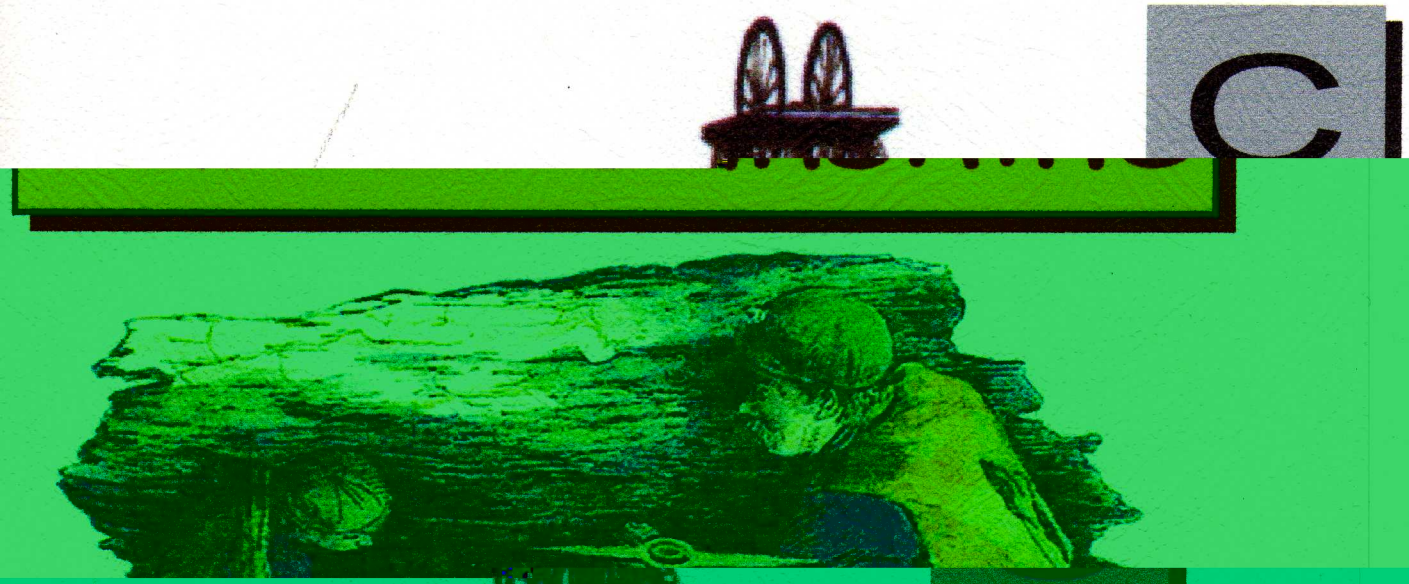
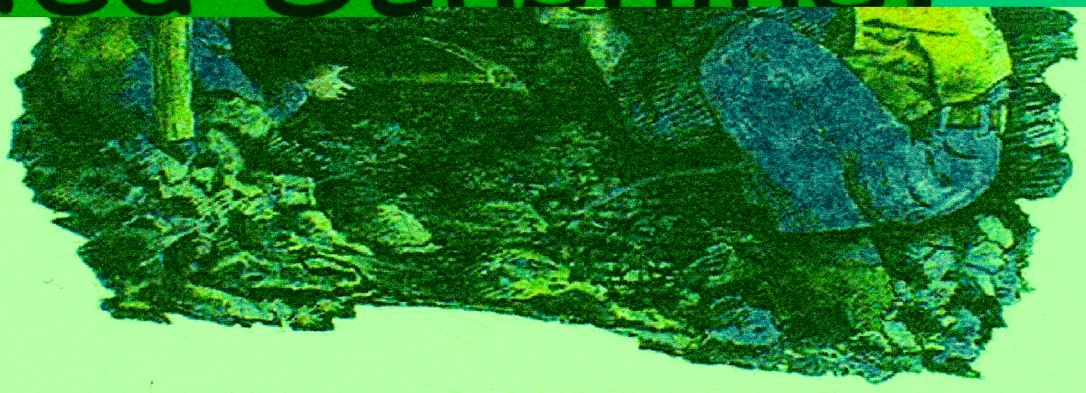
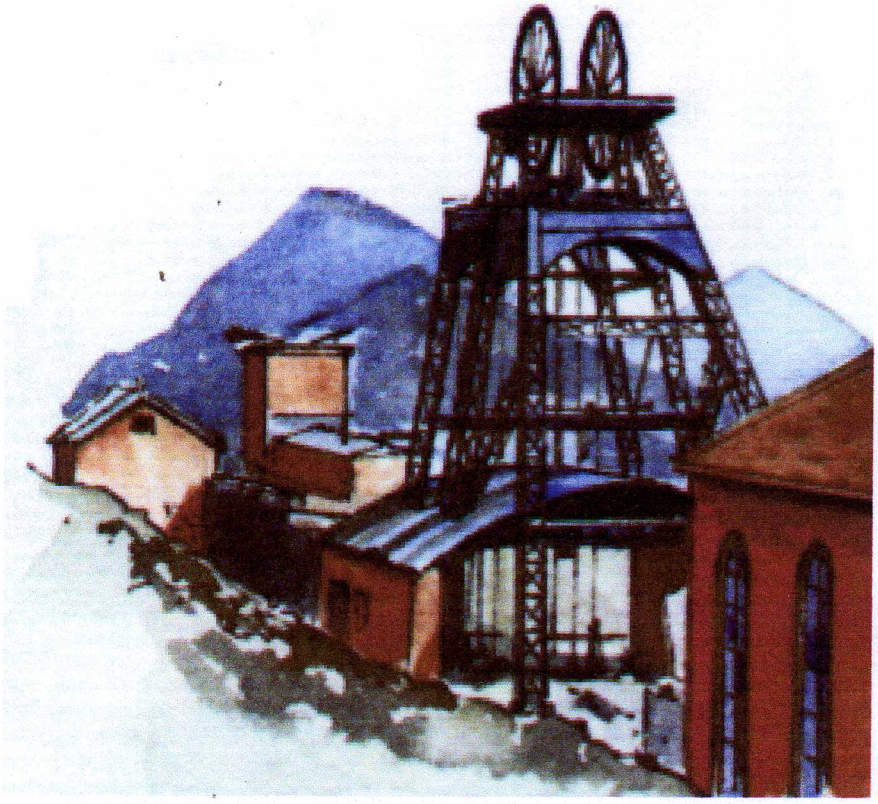


