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COAL

A CHRONOLOGY FOR BRITAIN

by

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CONTENTS

LIST OF ILLUSTRATIONS

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INTRODUCTION

The following book is a compilation of notes and references which I have collected over many years. Some years ago I had the idea to collate the information into a chronology of coal mining events, people and technology. Since my primary interest is in the technological aspects of coal mining there is a strong bias towards technology. The result of this work was that in 1991 *'Coal Mining – a Technological Chronology 1700-1950'* was published as a British Mining Supplement.[2.] The current chronology is a revised and much expanded version of the original and covers the period from Roman times until 2010. The chronology also includes a small number of references to metal mining technology, where these have a bearing on the technology employed in coal mining and other allied activities such as the electricity supply industry.

The chronology has been compiled from a wide variety of sources such as; the Colliery Guardian, Mining Journal, The Iron and Coal Trades Review, the transactions of the many regional mining institutes which abounded in the heyday of the industry in the latter half of the 19th century and the many text books which abound for what was such an important British industry. This has not been an easy task, not least from the point of sorting out the many concurrent claims that abound in the individual mining regions, as to who was the first to develop or introduce an idea or aspect of technology.

The primary function of the book from my point of view is as a reference document, and as such I have laid the book out with this in mind and provided a comprehensive index. I am sure the book will be expanded, corrected and further refined as the years progress, but as such will form the basis for much debate and thought amongst its readers.

Dr. E.F. Schumacher, who was Economic Advisor to the National Coal Board, for twenty years from 1950, as well as holding the positions of Director of Statistics and Head of Planning stated:

> *'There are only two basic items in the world economy – food and fuel. All the rest are secondary…….there is no substitute for energy; the whole edifice of modern life is built upon it'.*[2]

COAL AND THE INDUSTRIAL REVOLUTION

Coal has been used as fuel for more than a thousand years in Britain, though it was not until the 13th century that the use of coal became more widespread. Coal was the most important mineral mined in Britain, from the period running up to the start of the Industrial Revolution around 1760, until the late 20th century. In the 'latent phase' from 1690 to 1760, leading up to the start of the Industrial Revolution, there was a shift to a coal-based economy. Britain produced more than 80% of world production in the 18th century and the availability of indigenous cheap and plentiful coal was one of the main facilitators of the Industrial Revolution. The use of coal enabled Britain to become the first industrial country in the world and the world's major political and economic power. During the principal period of the Industrial Revolution, from 1760 to 1830, the shortage of wood & timber, the basic fuel and structural building material of all previous ages, forced the development of the use of coal and cast-iron structures.

A rapid concentration of industry developed on the coalfields together with a move of the iron industry from forest areas (based on the use of charcoal) to the coalfields. The increasing use of the steam engine to provide 'limitless' power and the domestic needs of a growing population provided new markets for an expanding coal industry. The availability of cheap coal in turn encouraged the development and expansion of energy-intensive industries, such as those of sugar, soap, paper, iron and pottery. In the later period of the Industrial Revolution, from 1830 to 1870, often refered to as the 'heyday of capitalism', radical new forms of transport were developed. Railways linked the centres of industry and population and steamships collected raw materials and distributed products far and wide. Both forms of transport consumed large quantities of coal, as well as distributing and exporting coal. In the 19th century the chemical industry, based on coal and its by-products, expanded rapidly.

The use of coal was a major facilitator of the Industrial Revolution enabling Britain to develop industry on a considerable scale and to support an increasing population and a rising standard of living. Britain could truly claim to be the 'Workshop of the World'. Coal 'fired' the Industrial Revolution and maintained the lifelines of a vast empire, which stretched around the world. For more than a century, coal had sped the Royal Navy around the world and filled the bunkers of a huge merchant navy. Coal was indeed the foundation of British overseas trade and in its own right was an important export commodity.

The death knell for the British coal industry came just before the First World War, with the introduction of ships powered by oil and with the relentless shrinking of her massive coal export trade, as emerging industrial nations developed their own indigenous coal industries. However, it was not until the 1980s that large numbers of mines were closed as the country turned to oil, gas and imported coal for fuel.

THE PROPERTIES OF COAL

THE CONSTITUENTS OF COAL

Ordinary 'household' or bituminous coal is a type of coal called *'humic'*. It was formed from plant-matter which was principally wood, leaves and bark and has a banded structure characteristic of sedimentary deposits. During bacterial decay, much of the plant cellulose disappears; the remainder, together with most of the lignin is transformed into *'ulmin'* compounds which are soluble in alkalis. The resistant plant tissues, resins and waxes and the waterproof protective tissues of the plants are mixed with the ulmins in varying amounts and give rise to layers within the coal which have differences in appearance and microstructure. The degree of coalification of the ulmins is related to the elementary composition and properties of the coal.

The layers along which the coal fractures are composed of an extremely friable, charcoal-like substance known as *'fusain'*, which soils the fingers and in which woody fragments which have resisted bacterial decay can be clearly seen. It does not swell on heating, has a high carbon content and usually high ash. *Durain* is a matt, dull, hard material composed of mixed plant debris. The volatile content is similar to clairain but it is non-swelling. *'Vitrain',* which is the most altered form of coal is shiny, bright and swells on

heating, has less volatile matter and can exist in bands of up to one inch thick. *'Clairain'* is of similar composition and appearance to vitrain but has a higher volatile content and swells more; it is intermediate in character between vitrain and durain.

A further group of coals, called *'sapropelic'* coals, are less abundant. These comprise the non-woody 'cannel' and 'boghead' coals.[3,4]

TYPES OF COAL

Solid fuels range from wood and peat to anthracite; their carbon content increases and their hydrogen and oxygen contents decrease according to the extent of geological metamorphosis. The carbon content of common solid fuels is: wood 49%, peat 59%, lignite 72%, cannel coal 80%, bituminous coal 86%, semi-bituminous coal 91% and anthracite (or stone coal) 92.5%. The calorific value of the fuel increases with its carbon content. Non-combustible ash decreases this to a disproportionate extent and may melt to form clinker which greatly impairs the value of the coal as a fuel.

