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# THE COALBROOKDALE COALFIELD, SHROPSHIRE. – MINERAL WORKING AND LAND RECLAMATION

by Ivor J. Brown.

The Background.

1. The East Shropshire or 'Coalbrookdale' Coalfield is one of the oldest coalfields in Britain. Although rather isolated geographically it happened to lie in the path of the Roman Road, Watling Street (now the A.5), and, from evidence found in the ruined Roman City of Uroconium only ten miles away, there is good reason to believe that the Romans used coal found where their road cut through the outcrop of the Fungeous Coal at the Nabb near Oakengates. There are several references to mining in the 13th and 14th century and from the seventeenth century the industry is fairly we documented.

From 1709, when Darby of Coalbrookdale first. successfully used coke instead of charcoal in the blast furnace, the industry literally exploded into action. This was the birth from which the area became the cradle of the industrial revolution. The number of firsts which followed and which may be credited to the area is staggering, among them are – the first metal rails (1767), the first iron bridge (1779), first iron boat (1787), first iron aqueduct (1796), first metal framed building. To support these, the area also provided the basic materials for the earliest Newcomen engines, for the world's first railway loco. built by Trevithick and for the works of many other famous engineers. The raw materials, ironstone, coal, limestone and fireclays for all these developments were obtained locally, as were the clays for the bricks to provide houses for the rapidly increasing population and the engines and works which provided them with employment.

By the late nineteenth century the industrial fortunes of the area had passed their peaks, only the poorer seams, and those more difficult to work, remained and newer, more economical works were constructed in trade centres elsewhere. The area became one of semi–decadence with abandoned furnaces and factories, brick and tile works, old railways and earlier canals and hundreds of cottages that fell short of modern requirements, situated in dying villages. To this could be added several thousand old mine workings and hundreds of quarries for stone, sand and clay, with miles of nothing more than spoil heap, slag bank and semi–waterlogged pasture between.

After the last war several committees considered the possibility of building new towns and when this became a reality, the East Shropshire Coalfield was chosen as one of the sites. The area's condition, the relative cheapness of the land and its close proximity to the West Midland conurbation were the main deciding features for this choice.

The New Town was designated as Dawley in 1963 and soon after in 1968 the boundaries were extended, it was redesignated TELFORD and its population was to grow from 70,000 to nearly a quarter of a million in 15–20 years. The total area was

to be 19,243 acres of which 5,230 acres were judged to be in need of some form of treatment including:-

| | | | | |
|---|---|---|---|---|
| 3,733 acres | (19.4%) | affected by | | shallow mine workings. |
| 2,821 " | (14.7%) | " | " | spoil deposits. |
| 833 " | (4.3%) | " | " | opencast mines and quarries. |
| 517 " | (2.7%) | " | " | landslip conditions. |

[11]

Since 1969 the Telford Development Corporation has built up a small reclamation unit, whose task it is to advise on treatment necessary so that these areas can be fully utilised, and to design and supervise the contracts which further this purpose.

2. Geological Outline.

The whole coalfield is most interesting geologically and extends from Lilleshall in the N.E. to Broseley in the S.W. It is roughly triangular in shape, about ten miles long and at maximum four mi les wide with a total area of about 25 square miles.

In the west and S.W. between Wellington and Coalbrookdale, and in the N.E. the Coal Measures rest un conformably on Lower Carboniferous rocks, (limestone and sandstone). In the south the Coal Measures rest directly and unconformably on the Silurian (sandstone, limestone and shale).

On the N.W. side the coalfield is bounded by the Lilleshall Fault which throws down Triassic rocks on its N.W. side. North–west of this fault only barren Upper Coal Measures (Keele Beds) are present under the Trias, resting directly upon pre–cambrian rocks like those of the Wrekin. On the east side the productive Coal Measures pass under, or are in places faulted against, barren, red Upper Coal Measures.

All the important seams of coal, ironstone and fireclay are contained in the Middle Coal Measures (Fig.1) which were folded along N.E. to S.W. axes and partly denuded before the U.C.M. were laid upon them. As a result of this folding and denudation, some or all of the seams are absent in the anticlinal areas, while present in the intervening synclines and on the flanks of the folds crop up against the base of the overlying U.C.M. producing the phenomenon known as the 'Symon Fault'.

