine 153ft deep. This single invention had such a major impact on the course of technology that Newcomen's principles were still recognizable over a century later, at a time when Britain's supremacy in the field of steam engineering, thanks to men like James Watt and Richard Trevithick, was unchallenged.

The idea of using steam pressure or the power of atmospheric pressure has occurred throughout history, although it has to be said that most of these attempts resulted only in novelty applications or laboratory experiments. For example, Hero of Alexandria, ca. 100AD, demonstrated his famous 'aeolipyle', a small reaction turbine which performed no useful work. The early 17th century saw della Porta and de Caus's apparatus which forced water out of small vessels using steam pressure and a steam-impelled wheel by Branca in 1629. Around 1644, Torricelli conducted his experiments on the measurement of atmospheric pressure and vacuum and went on to invent the mercury barometer. This particular line of research had been triggered by Cosimo II de Medici, whose mining engineers found they were unable to draw water more than about 30 feet high using a suction pump, although prevailing Aristotelian theory suggested there was no limit to the height a pump could draw.

Meanwhile in England, various ideas were in circulation relating to the harnessing of the power of fire to perform beneficial work such as raising water from mines or the provision of motive force for working mills. The names of David Ramsey, the Marquis of Worcester and Sir Samuel Morland are connected to patents, pamphlets, books and other extravagant forms of self-advertisement, including the diary of one Roger North from about 1680 but nothing tangible is known of their inventions. Morland, the 'Master of Mechanicks' to Charles II, devised a plunger pump which obviated the need to machine the bore and which was reintroduced in improved form by Trevithick around 1800.

Denis Papin, who emigrated from the Continent to England in 1675, joined the Royal Society and is known for the invention of his 'digester', known today as the pressure cooker. He also experimented with a certain piece of apparatus which took the form of an open topped cylinder with piston, beneath which was a small amount of water. Placing the cylinder over a fire rapidly produced steam which drove the piston upwards, any air being forced out through a non-return valve. When the piston reached the top, it was secured by a catch and the apparatus removed from the fire. Subsequent condensation of the steam caused a partial vacuum to form beneath the piston and on