Table 1. Chemical composition and calorific value of solid fuels.[5]

Fuel	Carbon (%)	Hydrogen (%)	Calorific value (Calories/gram)
Wood	50	6	5,000
Peat	55	6	5,500
Brown Coal	73	5	6,500
Coal	85	5	8,200
Anthracite	93	3	8,700

Lignite – is found in the UK at Bovey Tracey, in Devonshire. Some varieties show distinct woody texture, while others are structureless. They contain a large proportion of water, burn with a disagreeable odour, and are brown in colour. Lignite coal contains about 67% of carbon and 26% of oxygen. A subdivision of the class is sometimes made, called brown coal, which contains a larger proportion of carbon and less oxygen than the true lignite. It occurs in large quantities in continental Europe and in some of our ex-colonies; an analysis of brown coal from New Zealand shows: carbon 72.2%, oxygen 22.4%, hydrogen 5.4%.[6]

Bituminous coal – is common or pit coal and includes the following forms: caking coal, splint or hard coal, cherry or soft coal and cannel or parrot coal. The proportion of carbon in this class varies from 75 to 90% and the oxygen from 6-19%. The coals burn with a more or less smoky flame and are largely used for household and industrial purposes. As the proportion of oxygen decreases, the coal gets blacker and less sonorous and the friability increases.[6]

Bituminous coals may be further sub-divided into caking and non-caking varieties; the, latter when burnt, split into fragments, while the former soften on the fire and swell up, the particles bind together and to form a pasty mass. This property is an extremely

THE COALFIELDS OF GREAT BRITAIN

The coalfields of Great Britain are, with a few exceptions, contained in a series of rocks known as the Carboniferous Formation which was deposited in three phases:

Coal Measures (Westphalian) – by far the most economically important rocks of Great Britain, providing 95% of the country's coal, together with ironstone, fireclay and other minerals. Coal seams vary from thin streaks, of no economic importance, to seams of 8-10 ft in thickness, or as in the case of the Thick Coal of South Staffordshire and Warwickshire, a thickness of 30 ft or more. Seams of 18 in thickness, or less, have occasionally been worked (a sometimes quoted figure of 11 in has been regarded as a minimum economic workable thickness) in some coalfields but in general a minimum workable thickness is considered to be 2 ft.

Millstone grit (Namurian)

Carboniferous Limestone (Visean) – the lowest level, the Great Scar Limestone, is typically 3,000 ft thick.

The Coal Measures were originally deposited in five main basins on the mainland of Great Britain, of which the Devon and Cornwall basin was only worked on a small scale, probably for local consumption. The lignite beds of Bovey Tracey, in Devon, are unique in that they are the only coal to be found in this country which is not of Carboniferous date.

Coalfields in which the Coal Measures lie at the surface are called 'exposed coalfields', to distinguish them from 'concealed coalfields', in which the Coal Measures are covered by newer rocks. These are principally Permian and Triassic deposits, which were laid down immediately after the Coal Measures.

The maximum depth at which coal can be economically mined is commonly accepted to be a depth of 4,000 ft and when coal reserve figures are given they usually relate to seams lying within 4,000 ft of the surface and at least 12 in (or 18 in) in thickness. A minimum seam thickness of two ft is also often quoted.

References

Gibson W., 1920, *'Coal in Geat Britain'*, Arnold, London, pp. 311.
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SCOTLAND

The Scottish coalfields were formed by three main coal basins; the Ayrshire, Central Coalfield and Fife and Midlothians basins. The Midlothians basin is further sub-divided, by the Firth of Forth into two coal-producing areas. The Scottish coalfields differ in two important aspects from those in England and Wales:

- The workable coal seams occur, not only in the Coal Measures (which in Scotland are distinguished by the name Productive Coal Measures) but also in the Carboniferous Limestone, where about 45% of the coal output of Scotland was obtained. The seams in the Carboniferous Limestone occur at intervals throughout but are most persistent and important near the middle. These coals are normally bituminous coals, with some seams yielding the best coking coals produced in Scotland.
- In certain localities, some of the coal seams have been greatly altered by heat from nearby igneous intrusions.

The Scottish coalfields lie within a band, south-west from the Firth of Forth across to Ayrshire. The band is 95 miles long and up to 30 miles wide. Coals occur in all the sub-divisions of the Scottish Carboniferous Formation but the seams of economic importance are confined to the Limestone Coal Group and the Productive Coal Measures. Most of the seams occur in the Upper and Lower Carboniferous Series. However, those found in the Lower Carboniferous tended to be thin. A peculiar feature of these seams is the large number of intruded dykes of igneous rock that cut the coal measures. These dykes were forced in as molten lava and on contacting the coal turned it into coke and also anthracite. This latter coal commanded a higher price on the market. The main coalfields occur as a series of more or less isolated coal basins, varying in breadth and depth, strung along the Midland Valley. The individual coal seams are less continuous than in the English coalfields and, coupled with areas altered by igneous rocks, made coal mining more uncertain than in England.

The coals from both coal series are highly bituminous. Coking and gas-producing coals are also common. The Lesmahagow Gas Coal of the Auchenheath district was of exceptional quality and has been used as a standard gas coal. The Torbanehill Gas Coal of the Armadale district was rich in kerosene and was a good oil-producer. Steam coals were very limited both in number and extent and were second-class.

Refractory fireclays were also worked. Oil-shale was also mined and was the chief raw material of the British oil industry in the early 20th century. Limestone has been quarried and sometimes mined, in the Midland Valley since the mid-18th century. The clayband and blackband ironstones were the foundation of a great iron-making industry which began with the building of the Carron Ironworks in 1759. The output of iron ore reached a peak of a little over 2½ million tons in 1880 but declined thereafter, falling to 600,000 tons in 1913.

Lanarkshire (or Central) Coalfield

The Central, or Lanarkshire, Coalfield was the largest and most important in Scotland. It covers a triangular-shaped area of some 1,700 square miles, with Dumbarton, Paisley and Glasgow in the west, Coatbridge and Airdrie towards the centre and Linlithgow and Bathgate in the east. More than 60% of Scottish output was obtained from the Central Coalfield. The annual output was over 17,000,000 tons, or twice that produced by Fifeshire the next largest coal-producing county. Here, the Carboniferous succession comprises:

- Upper Carboniferous which contains the Productive Coal Measures and the Middle Coal Measures.
- Lower Carboniferous which contains the Coal & Ironstone Group, where the bulk of the important coals are to be found, together with Blackband ironstones.

Most of this coalfield consists of Upper Carboniferous measures; seams exist from Glasgow along the valley of the Clyde, almost to the town of Lanark. The Lower Carboniferous Limestone Series rise to the outcrop on most sides of the Lanarkshire Basin and to the north west of Glasgow; these have been extensively worked and are exhausted. These seams also occur in Renfrewshire and have been worked, even though they are much thinner and of poor quality. On the east of the Lanarkshire Basin from Bathgate to Wilsontown, the Limestone Series of coals are well developed and have also been extensively worked.