The principal (true) faults run in a N.E. to S.W. direction and of these the Lightmoor Fault, with an easterly down throw of about 400 ft. approximately bisects the coalfield. To the west of this fault, the seams are very shallow while to the east mining at over 1,000 ft. depth has taken place. It is almost certain that in this direction the seams continue at considerable depth to reappear in the Staffordshire Coalfield, although no mining has been done east of Shifnal.

The New Town itself includes over two thirds of the total mined coalfield and only small areas to the South (around Broseley), the West (Little Wenlock) and the East (Sheriffhales) are excluded.

The southern boundary of the New Town just includes the River Severn where it passes through the deep Ironbridge Gorge, and both banks of this and a similar but smaller valley nearby, the Loamhole Dingle, are liable to landslip, the actual cause of which is not yet certain.

A fairly large part of the coalfield is covered by thick superficial deposits and these will be dealt with in greater detail later.

3. Mineral Extraction

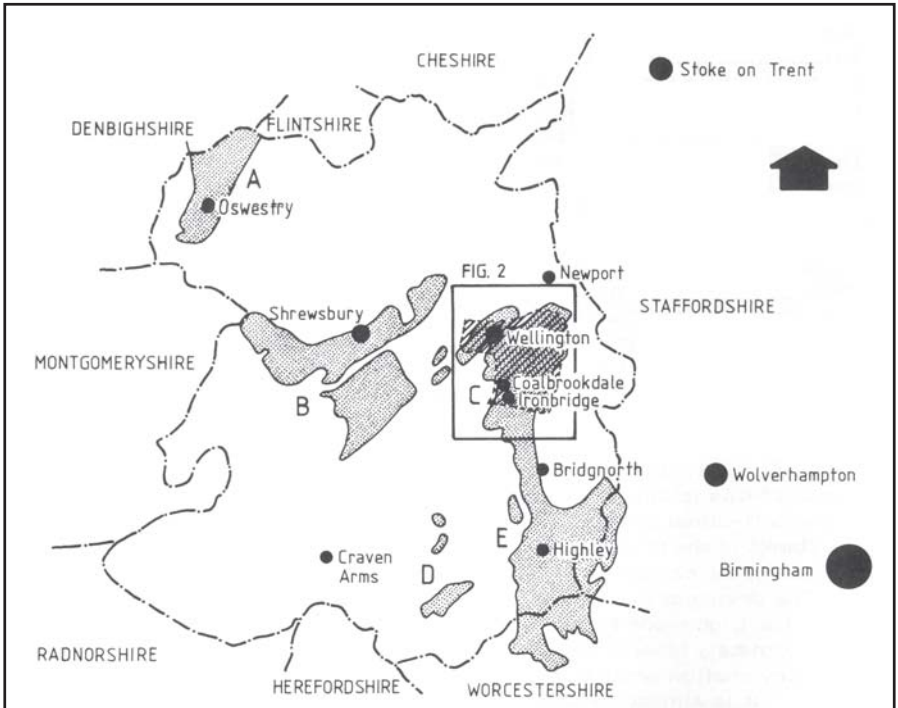
The term mineral is taken in its widest sense to include all materials of economic value extracted from the earth. The range of materials extracted has included marl, sand and gravel, boulder clay, brick clays and shales, ironstone, coal, fireclay, sandstone, limestone and igneous rocks. Secondary minerals have included pyrites, bitumen and natural gas. The extraction of all the chief minerals has produced cavities, both [12] open pit and underground and the actual methods of working each mineral have to be studied to determine the extent to which development must be restrained or until reclamation has been carried out.

The earliest mineral workings were just small pits in the deposit or along the outcrop and numerous examples of these can be seen throughout the area. During the seventeenth and eighteenth centuries these open pits or quarries became larger and more formal. By 1803 Plymley could write “in this ‘parish’ (Wombridge), Mr. W. Reynolds put into practice an idea he had conceived some years before, of uncovering the strata of ironstone and coal which lay near the surface, so as to get the whole of the strata of ironstone and coal, clay, etc. to a certain depth. This method is now followed in other works where the strata be sufficiently near the surface”.

This seems to indicate a swing from deep mining for both adit and shaft working were both extensively used at this time. Some of these workings were considerable for in 1773 Fletcher wrote of a “sloping pit” or adit “a mile under the ground”, and by the end of the century Donnington Wood Colliery plans shall it to have had about 10 miles of tunnel and nearly 100 shafts. At this time the deepest mines were over 900 ft.