COAL

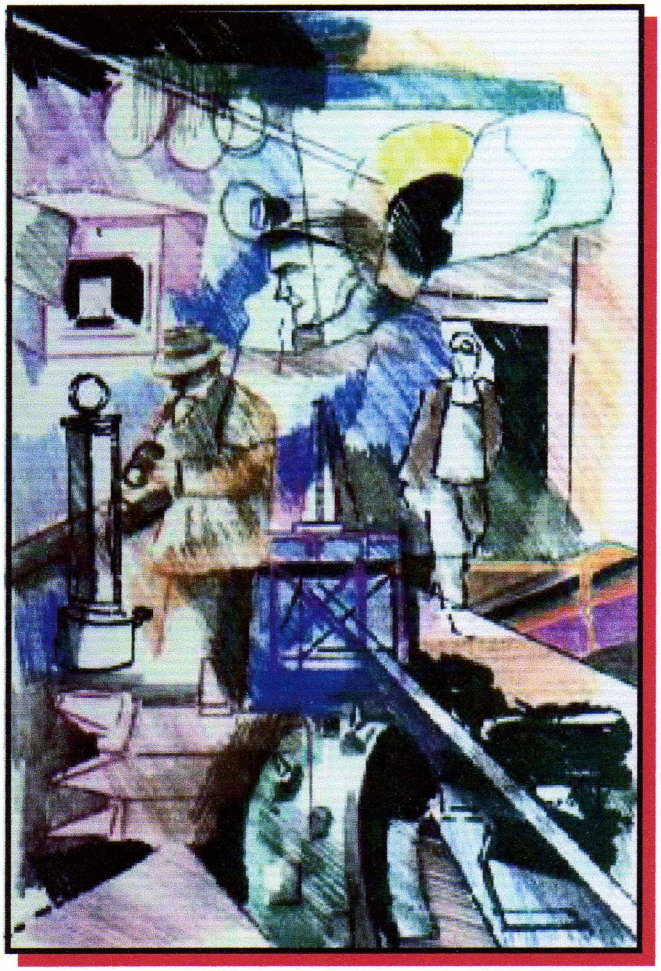
Buried Sunshine





COAL

Buried Sunshine



INTRODUCTION

When I was a young boy, living in Ballingry, I had a book called -

THE CHILDREN'S BOOK OF ACHIEVEMENT

Now sadly out of print it had a really interesting chapter with the title -

BURIED SUNSHINE - COAL

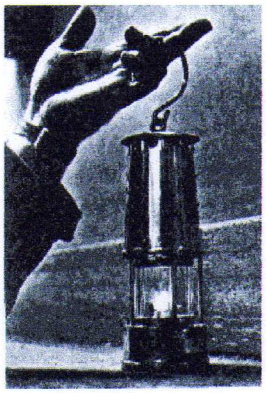
It contained fascinating information about the importance of coal - not simply as a fuel, but as a valuable source of other fuels, chemicals and everyday substances.

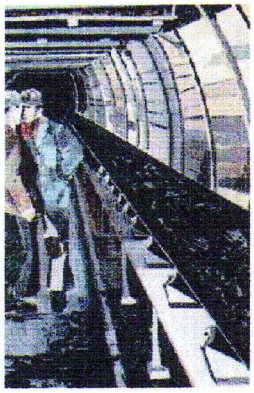
Maybe this was the reason why I had a career in chemistry, starting out in industry but ending up as a school teacher of the best subject in the