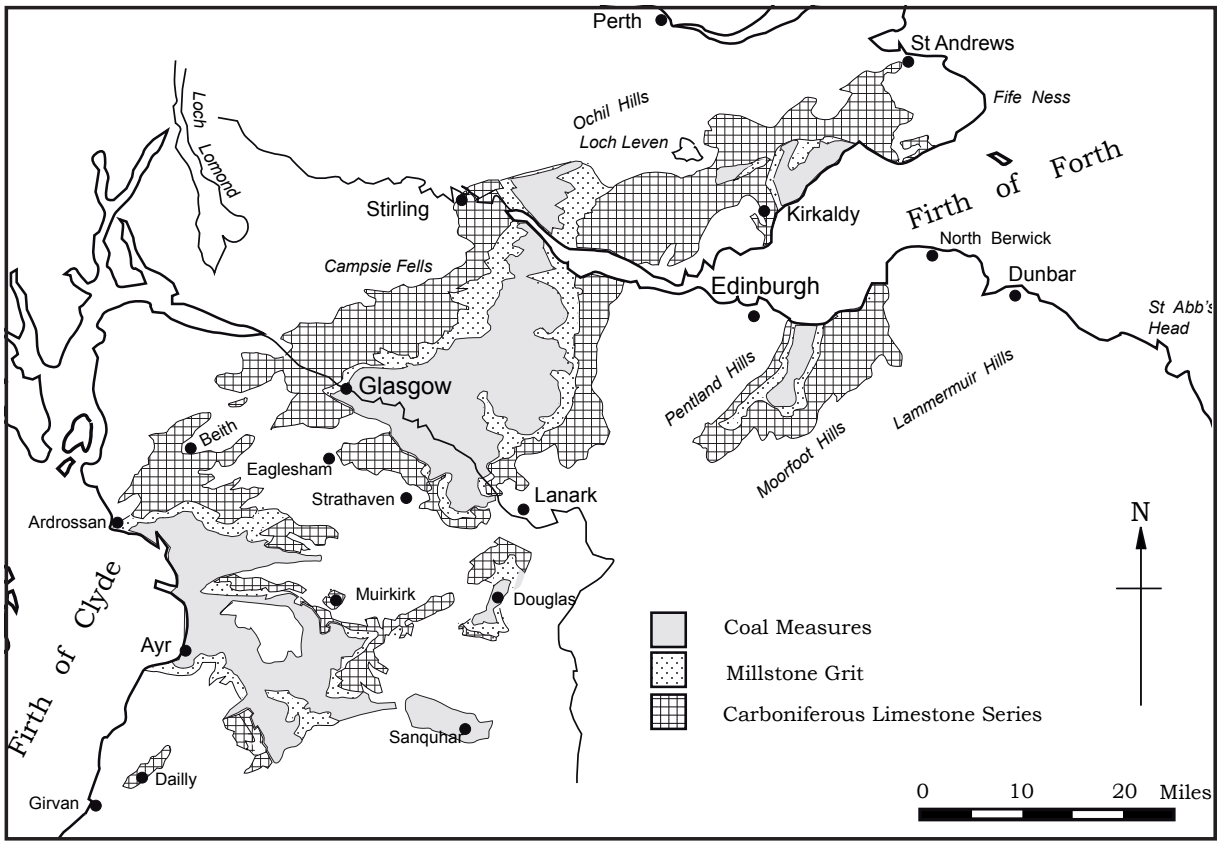

Figure 3. The Scottish Coalfield between Ayr and Fife.

In some areas both the Carboniferous Limestone and Productive Coal Measures have been affected by igneous intrusions, which have produced steam coals, semi-anthracites and anthracites. The anthracites have a low arsenic content and were much in demand by the brewery industry for malting. The coalfield also produced house coal, including the high-quality Bannockburn Main Coal, coking and gas-making coals, including the famous Lesmahagow Gas Coal. In addition the coalfield produced Blackband ironstones and fireclays and at one time the Productive Coal Measures produced coal which was extensively used for Scottish blast furnaces. In 1902 the output of this coalfield was 21,758,748 tons and in 1912 it totalled 22,506,984 tons.

Fife Coalfield

The Fife Coalfield extends roughly parallel to the Firth of Forth for nearly 32 miles and has an average width of about 5½ miles. It covers an area of approximately 170 square miles, of which a triangular-shaped area of 20 square miles, between Dysart and Leven, is occupied by the productive Middle Coal Measures and contains the well-known Dysart Main Coal, which attains a thickness of 23 ft. The general succession is the same as in the Central Coalfield but the Limestone Coal Group is richer in coal and the Upper Limestone Group also contains some workable coal seams. Within this coalfield the complete Carboniferous series of measures were found, with seams of a workable thickness over large areas. The Upper Series or Coal Measures occur in the north end of a large basin along the Fife coast from Dysart to Largo. This elongated, north to south, basin is continuous under the Firth of Forth with the Lothian Coalfield. Coal was worked for several miles under the sea. Coal also outcropped on the seashore and for 2-3 miles inland, having been worked in the area for many centuries.

The Carboniferous Limestone Series occupies a far larger area, from Elie westwards, north of Largo, through Markinch and Lochgelly, past Dunfermline to Cidross. It occupies a widespread area of which Dunfermline is very nearly the centre. The Limestone Series is thinnest near the coast at Kirkcaldy but thickens as it is followed inland, attaining a maximum thickness at Lochgelly, where the 16 seams have a total thickness from 57-70 ft. This coalfield of the Limestone Series is from 15-18 miles from east to west and 4-5 miles broad. West of Dunfermline the seams become thinner continuing to the border of the Clackmannan Coalfield, where the limestone dips west and north-west under the Millstone Grits. The latter passes under the Upper Series of Clackmannan, which is geologically continuous with the Lanarkshire Basin. From this it is apparent that the Fife and Lanarkshire Coalfields are continuous throughout the Limestone Series; the coals produced were chiefly bituminous. The Dunfermline Splint Coal was celebrated in Scotland as a steam coal. Output in 1902 was 6,206,519 tons and in 1912 was 8,435,516 tons. The last deep mine in Scotland, the Longannet Complex, which produced two million tonnes per annum, closed in 2002.

Clackmannan Coalfield

This coalfield, on the Fifeshire border, comprises an area of Lower Coal Measures some 6 miles long and 4 miles wide around Alloa and Clackmannan, the Ochill Hills forming its northern boundary. The coal seams in the Carboniferous Limestone are thinner than in Fifeshire. Over much of the coalfield the higher seams were exhausted first, leaving the deeper coal to be worked later. The coalfield principally produced household and manufacturing coals; cannel coals having been extensively mined for gas-making. Bunker coals and coals for general steam-raising are very limited in this coalfield. Fireclays have also been mined and used in the iron and steel industry and in zinc furnaces, as well as for special purposes.

Ayrshire Coalfield

This important coalfield lies on the east shore of the Firth of Clyde, covering an area of 330 square miles. The Productive Coal Measures occupy the greater part of the coalfield and the Carboniferous Limestone seams are of little economic importance. The coal-bearing Carboniferous strata extend from the borders of Renfrewshire in the north, through Kilwinning to Dalmellington in the south, a distance of 25 miles. The coalfield stretches inland from the coast at Ayr to Sorn, a distance of 14 miles. Of this large area some 60 square miles, which contain most of the valuable coal seams, has been spoilt (burnt) by igneous rocks. Coal seams occur in both the Upper and Lower Carboniferous Groups and are generally bituminous with a high percentage of volatile matter and were widely used in the domestic market, as well as for gas-making. The seams are few but thick enough to be workable in localised areas. The quality tended to be average with a number of igneous intrusions making mining conditions difficult, while turning the coal into either steam coal or anthracite. Output in 1902 was 4,044,876 tons and in 1912 was 3,935,949 tons.

Dailly Coalfield

The Dailly Coalfield forms an important part of the Ayrshire coalfields. The north-western margin of the coalfield is defined by the Kerse Loch Fault and the south-eastern margin by the Headmark Fault. The Limestone Coal Group is important with seven seams, varying from 2½ to 7½ ft in thickness. The Maxwell and Killochan Collieries

on the coalfield, survived the nationalisation of the coal industry and finally closed in 1973 and 1967 respectively. Killochan Colliery worked the Main, Hartley, Craigie and Parrot Seams, producing steam coal. Maxwell Colliery worked the Main, Hartley, Craigie, Coral and Parrot Seams and also produced steam coal.