The extent and effect of the working of each mineral can best be seen if they are dealt with separately. Where production figures are given these relate to the whole of Shropshire, but the bulk of the production has always been from within this Coalfield.

I Marl is found at the surface in the north and eastern areas of the Coalfield and was much worked as a fertiliser until the mid–nineteenth century. Lock, writing in 1820, was very concerned at the loss of agricultural land to mineral working and encouraged the use of lime as substitute for marl. He said “They, until lately, hurt these cold lands by making use of a bad sort of red clay marl, which they dug out of every field. A rapid deterioration of the property has been occasioned by the digging of the pits”; of course these were all shallow and do not interfere with modern development. Marl has also been worked for brickmaking and this is dealt with later.




II Sand and Gravel – Although this is a very old industry within the area, one of the earliest references is the sale of eight shillings worth of sand in 1255, the industry has always been insignificant. Few pits ever employed more mechanisation than a shovel, horse and cart. Sand pits have been worked in the Triassic near Donnington (moulding sand) and Sheriffhales and from the U.C.M. near Preston, to the north of the Coalfield. Small glacial sand pits are scattered throughout the area, around Madeley, Ketley and Wombridge. Alluvial sands are still worked at Buildwas. It is not likely that any of these works have been extensive enough to affect substantially new town developments.

III Brick and Tile Clays – These materials have been obtained from three different sources,

1. Weathered pit shale.
2. Boulder Clay.
3. Marls of the U.C.M.

[14]

This industry is an ancient one and with the great expansion that occurred 1750 – 1875 several hundred brickworks, some quite large, mushroomed into existence in addition to drain pipe, ceramic tile and pottery manufacturers. Workings in weathered pit shale around Oakengates, Wombridge and Donnington Wood have been serving a useful purpose, those in the boulder clay, e.g. at Preston and near Shifnal tended to be small in area, and shallow, causing minimum disturbance.

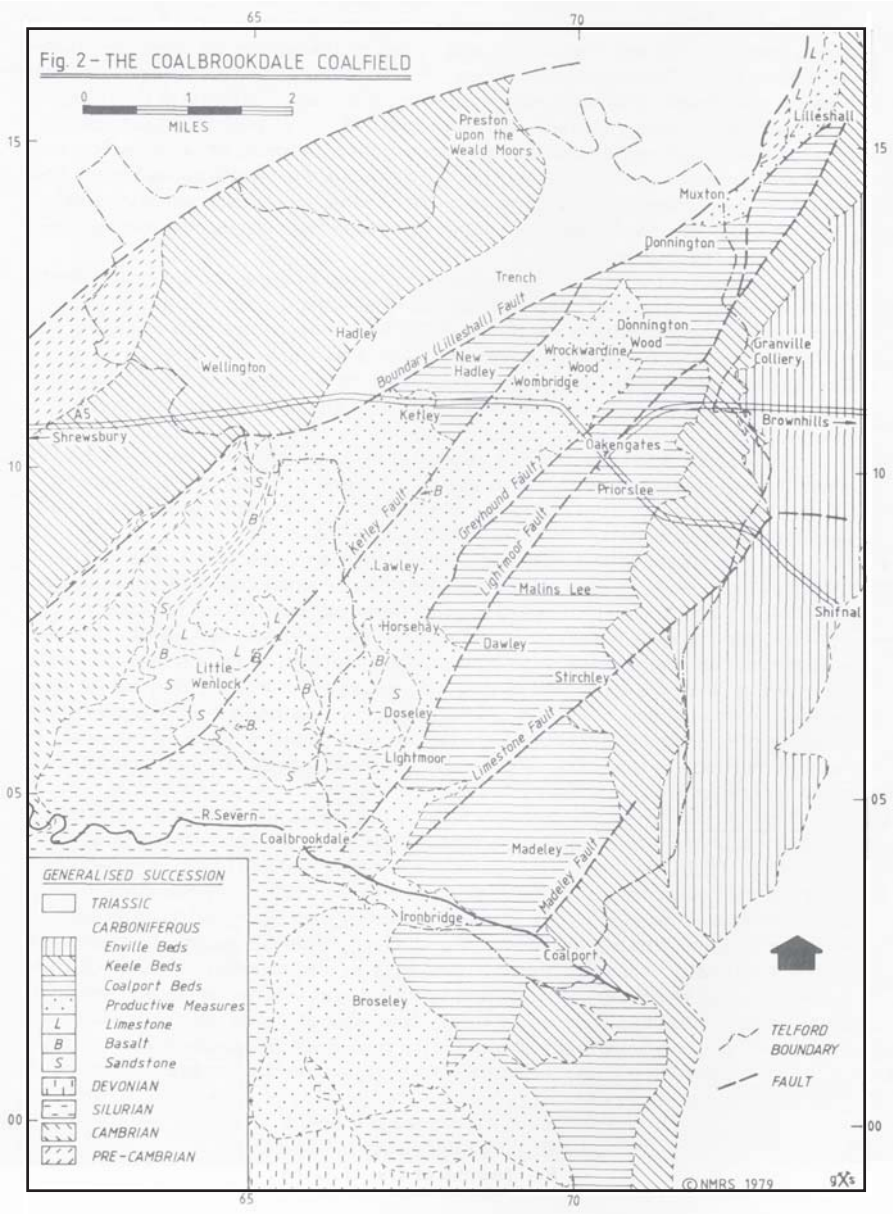
Workings in the red marls of U.C.M. have, on the other hand, produced many problems. These marls occur at several different horizons in these Measures. Upper horizons have been worked from large quarries at Malinslee and by shafts around Lightmoor. The most prolific workings have however been in the lowest horizon, in all about 17 ft. of good brick and tile clays. These have been worked at large quarries at St. Georges, Snedshill, Hadley and Wombridge and near their outcrop along both banks of the Ironbridge Gorge. The surface workings are now flooded while the shallow underground workings are waterlogged and unsafe. Considerable subsidence has been caused by these and they may well have aggravated the landslip condition in the Gorge.