school! The National Coal Board produced some fantastic booklets free for use in schools at this time and one in particular - **"Your project is coal"** - was a great favourite with many of the school teachers and science students. These two acknowledged publications are the sources and the inspiration for this presentation:

"Coal - Buried Sunshine"

Chris Sparling

COAL - BURIED SUNSHINE





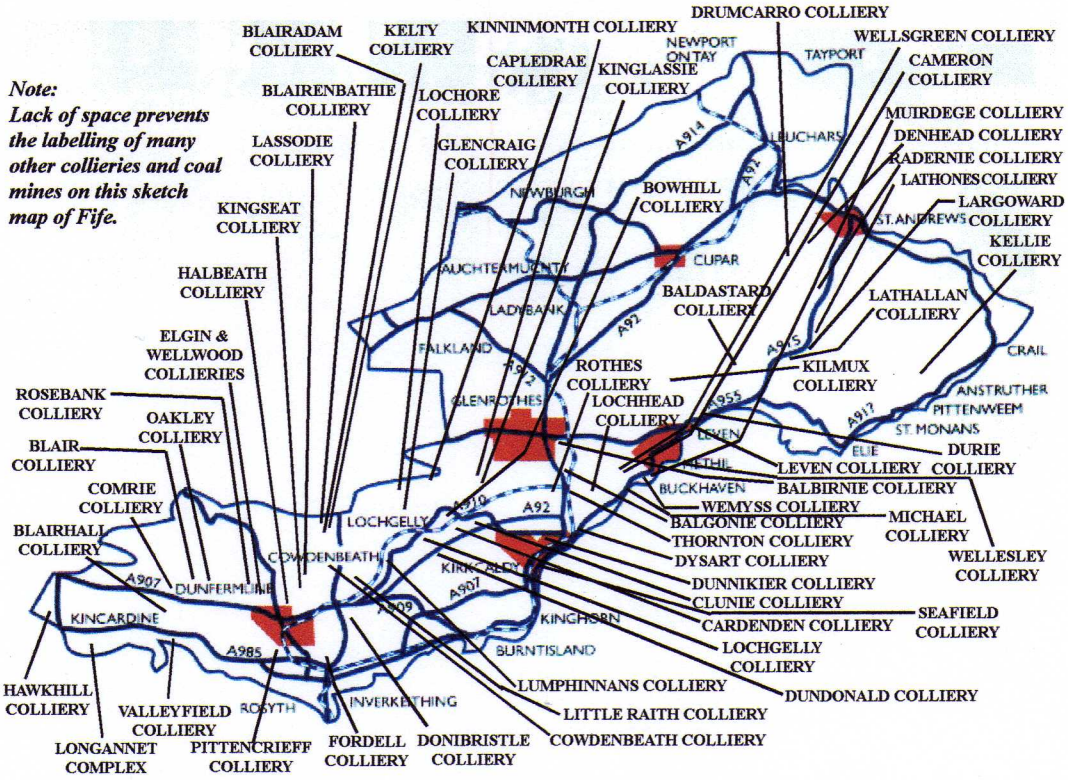
The 'Kingdom of Fife' is very rich in the history of coal mining. Although there are no more working coal mines in Fife, it is important for you to realise just how much the coal mining industry was a big part of everyday life for many people in previous centuries.