Lothian Coalfield

This coalfield is geologically the southern end of the Fife and Forth Basin and was economically the most important in Scotland with regards to output and reserves. The sub-divisions of the coalfield are:

- Productive Coal Measures - these cover an area in the centre of the Midlothian Basin of some 9 miles in length and breadth of up to 3½ miles and attain a maximum thickness of nearly 1,500 ft. There are 12 or 13 principal coal seams.
- Carboniferous Limestone Series - contains the Upper Limestone Group, Limestone Coal Group and the Lower Limestone Group which contains two or three seams which attain a workable thickness. The Upper Limestone Group contains the South Parrot Coal which attains a workable thickness on the west side of the coalfield. The Limestone Coal Group contains at least 8 and as many as 20 workable seams.
- Calciferous Sandstone Group - contains the Oil-Shale Group.

The seams are nearly horizontal in the centre of the coalfield, where the Upper Series measures are exposed but are highly inclined at the margins, particularly on the west side, where the Limestone Series come to the surface. The seams of the Limestone Series average 100 ft in thickness in the north but deteriorate rapidly in thickness and quality the further south they are found. They usually contain bands of cannel coal, one of these in the Great Seam reaching a thickness of two ft. Cannel was a highly bituminous coal much in demand for gas making. A notable feature of the Lothians Coalfield is the almost complete absence of igneous intrusions. Probably the seams of this coalfield were the earliest to be worked. Output in 1902 was 1,945,559 tons and in 1912 it was 4,115,573 tons.

Brora Coalfield

Along the sea coast at Brora in Sutherland occurs a small coalfield of Jurassic age. The coalfield has been worked intermittently since the sixteenth century, the earliest workings from shallow pits on the south side of the River Brora, near the shore, where salt-pans were also in operation. There are two seams, the Main Coal, which has been worked for a long time and the Parrot Coal lying below it. The latter is a poor shaley coal, of little value but often 6 ft thick. The Main Coal is lustrous and rather friable, with a varying content of pyrites, which combined with a relatively high ash-content, has in the past mitigated against its use as a general-purpose coal. It is possible that the coal seams extend over an area of about three or four square miles and may contain a million tons of coal in seams of 24 in or more. Output in 1902 was 5,042 tons.

Canonbie Coalfield

On the Dumfries-Cumberland border, north of Carlisle, a small area of coal measures appears at the surface from under the Triassic deposits of the Carlisle Basin. For many years the Canonbie Colliery obtained coal from this small coalfield. The area of exposed productive coal measures amounted to about 1½ square miles. The coalfield is

and about 16 square miles in South Derbyshire. The Coal Measures at the surface occupy an area of about 24 square miles, centred on Ashby-de-la-Zouch.
The Coal Measures are divided into three groups;

- Upper Coal Measures, which contain the Etruria Marls.
- Middle Coal Measures which contain the productive coal seams.
- Lower Coal Measures or Unproductive Series.

There are 33 seams ranging in thickness from one to 16 ft with a total thickness of 94 ft. Records of workings go back to at least 1204. The coals of Leicestershire and South Derbyshire have similar properties; the majority are bright coals with low ash and high volatiles contents and are principally used for household and industrial purposes. Some of the coals were also suitable for locomotive and steam-raising. Refractory clays were worked in the South Derbyshire Coalfield. Output in 1912 was 2,765,103 tons.

WEST MIDLANDS

North Staffordshire Coalfield

This is the largest of the Midland coalfields, triangular in shape and covering an area of about 110 square miles. The detached Cheadle Basin, increases the area of the coalfield to 128 square miles. The coalfield is in essence four coalfields: Goldsitch Moss, Shaffalong, Cheadle and the Potteries. The first three coalfields cover a combined area of less than 30 square miles, with the Potteries Coalfield more than three times as large as the other areas combined and having an area of about 100 square miles. A number of large faults traverse the field, creating areas of inclined seams that approach the vertical. These are known as 'rearer' workings. There are 36 seams of one foot and over, with a total thickness of 144 ft of coal. Most of the coal worked is concentrated in seams of six ft and over. The Cheadle portion of the coalfield contains 17 seams and a thickness of 65 ft of coal.

The field is divided into the Lower, Middle and Upper Coal Measures and the principal seams are:

Lower Coal Measures	Middle Coal Measures	Upper Coal Measures
Banbury (=Little Dilhorne)	Yard,Ragman Rough Seven Ft	Peacock
Cockshead (=Dilhorne)	Hams	Spencroft
Bullhurst (=Alcos)	Ten Ft (=Two Yard)	Great Row
King (=Woodhead)	Bowling Alley (=Half Yard)	Cannel Row
	Holly Lane (=Yard)	Winghay
	Hard Mine (=Littley)	Rowhurst
	New Moss(=Four Ft)	Moss

Seams in brackets are the equivalent names used in the Cheadle Coalfield

Geological experts noted that the coalfield had the most complete known sections of the Carboniferous System and was remarkable for the variety and quality of its coals (only anthracite and dry steam coals were missing) serving a wide variety of purposes: the Great

Row was used in the production of pottery and in manufacturing, the Bowling Alley for smelting and for railway fuel, the Holly Lane was a high quality house coal and the Crabtree (or Four Foot Mine) was used for coke making. Coal, potter's clay and high grade ironstone have largely determined the character of North Staffordshire's economic development.

One of the most striking characteristics of the coals of North Staffordshire is their remarkably wide variation in properties from area to area. A coal, which was strongly coking and suitable for the production of gas, in one area of the coalfield, could become weakly coking and suited to household purposes in another area. In 1862 it was noted that the total thickness of workable coal seams in the Potteries Coalfield was some 147 ft, 25 ft more than any other British coalfield. Steeply pitched seams and considerable faulting made mining hazardous and expensive. The Goldsitch Moss Coalfield was of no economic consequence.