Production was maintained at about 125,000 tons per annum for many years, but since the war it has fallen rapidly and now there is only one large producer remaining.

IV Ironstone – It is not often realised that ironstone production has been of equal importance to that of coal in this coalfield. Iron was being smelted using charcoal and considerable quantities of local stone long before Darbys discovery of 1709. The earliest reference appears to occur in 1250 when the local Buildwas monks were granted a right of way for the conveyance of ironstone and the peak production year was 1873 when 430, 725 tons of ironstone were produced.

The main seam worked was the Pennystone and since the ironstone nodules are found in grey shale, the whole had to be sent to the surface for women and girls to pick. For each ton of stone it said that there were ten of shale, so that the 1873 production alone would probably leave several million cubic yards of cavity and a similar amount of surface spoil heap. In addition many thousands of cubic yards of slag would also be produced in the smelting.

The Pennystone seam was on average about 24 feet thick and according to Smith in 1846 the whole was taken in six lifts each of four feet thickness, commencing with the upper one and using the longwall system. On the other hand, in evidence, during




a High Court Action over a Railway tunnel at Oakengates, it was said in 1858 that here it was worked by pillar and stall with stalls 21 ft. high, 21 ft. wide and pillars 9 ft. long by 6 – 9 ft. wide. Workings in the other ironstone seams were on a much smaller scale.

V Coal – As previously mentioned, coal was probably first worked by the Romans and has been very heavily worked since 1700. The peak years were again in the 1870's when production reached 1.4 million tons per year. Over 100 mines were .a.t work at anyone time during this period. There is an aggregate thickness of coal of about 40 ft. within the workable seams – and in some cases otherwise unprofitable seams were worked by taking them with adjacent seams of fireclay or ironstone.

[16]

In this way it was not unusual for the working height to exceed 10ft., although in many mines individual seam heights were less than two feet. In the smaller mines the pillar and stall method has always found a place, but in the larger a variation of the longwall system has been used since at least the early eighteenth century. This method consisted of a main roadway with branches, each leading to a pair of stalls, one in either side, and all stalls connected up to form a long, nearly straight face. In 1849 the Mines Inspector was very impressed with the "Shropshire" method of working and quotes one face over 1500 feet long. Two years later he wrote of another variation, a new method called the longwall retreating system. It is now believed that the conventional longwall system was also developed first in this area.

There is now only one big deep mine working in the area, the Granville Colliery; some eleven nationalised and twenty private mines having closed since 1947. About 2,000 tons of coal per week is produced at one opencast site in the New Town and three other sites produce some coal although they are mainly working clay. Opencast working is not new for, as previously mentioned it was done during the 1790's, but there was a boost during the period 1942 to 1948 which has continued in a smaller way since. Some sites have been reopened two or even three times as it became possible, with bigger machines, to go to greater depth economically.