In addition to providing you with a great deal of useful information on formation of coal, composition of coal, coal mining practices and the many uses of coal, these notes may give primary teachers and classroom assistants some ideas for either individual-pupil project work or whole-class projects on coal.

As you read the notes, remember they describe times past when the Fife coal pits and mines were the workplaces for many thousands of men as miners, engineers, labourers, etc.

COAL - BURIED SUNSHINE

Coal pits and coal mines have been worked in the Kingdom of Fife for many centuries. Some are so ancient that no records of the coals worked exist. Fortunately, old maps and plans exist to show the locations of many old coal pits and collieries worked during the 17th - 20th centuries. In comparison to the extensive Fife collieries which were established in the 20th century, some of the early pits were very small and some just shallow holes in the ground!

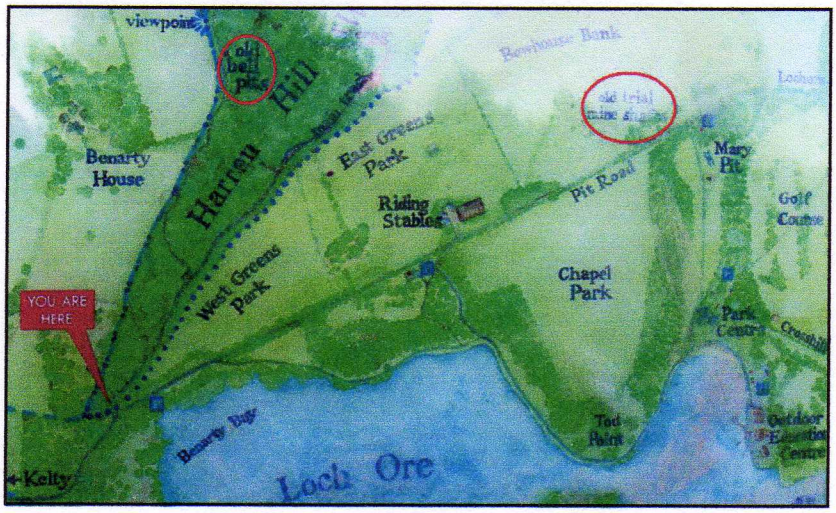


There were coal works across Fife from Tulliallan and Kincardine, in the west, to Anstruther and Crail, in the east of the Kingdom. There were even some small coal pits near Falkland and, in the north-east of Fife, near the historic town of St Andrews.

COAL - BURIED SUNSHINE

OLD PITS IN YOUR AREA

One information board to the west end of the Lochore Meadows Country Park shows where you can see the sites of old bell pits and trial mine shafts.

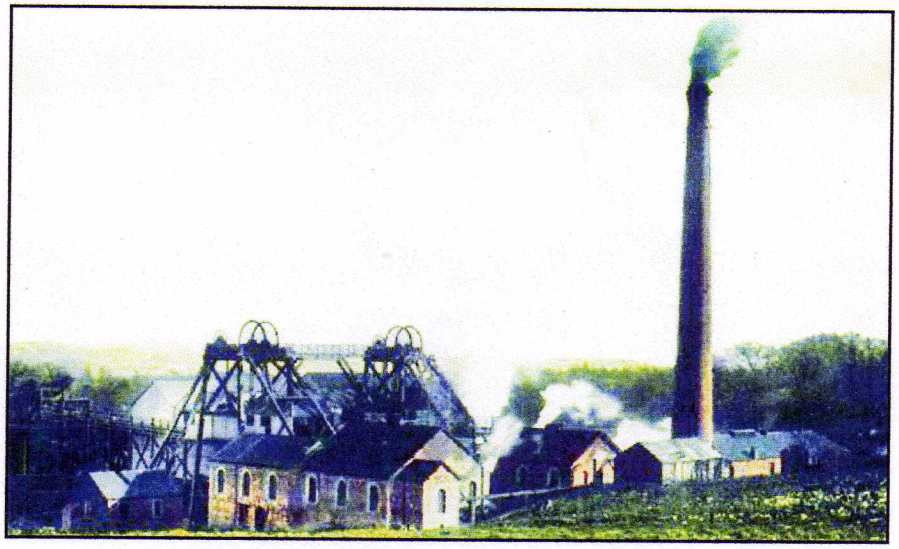


This is the site of one of the bell pits on Harran Hill.