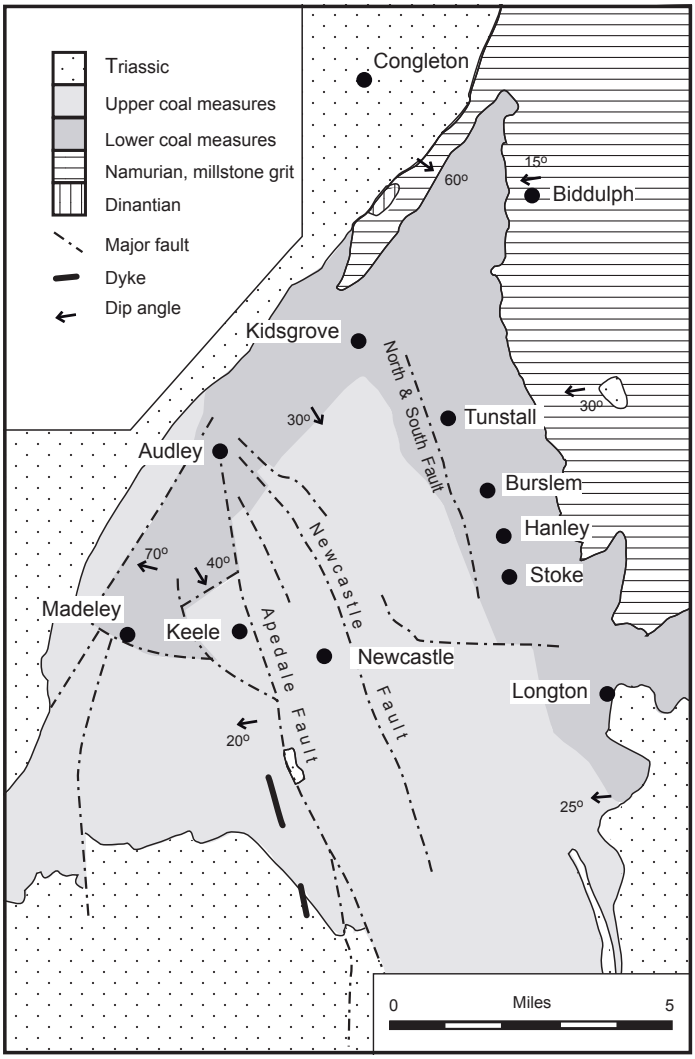

Figure 10. The Potteries Coalfield.

The first large scale investigation of the coal resources of North Staffordshire took place following the chance discovery of a rich coal seam during the excavation of a section of James Brindley's Trent & Mersey Canal between Chatterley and Harecastle. Previously there had been small scale mining where the coal seams outcropped and mining on a commercial scale probably started in the 17th century. Great quantities of coal were required in the area, for the expanding pottery industry. Other raw materials, such as marls, sandstones and ironstones were tapped during coal mining; these were used in building and iron-making and led to the rise of other industries. Many of the collieries of the 20th century were initially sunk to work the ironstone deposits and were later deepened or adapted for coal working.

Cannock Chase Coalfield

The Cannock Chase Coalfield is separated from the South Staffordshire Coalfield by the belt of Bentley Faults, which run east-west, from north of Walsall to north of Wolverhampton. The Middle Coal Measures, which were extensively worked in the 19th century, outcropped in a triangular belt extending from the Bentley Faults in the south

A COAL MINING CHRONOLOGY

43-410 AD Coal was in use in Roman Britain as evident from the remains found at stations along the Roman Wall, from the Tyne to the Solway Firth. Coal was also used to feed the sacred flame in the temple of Minerva at Bath. The principal use for coal at this time was probably as ballast in the empty grain ships returning from Tyneside to the Fens. Some writers say that the Romans used coal for salt-making, however, there is no evidence to support this claim.

852 The Saxon Chronicles of the Abbey of Peterborough, record the payment for twelve loads of fossil, or pit, coal to the abbey in 852 AD.

1085 In the Domesday Book there is no mention of coal mining in England, although there is detailed information about other trades and industries.

1180 One of the earliest references to the working of coal in the northern coalfield appears in the Boldon Book, in which a grant of land was made to a collier to provide coal for a cart-smith at Coundon. A similar grant was made to the smith of Sedgefield and the smith of Bishopwearmouth had 12 acres for the iron work of the carts and found his own coal (*carbonem*).

ca. 1200 The records of Newbattle & Holyrood Abbeys show that coal began to be dug on the south shore of the Firth of Forth, at Carriden in Linlithgow and at Preston in East Lothian before the end of the reign of William Lionheart in about 1200.

C12th By the late 12th century coal was being used by smiths and lime burners.

C13th By the 13th century the coal produced rarely exceeded 15,000 tons/yr.

The first evidence for the use of coal for salt-making dates to the 13th century. The Priory of St Bees, in Cumbria, operated a saltworks probably at either Whitehaven Harbour or the site of the later Saltom Pit. However it is unlikely that the fully fledged panhouse salt-making process took off until the 15th century and then probably in Scotland before England.

1228 By this date, sea coal was being shipped to London, as shown by a lane in London which went by the name of ‘Sacole Lane’, and was later changed to ‘Secole Lane’ in 1253.

The earliest workings of ‘sea coal’ were situated on the coasts of Northumberland, Durham and the Firth of Forth estuary.

ca. 1235 One of the first references to coal in a document was in a grant of land on the coast by Adam de Camhous to the monks of Newbattle Abbey in Scotland. The grant included the right to build a road to the shore for the

were however associated with the reclamation of relatively small amounts of high value mineral from a much larger quantity of valueless rock and shale. The principles and benefits of 'wet' separation methods were widely known at the time. Agricola also mentions that trough washers were in use, prior to 1556, for metallic ore separation.

1560 The estimated annual production of the principal coal mining districts in the decade 1551-1560:

Durham and Northumberland	65,000 tons
Scotland	40,000
Wales	20,000
Midlands *	65,000
Cumberland	6,000
Kingswood	6,000
Somerset	4,000
Forest-of-Dean	3,000
Devon & Ireland	1,000
Total	210,000 tons

*includes Yorkshire, Lancashire, Cheshire, Derbyshire, Shropshire, Staffordshire, Nottinghamshire, Warwickshire, Leicestershire and Worcestershire. (Nef J.U., *'Rise of the British Coal Industry'*.)

1563 The ninth Parliament of Mary Queen of Scots forbade coal exports under pain of confiscation of ship and cargo: *' ...quhilk is now becummin the common ballast of emptie shippes, and gives occasion of most exorbitant "dearth and scantness of fewall."* ' Rewards were offered in 1579 to the *'reveiler and apprehender of the contravenors of the Acte.'* And in 1597 King James VI enacted a ban on the export of large coals: *'the great burne coals are commonly transported forth of this realm'*.

1566 In a letter to Cecil, dated 1566, coal is recorded as being dug near Bristol.

1573 The earliest mention of a 'sough' (a tunnel driven into a hillside to drain coal mine workings) in the Wigan area of the Lancashire Coalfield, dates from 1573, when an agreement was made between James Worsley and Edmund Winstanley to construct a sough to drain their respective coal mines near Orrell.

ca. 1578 The County of Durham became the largest regional producer of coal, a position which it held for 300 years. The early development of large-scale deep mining in Durham and the expertise gained, made the area the training centre for mining engineers in the British Isles and all over the world. ('The Newcastle Coal trade II', *Colliery Guardian*, 204, p.338.