VI Fireclay – The pattern of fireclay working has been similar to that of coal, some mines have worked it in conjunction with the coal seams, either by longwall or pillar and stall, while others have been sunk specifically for it. The peak production period was probably just before the last war when about 60,000 tons per annum were produced.

As mentioned previously, fireclay is still produced from opencasts, but the last deep mine closed in 1966.

The fireclays of this Coalfield and those of the central area of Scotland are the best refractory clays available in Britain, whenever it is possible as much of the clay within the New Town as can be worked economically will be extracted before it is sterilised by development.

VIISandstone – Most of the harder sandstones in the Upper and Middle Coal Measures have been quarried at some time for building purposes, and the construction of railway embankments and roads. The Thick Rock of the U.C.M. has been quarried around Malinslee as has the Big Flint Rock elsewhere. The Little Flint Rock was, it is believed,

actually mined for "hearthstone" in the Coalbrookdale area. It has also been worked in the Ketley area for making, after crushing, silica bricks.

Most of the workings have been small and the pits will cause no special problems to modern developments.

VIII Limestone – Both the Carboniferous and Silurian Limestones have been worked for a very long time, a reference of 1255 mentions "two burnings of lime" in which 500 oak trees were consumed. Besides being used for lime burning, the limestone has been used as a fertiliser and as a flux in the blast furnaces. One of the beds was found to make an excellent hydraulic cement. The limestones have been worked in large quarries, from adits and by shafts around Lilleshall, Ironbridge and near Lawley. While some of these underground works are still accessible, [17] many are not and there is only one mine plan known to exist. This shows only a small area of the total workings. Contemporary reports and present evidence indicate that the workings where "vast subterranean caverns" up to 45 ft. high. Limestone is not now worked within the coalfield, working having ceased about 1920.

IX Igneous Rock – The only igneous rock within the coalfield is a basalt lava flow, which outcrops to the west and is about 100 ft. thick. Just outside the area around the Wrekin other igneous rocks occur. All these rocks have been intensively worked for roadstone and some pits, nearly 100 ft. deep, around Horsehay and Doseley were quite extensive. The wall of one of these shows several lava rolls and much columnar basalt and is scheduled for preservation. The quarrying of basalt ceased about 1964, one of these quarries is now flooded, another is used as a Council rubbish dump.

FIG. 1. TYPICAL SUCCESSION OF WORKABLE SEAMS MIDDLE COAL MEASURES

Chance Pennystone Ironstone (I)
Chance Coal (C)
Chance Fireclay (FC)
Fungous C.
Fungous FC.
Ragged Robbins I
Blackstone I
Deep C
Gur C
Brickmeasure I
Ballstone I
Top Coal
Top FC
Double C
Yellowstone I
Yard C
Blue & White Flats I

Notes
1. Some localised seams of coal and ironstone are not included.
2. Seams of mineral other than those shown have been worked at their outcrop.
3. Seam thicknesses vary considerably throughout the coalfield.
4. There is no place within the coalfield where all seams can be recognised in a section

Big Flint C
Pennystone I
New Mine C
New Mine FC
Clunch C
Clunch FC
Two Feet C
Two Feet FC
Best Coal
Best Coal FC
Randle Coal
Clod Coal
Clod Coal FC
Little Flint Sandstone
Little Flint C
Little Flint FC
Crawstone I
Lancashire Ladies C
Poor Robbtns I

[18]

Secondary Minerals – The production of these minerals has not affected the surface structure to any great extent.

Pyrites – has been worked in considerable quantity in the past, mainly from the New Mine coal seam. Plymley in 1803 described the manner of producing "salts of iron" and various acids using lumps of pyrites, twelve to fourteen pounds each, taken from the coal at Wombridge. By 1900 production of "copperas lumps" had reached 400 tons per year and the production of lump pyrites commercially finally ceased in 1928.

XI Natural bitumen – occurs in both the Middle and Upper Coal Measures in several places within the coalfield and has been worked commercially in at least one place, the tar tunnel at Coalport. This tunnel has been preserved and visitors on guided tours can see considerable quantities of the mineral. It was sold for medicinal purposes as Bettons British Oil and still available, now only to raise funds for the Ironbridge Gorge Open Air Museum of which the Tunnel is now part.

XII Natural Gas – has also been produced and sold to the West Midland Gas Board. The Coal Measures are very gaseous and methane drainage is applied at the surviving colliery. The sale of gas continued until the area went over to natural gas and it is now discharged to atmosphere.