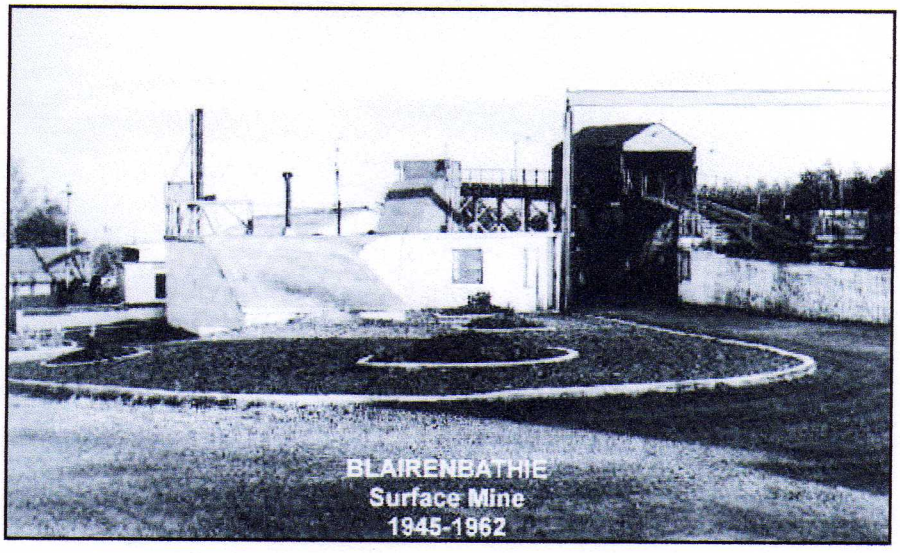
COAL - BURIED SUNSHINE

COAL PITS AND MINES NEAR KELTY

Blairenbathie Colliery



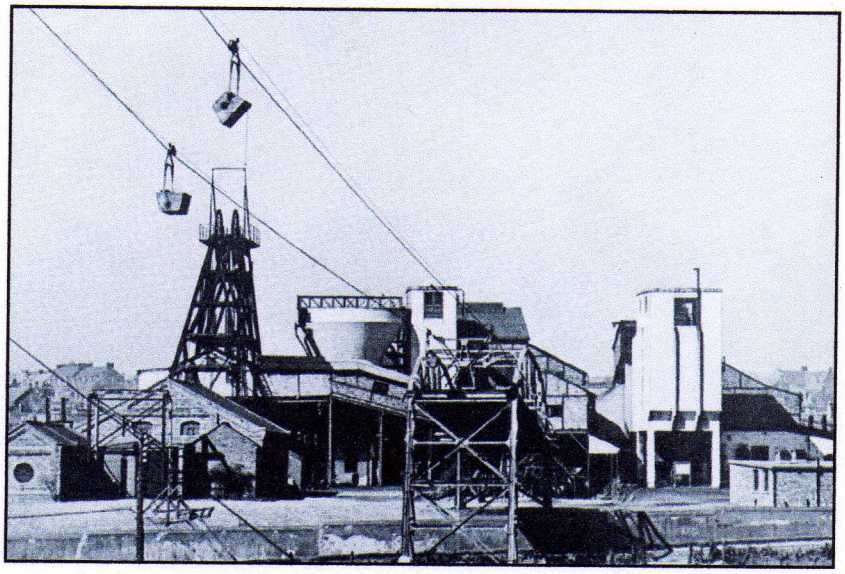
Blairenbathie Mine



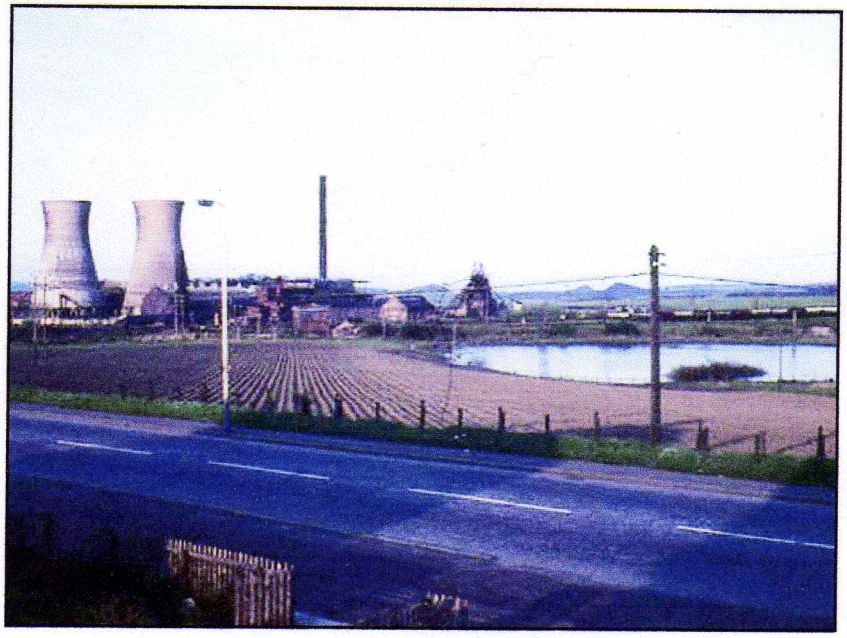
COAL - BURIED SUNSHINE

MORE COLLIERIES NEAR KELTY