1578 A petition to the Government by London brewers, dated 1578, shows that coal was used by them. Anxious not to offend Queen Elizabeth I they offered to burn wood only in the brew-houses close to Westminster Palace, as they understood, *'her majesty findeth hersealfe greately greved and annoyed with the taste and smoke of the sea-cooles.'* Though an owner

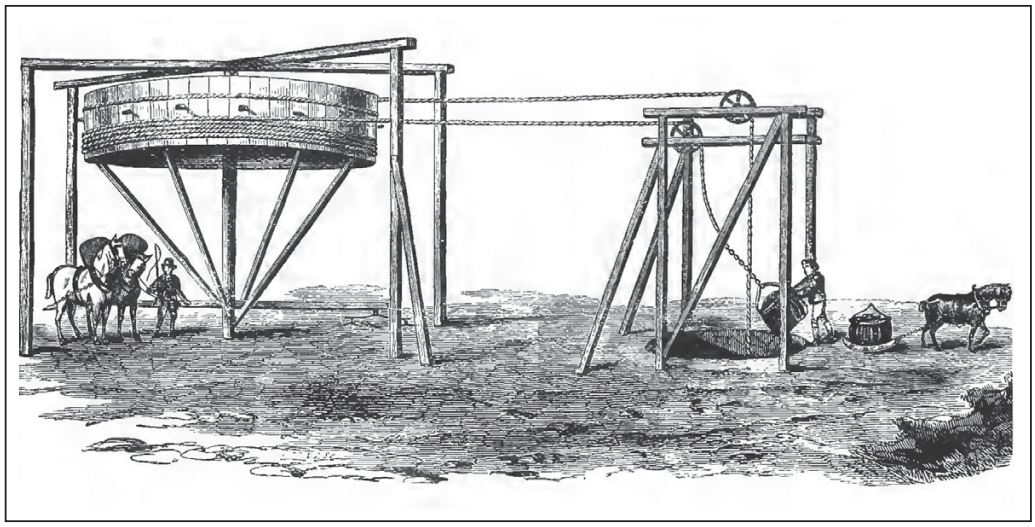

Figure 22. Horse whim in operation at a coal mine - note, the shaft is outside the horse track. [from: Boyd R.N., 1892, 'Coal Pits and Pitmen', Whittaker, London].

pit coal. This was the forerunner of the coal-tar distillation industry. Patents were also taken out in 1697.

1680s The national output of coal was estimated at about 300,000 tons. (Nef J.U., *'Rise of the British Coal Industry'*.)

1685 About 300,000 chaldrons of coal were exported to London each year.

The growing importance of coal is shown by the exclamation of the Archbishop of York in 1685, *'God bless Yorkshire and preserve the coal pits.'*

1686 Dr. Plot, writing in 1686, said that Beaudesert Colliery on Cannock Chase was the deepest in Britain at a depth of 234 ft. Cannel coal, which could be carved like stone, was mined there. The floor of Lichfield Cathedral choir was floored with alabaster and cannel coal from Beaudesert, in alternate black and white squares.

Dr. Plot went on to report that there were 12 to 14 collieries at work and twice as many out of work within ten miles of Wednesbury. These collieries typically produced 2,000 tons/yr and some up to 5,000 tons. Plot reported that a feature of mining in South Staffordshire and Worcestershire were the numerous underground fires; at Wednesbury eleven acres of coal were on fire. Writing about spontaneous combustion in the coal mines of Staffordshire and Warwickshire, Plot is reported to have said *'...that some cole-pits may and doe fire of them-selves...'*.

A 'fire lamp' (or brazier) was in use, hanging in a shaft at a Colliery at Cheadle in North Staffordshire, for the purpose of inducing ventilation. (Plot R., 1686, *'History of Stafford-shire', Oxford.*)

In 1787, the vend (sale) of coal from the Tyne amounted to 480,000 chaldrons or 1,272,000 tons. (Royal Coal Commission iii, p.23.)

1788 Dr. Ure spoke of several attempts to reduce iron (from iron ore) using coked coal.

In 1788 there were 121 pits on the Forest of Dean Coalfield, 90 of which were working and producing a total of about 94,000 tons/yr. (Nicholls H.G., 1858, *'Forest of Dean', Murray, London*.)

The earliest firm evidence of the use of flanged cast-iron plate rails at the surface of a mine, dates from about 1788. These were employed by a Joseph Butler in connection with an ironstone mine.

James Watt was the first to apply a governor to control a steam engine, when he fitted one to regulate the 'lap' rotary-beam engine in December 1788. (Dickinson H.W., 1935, *'James Watt'*, University Press, Cambridge, p.126).

1789 The steam-driven, endless-chain system of winding was introduced into collieries in Lancashire and Cheshire. There would be many 'chain pits' in Lancashire. This method of coal winding was successfully used at collieries up to a depth of 300 ft and was particularly common at the shallow collieries in and around Burnley in North East Lancashire. Endless-chain winding declined after 1865 but continued in North West Lancashire into the early twentieth century, one installation still operating in 1927. (Percy C.M., 1905, *'The mechanical equipment of collieries'*, James Collins & Kingston, London, pp.604-5).

In 1789, Brand mentioned three types of gin in use for winding: common or cog and rung gins, whim gins and 'macaroni' gins. Nothing further is known about this last type of gin, except that one of the Shiremoor Colliery pits was known as the Macaroni Pit. Brand also wrote of wheeled trams in use for conveying coal underground.

In 1789, William Jessop used fish-bellied, cast-iron edge rails and flanged wheels on a horse-drawn railway for coal wagons at Loughborough in Leicestershire. The following year (1790) Jessop went into partnership with Benjamin Outram and others to establish what was to become the Butterley Iron Works in Derbyshire, which went on to produce iron rails.

Pilkington, in *'A View of the Present State of Derbyshire'*, noted the use of firebaskets, hung in upcast shafts, for the purpose of assisting ventilation, at collieries in Derbyshire.

In 1789 Mr. Beaumont reported that the quantities of coal exported from

In 1866, London received 6,013,265 tons of coal; of which 3,033,193 tons (50.4%) were shipped by sea in colliers and 2,980,072 tons (49.6%) was transported by rail and canal. Of this total some 3 to 4 million tons were used for domestic purposes and the balance for steam vessels leaving London and for use on southern counties railways.

On 12 December 1866, the worst mining disaster of the 19th Century occurred at the Oaks Colliery, Barnsley in Yorkshire. In the underground explosions which occurred, a total of 344 men and boys were killed. On the following day a further 27 men, from the rescue team which went underground, were also killed, increasing the total to 371 deaths.

Accident statistics for 1866 showed that there was one death for every 216 men and boys employed and one life lost for every 68,484 tons mined in the British coalfields.

In 1866, a hydraulically-powered coal cutting machine was installed at Kippax Colliery near Leeds. The machine was powered by a cylinder, which obtained its hydraulic pressure from the shaft pumping column. Previously coal-cutting machines had been powered by compressed air.

1867 In the Seaton Delaval Colliery system the haulage engine and its boilers were located underground.

In 1867, Dutton introduced a cylindrical coal screen with two, or more, concentric cylinders revolving within each other.

John King patented his detaching hook on 18 October 1867. In 1873, it was successfully tried out for the first time at Sleights (Pinxton) No.1 Colliery, in Derbyshire, where he was the enginewright. The detaching hook was a safety device which was designed to detach the winding rope from the cage in the event of an overwind. (Griffin A.R., 1971, *'Mining in the East Midlands 1550-1947'*, Frank Cass, London, p.11).

Henry Johnson was principally responsible for setting up the South Staffordshire & East Worcestershire Institute of Mining Engineers in 1867.