XIII The Blast Furnace Slag in the old heaps was an early and cheap source of material for roadstone and tarmacadam, but by 1928 Whitehead said "this source of material is becoming exhausted." An attempt was once made to mould hot slag into

building blocks, but this was relatively unsuccessful, although the slag lumps have been used considerably for building walls.

XIV Red Shale – the result of spontaneous combustion within the spoil heaps has also been removed commercially. Its haphazard removal has frequently spoiled a well contoured mound with mature trees thus necessitating remedial action even in areas planned for open space.

4. Development Restraints.

The mineral workings previously described have seriously affected the development potential of the area, both above and below ground and have aggravated the possible effect of natural geological features, such as faults, landslips and drainage. The possible extent and effect of each restraining feature must be considered when development is envisaged as is shown by the following. For the sake of brevity the problems and solutions have been greatly simplified.

Surface Restraints.

I Spoil deposits – There are about 3,000 acres of spoil heap within the New Town boundary alone and the combined effects of the many heaps in some areas give a natural level twenty to thirty feet above the original. Much of this spoil is only loosely compacted and modern earthmoving methods reduce the total volume by up to 15%. Some of the heap materials naturally support vegetation, others do not, while the heaps from the coal mines have frequently burned spontaneously to form red–shale. Treatment consists of re–grading and controlled compaction.

II Waterlogged and Flooded Ground – This has been caused by differential subsidence of the land and spoil deposits affecting former natural drainage paths. Formerly underground drainage was accomplished by [19] central steam pumping engines and long drainage levels or soughs, the former have stopped and many of the latter have now ceased to function and the water table has generally risen. Flashing has also occurred in the Priorslee – Donnington area, probably due to the collapse of pillars left in the mines. Treatment is to put in storm sewers (where necessary constructing tunnel – culverts using the caisson method) and removing materials such as heavily watered materials and peat, which do not make good constructional foundations.

III Opencasts, quarries and open–pits cover over 830 acres within the New Town alone. Generally the open casts have been refilled and re–graded and after 15–20 years should be sufficiently compacted to be used for building. The quarries and pits remain open and, in many cases, flooded. Treatment is to refill by layer placing and controlled compaction.

IV Landslip conditions occur naturally in the area and the effects are considerable, for example, earth slips have blocked roads and covered houses and as recently as 1954, one slip carried the Severn Valley Railway line 1,200 ft. and caused the evacuation and partial abandonment of Jackfield Village. Although the causes are not yet fully understood, it is thought that some landslips may be partly due to

movement of spoil on valley sides, possibly accelerated by water pressure from the old workings in the seam outcrops behind. However, the slips have occurred at several different geological horizons in some of which no mining has ever taken place. Research is being carried out into these slips, but it is quite likely that the only practical treatment possible may be some artificial drainage and the avoidance of these areas when planning development.

V Random building of hamlets in the past around the more profitable mines with furnaces, foundries, brickworks, schools, shops and chapels causes some problems when planning present–day large scale developments. As many of these works had been abandoned and the houses have few modern facilities, some large areas are being cleared for development by Compulsory Purchase Order, but wherever possible, existing built–up areas are incorporated in modern developments.

Sub–surface restraints.

VI Faulting – Several large faults, including one of over 400 ft. in a fault band 200 yds. wide, and numerous small faults are present in the area. As, except for the Granville Colliery, no underground working is now taking place, substantial differential movement is unlikely to occur unless pillar collapse takes place. In the deep–mined areas the affect of this is unlikely to be felt at surface, but in shallow areas it could. An attempt has been made to locate some of the faults using the seismic geophysical method, but drilling appears to be more successful especially in the shallow areas. No treatment is really possible except that the major faults, once located, can be avoided when planning developments.

VII Shallow Mining – i.e. workings less than, say 100 ft., has taken place over nearly 4,000 acres within the New Town area. It is conceivable that beneath anyone point, there may be as many as twenty–four cavities (twelve coal, seven ironstone, three fireclay, one limestone and one red–clay at a higher level). No case is known, however, where this [20] exists, but up to ten cavities would not be at all unusual. The cavities would be the result of the extraction of over thirty vertical feet of mineral, although some of this would have been taken up in general subsidence. Another problem is caused by the thick layers of sandstone which can bridge the subsidence that occurs below them and leave a void made up of the combined subsidence resulting from the working of these seams.