Lindsay Colliery



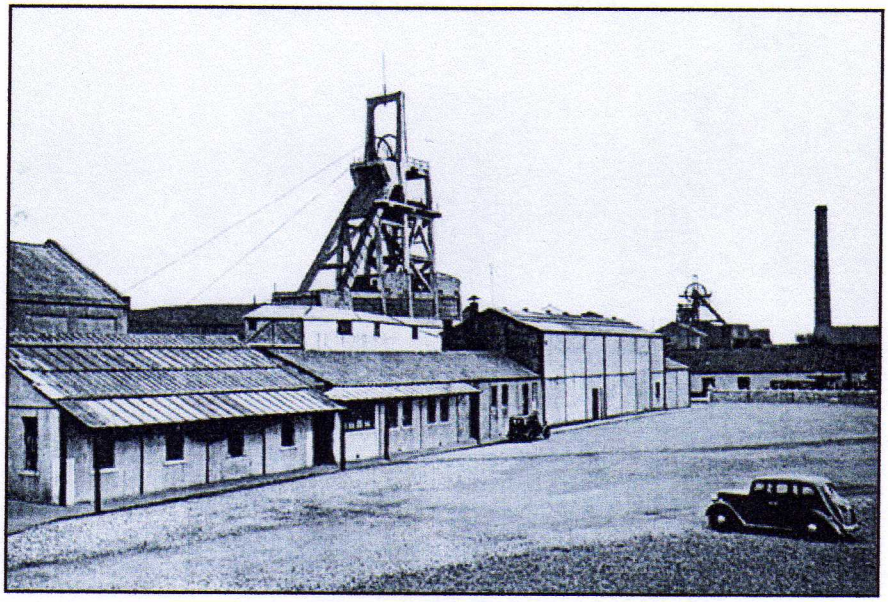
Aitken Colliery

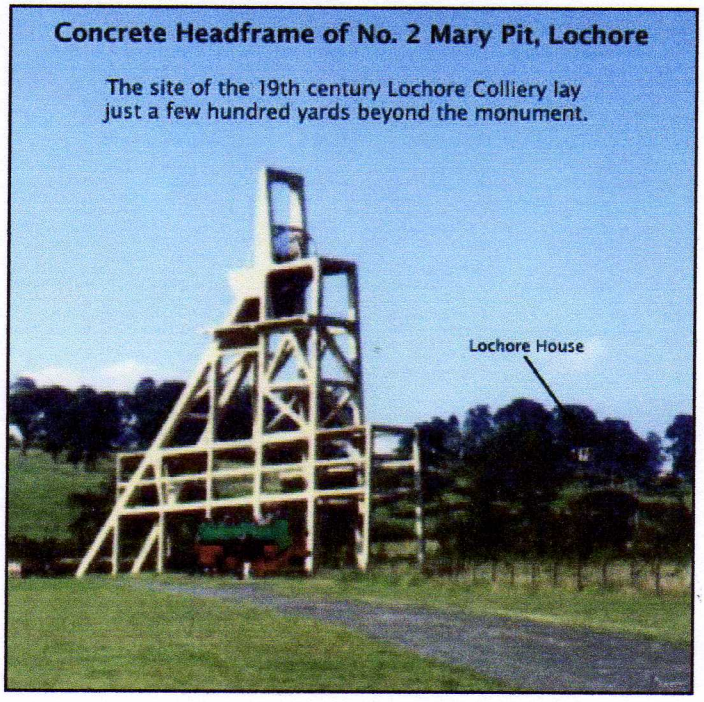


COAL - BURIED SUNSHINE

LOCHORE'S MARY PITS

The Mary No. 2 Pit (foreground) with the older Mary No. 1 Pit and its chimney in the distance.