Edward Ormerod (1834-1894) of Atherton in Lancashire, patented a successful detaching hook on 15 August 1867. It was first tried out at Gibfield Colliery, in Lancashire, in 1867. Ormerod's three-plate detaching hook was first manufactured commercially in 1868. A further patent followed in 1875, the same year in which Ormerod was awarded a medal. By this time some 700 of Ormerod's detaching hooks were in use.(Metcalf B.L., 'A century of engineering progress in British coal mines 1851-1951', Inst. Mech. Engrs., June 1951, p.9).

In September 1867, a comprehensive report was submitted to the North

The total 'engine-power' employed in British coalmines (for winding coal, haulage, ventilation, pumping water, and sundry anciliary operations) was estimated as 2,293,256 hp. (Parsons R.H., 1936, *'The development of the Parsons steam turbine'*, Constable, London, pp. 319-321

ca. 1908 A 4 miles long aerial ropeway was constructed between Rockingham Colliery and Smithywood Colliery, in South Yorkshire. (Bennett A., *'Rockingham Colliery through the Ages'*.)

1908 The Coal Mines Regulation Act (1908) reduced the working day for coalminers and made important contributions to the welfare of the mining community.

A fire started at the bottom of the downcast shaft at Hamstead Colliery on the South Staffordshire Coalfield on 4 March 1908 and was rapidly fanned by the current of air drawn down the shaft. Smoke and fumes were drawn into the workings, killing all 25 men who were underground at the time. Fortunately, the colliery had temporarily ceased production in order to carry out necessary maintenance work, otherwise the death toll would have been much greater. Attempts to rescue the trapped men, using breathing apparatus failed and it was soon realised that the only way of clearing the mine of the smoke and fumes was to reverse the ventilation flow. Eventually, the ventilation was reversed and the fire was driven back into the already burnt out-section of the mine which put it out. The Hamstead disaster caused the Royal Commission on Mines to consider the need for the ventilation in all collieries to be capable of being reversed. The Royal Commission took evidence from James Allardice who had built an arrangement of doors into the Guibal fan at Auchenbegg Colliery in Scotland, which enabled the ventilation current to be reversed without changing the direction of rotation of the fan. The Coal Mines Act (1911) included new provisions to require collieries to provide the means for reversing their ventilation.

When Bentley Colliery in South Yorkshire was sunk (1902-8), it was well known that the Barnsley Seam was liable to both spontaneous combustion and the release of immense quantities of gas, which would have to be removed by adequate ventilation. Due consideration to these potential problems was reflected in the layout of the roadways and workings. The underground layout was divided into six self-contained districts of equal size. Each district had two intake and return roads and its own split from the ventilation and was capable of being sealed off from the rest of the mine in the event of an explosion or fire. Dividing the workings in this manner proved to be great foresight in later years, contributing to rapidly increasing output and when disaster finally came – of fulfilling its primary purpose. Bentley became universally accepted as the 'safest pit in the Doncaster district'.

The first electric winder of moderate capacity in Britain, was installed at the Maritime Pit of the Great Western Colliery Company in South Wales,

in or about coal mines and to promote mining education and research. An Act of 1926 augmented the fund by a royalties welfare levy. This act also required the Miners' Welfare Committee to secure the provision of pithead baths and facilities for drying clothes. The Safety in Mines Research Board was largely funded by the Welfare Fund when it was set up in 1921. The Welfare Fund greatly improved the social conditions of the miner and his family. In 1939 the Miners' Welfare Commission was established and operated until it was superseded by the Coal Industry Welfare Organisation in 1952.

The first Rheolaleur coal cleaning plant to operate in Britain, was installed at Ormonde Colliery, Derbyshire in 1920. Designed to handle 100 tonnes/hour of 0-8 mm size coal, the plant was an experimental facility. A Rheolaleur plant was commissioned at Llay Main Colliery in North Wales in 1921 and proved to be very reliable.

Hathorn Davey differential pumping engines were still being manufactured and employed at British mines in the 1920s. The Cardiff Hematite Iron Ore Company ordered a 37 in and 72 in diameter by 10 ft stroke, horizontal compound differential pumping engine for their Llanharry iron mine. This engine was started up on 11 January 1920. In the previous year a Hathorn Davey horizontal triple-expansion tandem differential pumping engine, had been delivered to the Florence iron mine at Egremont in Cumbria, on 31 July 1919.

1921 Underground stone dusting was introduced at British collieries and resulted in a great reduction in the severity of explosions.

1922 Tilmanstone Colliery on the Kent Coalfield is believed to have experimented with ten-ton battery locomotives for underground use in 1922.

The S.F. pit prop was introduced in 1922; this had a jib key which facilitated the safe removal of the prop by enabling it to collapse slightly. ('The S.F. patent pit prop', *Iron & Coal Trades Review*, 106, March 1923.)

1923 Following the success of the tower-mounted Koepe winder at Plenmeller Colliery, a second tower-mounted Koepe winder, was commissioned at Murton Colliery on the Durham Coalfield in December 1923. The Murton installation had a reinforced-concrete tower and a single locked coil winding rope driven by a 315 KW (420 hp) A.C. (2,000 v, 40 Hz) winding motor. This structure was operational when the colliery closed in November 1991.

Brodsworth Colliery became the largest colliery in Yorkshire and, following the sinking of the third shaft in 1922-23, became the highest output three-shaft colliery in Britain. By the early 1920s Brodsworth was claiming the world record for coal drawing with a record daily output of 6,027 tons in February 1924 and a weekly output of 30,246 tons in December 1923.

Figure 68. Demolition of Newstead Colliery, Nottinghamshire [Photograph courtesy of Shane Phillips © Creative Commons licence 2.0].

and technical problems which had stopped production.
In 1995, the Selby Complex of mines was purchased by RJB Mining from British Coal. Later RJB Mining PLC was to become UK Coal.

1996 Point of Ayr Colliery, the last working colliery in the North Wales Coalfield, closed in August 1996; it had worked from 1873 to 1996.

1997 In 1997, the UK market for coal stood at 58 million tonnes/yr but by 1998 had dropped to 29 million tonnes/yr and looked set to decline further.

1998 Silverdale Colliery, the last colliery in the North Staffordshire Coalfield, closed in 1998. The colliery had worked from about 1870 until 1998.

1999 Britain's oldest colliery, the Annesley-Bentinck Colliery Combine at Ashfield on the Nottinghamshire Coalfield, closed in January 1999.