Since mining in the area was already on the decline when the laws were passed making it compulsory to keep plans, those plans that remain can only be used as a guide to the fact that the seam will have been worked in that place, possibly over a wider area and in determining the depth of the seam and the location of faults and some shafts. Shallow workings are best located using close–spacing exploratory boreholes. Treatment could be by digging out, back–filling or stowing. Opencast working to remove the remaining seams of mineral, and that mineral remaining in the worked seam (up to 25% of original volume), is being used to dig–out the shallow workings in some parts of the New Town area.

VIII Shafts – There are over 3,000 known shafts within the coalfield and possibly as many unknown. Most of these are seven to eight feet diameter and with depths varying from 10 feet to 1,200 feet. Many of the shafts are not now evident at the surface and the methods which can be used to locate these include the study of old plans and surface features (brickwork, drainage, etc.), excavation and trenching and the use of close–spaced short hole exploratory drilling. Both the magnetometer and electrical resistivity geophysical methods have also been used, although, as yet, without much success.

Many of the shafts were crudely filled during public uproar after a boy was lost down one in the late 1940's, and the degree of compaction, presence of cavities, etc., has to be tested by drilling through them before development can take place. Treatment is by drilling and grouting or controlled filling, and capping with reinforced concrete. Adits too may have to be treated, but this can be done in the main by dealing with them as for shallow mining.

IX Outcrops – Due to the faulting and topography of the area all the seams outcrop at least once and the outcrops are indicative of many of the restraints mentioned above. All geological information is collected and is of vital importance in ensuring the stability of buildings and roads.

Other problems include the presence of mine gases and of spontaneous combustion. Regarding gas, two persons have been asphyxiated at adit entrances since the last war and during recent exploratory drilling near Lilleshall the gas pressure was so great that it was difficult to keep drill rods in the hole.

In another incident, an explosion injured two men during shaft filling operations at Madeley Wood Colliery in 1968.

Spontaneous heatings continue in two old spoil heaps and near Shortwoods old workings are on fire giving a moon–like landscape to the surface and in another case a fire in a seam, said to be solid, is approaching a housing estate.



5. Land Reclamation.

The earliest attempts at reclamation are reported by Lock in his book of 1820, he wrote in reference to Redhill – Donnington area.

"To level down these pits, and to render them again fit for the purpose of husbandry, has been an object of great attention. In this way, there was applied the labour of a great proportion of the parishioners, to whom, from time to time employment has been afforded, in those years when the circumstances of the country rendered such an exertion of the landlord's bounty necessary. This was particularly the case in 1817, in which year a vast body of men was employed on each of the estates."

The next major attempt at reclamation does not seem to have been made until 1934 when for the next four years a party of students and others from the League of Nations spent their summers removing spoil mounds in the centre of Oakengates.

Oxenham in his book 'Reclaiming Derelict Land' records that between 1946 and 1964 some 744 acres were reclaimed in the coalfield – but this 'reclamation' may only have been superficial or simple re–grading and the land may not have been reclaimed for any other purpose than for open space. Similarly, the designation of derelict land may cover a very wide, or a very narrow, range of conditions.

During the next few years the Telford Development Corporation have to reclaim large areas of land containing all the problems mentioned above and already several major schemes are underway.

The following are examples of reclamation projects recently carried out in Telford New Town:

(a) Deep–mined area containing 20 shafts, 2.7 million cu. yd. of spoil heap, old clay works, stone quarries, abandoned railway and waterlogged ground. Total area 70 acres.
The whole to be re–graded, drained, shafts drilled, grouted and capped at a total cost of nearly ¾ million pounds.

(b) Shallow–mined area containing about 24 shafts, some old spoil heaps, old ironstone and coal outcrop workings, at least five seam outcrops and extensive un–recorded old workings. The whole to be opencast for coal and clay to a depth averaging 50 ft . Total area 38 acres.

During the operations the shallow workings are removed, shafts treated and area backfilled using specified and controlled methods. As this is a joint operation with the N.C.B. Opencast Executive, there are no additional reclamation costs to the New Town Corporation.

Conclusion.
This short paper has attempted to show the effects of extensive mineral working upon a relatively small area and the problems that it raises when re–development has to take place. Already some parts of the area have changed beyond recognition and the worst areas described in the early paragraphs will gradually change also as the reclamation and redevelopment programme accelerates over the next few years.

96 Manygates Lane,
Sandal,
Wakefield,
West Yorks