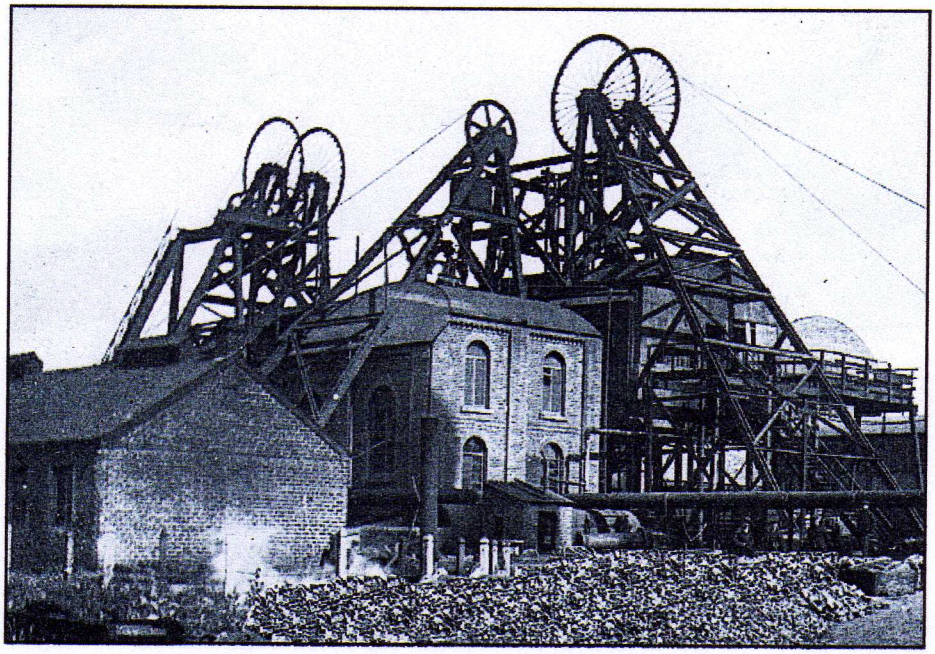


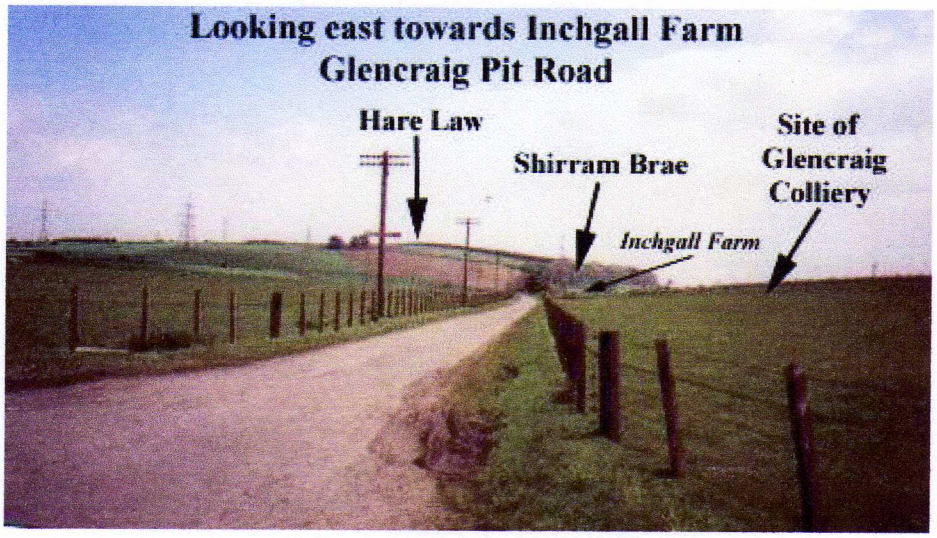


COAL - BURIED SUNSHINE

GLENCRAIG COLLIERY

Glencraig Colliery had two shafts - the No. 1 and the No. 2 - which were sunk quite close together.





COAL - BURIED SUNSHINE

DISCOVERY OF COAL

Coal was known to man thousands of years ago. Ancient writings tell us that three thousand years ago the Chinese knew that certain kinds of black rock would burn, and in one part of the country where there was little wood they used to dig into the earth to find this black rock for their fires.

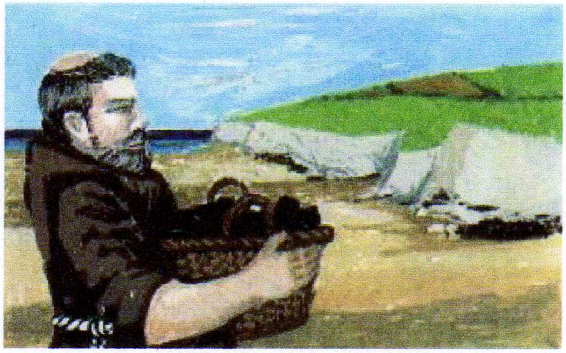
This is thought to be the first evidence of coal being deliberately dug from the ground, but it is quite possible that even before this, coal was used for fuel in some parts of the world.