2004 The Selby Coalfield of the North Yorkshire Area closed, when the last working colliery at Riccall ceased production on Tuesday 26 October 2004. During the 21 year life of the complex, over 400 faces were worked. By 2001, the Selby complex had produced over 110 million tonnes of coal and at its peak in 1993-4 was producing over 12 million tonnes. During the life of the coalfield, the Barnsley Seam was the only seam to be worked, by a peak workforce of over 3,000 direct and over 1,000 indirect employees. In 1995, the complex was purchased by RJB Mining PLC. It was situated in an area of heavily-watered

INDEX

-Jesmond, 1676, 1769
-Johnstone Castle, 1827
-Kellingley, 1976, 2010
-Kibblesworth, 1884
-Killingworth, 1812, 1814
-Kilmersdon, 1973
-Kilnhurst, 1949, 1955
-Kingshill, 1935
-Kingswood, 1862
-Kinsley Drift, 1979
-Kippax, 1864, 1866
-Kirkby, 1968
-Knockshinnoch Castle, 1950
-Ladies Lane, 1869
-Ladyshore, 1884
-Lambton, 1769, 1878
-Langley Park, 1903
-Lawson Main, 1797
-Lea Hall, 11960, 1965, 1976
-Lemington, 1769
-Lens No.10 shaft, Belgium, 1883
-Lightmoor, 1930
-Littleton, 1993
-Llanover, 1932
-Llay Main, 1920
-Lockwood, 1864
-Lodge, 1951
-Lofthouse, 1973
-Longannet Complex, 1976, 1994
-Long Benton, 1749, 1774, 1777, 1780
-Lower Elsecar, 1852
-Lumley, 1676
-Lynemouth, 1955, 1983
-Mainband Drift, 1982
-Mainsforth, 1904
-Maltby, 1882, early C20th century
-Manvers Main, 1949, 1955
-Mardy, 1990
-Marine, 1901
-Maritime, 1908
-Markham, 1973, 1976, 1993
-Markham Main, early 20th century
-Marsden, 1877
-Merthyr Vale, 1859, 1879, 1966
-Middle Duffryn, 1846
-Middleton, 1812, 1969
-Monk Bretton, 1961
-Monkton Hall, 1976, 1992
-Moorhouseclose, 1486-7
-Morrison Busty, 1947
-Morton Hill, 1769
-Mosley common, 1954
-Moss pit, c1882, 1885
-Mostyn, 1848
-Murton, 1867, 1894, 1923, 1955
-Netherton, 1808
-Newbiggin, 1769, 1955
-Newbottle, 1769, 1878
-Newburn, 1769
-New Copley, 1880
-New Hawne, 1870
-New Hucknall, 1947
-New Moss, 1892
-Newstead, 1963
-New Tredegar, 1876
-North Biddick, 1756, 1769, 1884, 1885
-Northern United, 1965
-North Gawber, 1950s
-North Hetton, 1867
-North Seaton, 1872
-North Selby (Selby), 1983
-Norwood, 1714, 1769
-Nostell, 1883
-Nottingham, 1769
-Nuneaton, 1880
-Nunnery, 1891
-Oaks, 1862, 1866
-Oakthorpe, 1790
-Ollerton, 1946
-Ormonde, 1920, 1954, 1963
-Osmondethorpe, 1837
-Ouston, 1769, 1816
-Outwood, 1910
-Ovington's pit, 1776
-Oxclose, 1714
-Page Bank, 1860, 1863
-Parkside, 1993
-Parton, 1769
-Pease's West, 1882
-Pelaw Main, 1812
-Pelton, 1898, 1902, 1926
-Pemberton, 1852
-Penalta, 1910
-Pendleton, 1876
-Pensher Tempest, 1769
-Percy Main, 1796, 1799, 1810, 1815
-Pilsley, 1908
-Pinxton, 1867, 1934
-Platt Lane, 1870
-Plenmeller, 1916, 1923
-Pleasley, 1901
-Plessey, 1769

-Point of Ayr, 1950, 1996
-Powell Duffryn, 1869
-Prestonpans, 1907
-Pye Hill, 1976
-Radstock, 1782, 1825, 1949
-Ramcroft, 1946
-Ravensworth, 1671, 1769
-Rawdon, 1869, 1984
-Riccall (Selby), 1983, 2004
-Riddings Drift, 1969
-Risca, 1878
-Rise Moor, 1769
-Rockingham, 1878, c1908
-Rosebridge, 1860, 1876, 1885
-Rosebridge (Caroline pit), 1869
-Rossington, early C20th, 1939, 1971
-Rothwell, 1983
-Rowley, c1847
-Royston Drift, 1976
-Rufford, 1943
-Ryhope, 1855, c1891, 1956
-Rylands Main, 1888
-St. Anthony's, 1790
-St. John's (Maesteg), 1955
-St. John's (Normanton), 1887, 1899
-Salt Meadows, 1769
-Saltom, C13th, 1729, 1776
-Sandhole, 1943
-Sandwell Park, 1874, 1968
-Seaham, 1867, 1926
-Seaton Delaval, 1848, 1849, 1867
-Selby, 1979, 1981, 1983, 1989, 1995, 2004
-Senghenydd, 1913
-Sheffield, 1776
-Sheffield Park, 1783
-Sherdley, 1869
-Sherwood, 1976
-Shilbottle, 1769
-Shipley, 1869
-Shirebrooke, 1976
-Shiremoor (Macaroni pit), 1789
-Silkstone, 1876
-Silksworth, 1882, 1897
-Silverdale, 1976, 1998
-Silverwood, 1909
-Simonwood pits, c1836
-Smithywood, c1908
-Sneyd No.3, 1884
-Snowdown, 1954
-South Biddick, 1769
-South Durham, 1877
-South Hetton, 1835, 1860s
-South Kirkby, 1969, 1974
-South Moor, 1769
-South Moor (William Pit), 1923
-South Normanton, 1956
-South Shields, 1796
-Stillingfleet (Selby), 1983, 2004
-Stone, 1715
-Stoney Flat, 1705
-Sutton Manor, 1887
-Tankersley, 1902
-Tarbrax, 1904
-Thoresby, 1965, 1976, 2010
-Thorne, early C20th, 1926
-Thornley, 1835
-Thorpe Hesley, 1902
-Thrislington, 1868
-Throckley, 1756, 1769, 1886
-Thurcroft, early C20th
-Tilmanstone, 1922
-Tirpentwys, 1928
-Tower, 1994, 1995
-Townley, 1800
-Townley 'A' pit, 1808
-Trafalgar, 1881
-Tredegar, 1907
-Treeton, 1990
-Tursdale, 1859, 1911
-Tyne Main, 1778, 1830
-Tynemouth Moor, 1769
-Tynewydd, 1806
-Union Pit (Workington), 1814
-Unthank, 1769
-Upton, early 20th century
-Urpeth, 1828
-Usworth, 1847, 1871
-Walbottle, 1794
-Waleswood, 1882, 1941
-Walker, 1758, 1763, 1765, 1769, 1784, 1795, 1796, 1797, 1815
-Wallsend, 1778, 1785, 1787, early C20th, 1815, 1835, 1843
-Wallsend 'B', 1785-6
-Wallsend 'C' (Village Pit), c1835
-Wallsend 'G' pit, 1810
-Wallsend 'H', 1894
-Walsall Wood, 1889, 1891, 1955
-Washington, 1769, 1816, 1902
-Water Haigh, 1907
-Wath Main, 1928, 1949, 1955, 1970
-Wearmouth, 1826, 1846, 1873, 1883, 1951, 1957, 1976, 1993
-Welbeck, 1976, 2010
-Wellington, 1894