Early man probably discovered it by accident when he noticed that in some places the black stones on which he built his fires would burn.

COAL - BURIED SUNSHINE

WORKING THE COAL

When the shortage of wood in some places forced men to look for other material to burn, they searched for coal in the banks of streams, by the cliffs at the seaside ...



... or on the sides of the valleys and hills.

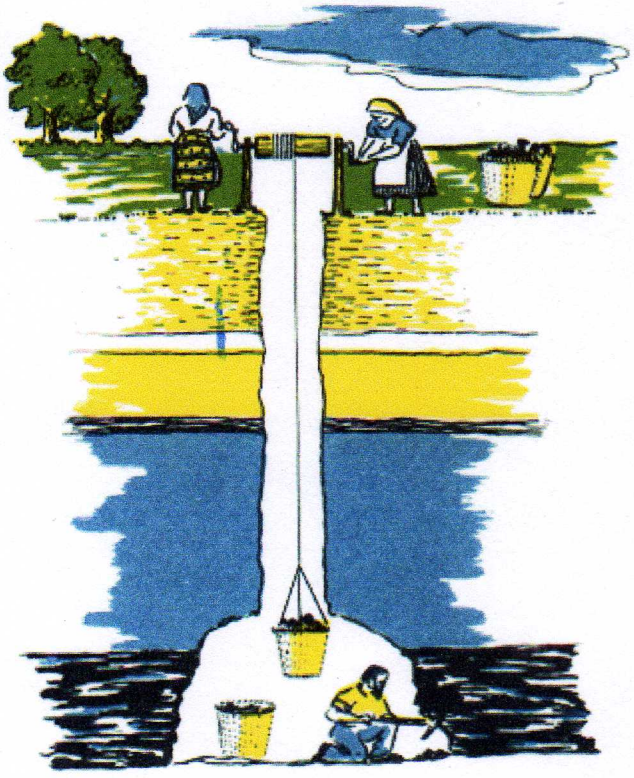
Having found coal, they worked it by burrowing into the cliff face or hillside, as they soon discovered that the coal occurred as a thick layer or 'seam' running into the hill.

COAL OUTCROPS

The place where a layer of coal or any rock comes to the surface is known as its 'outcrop'.

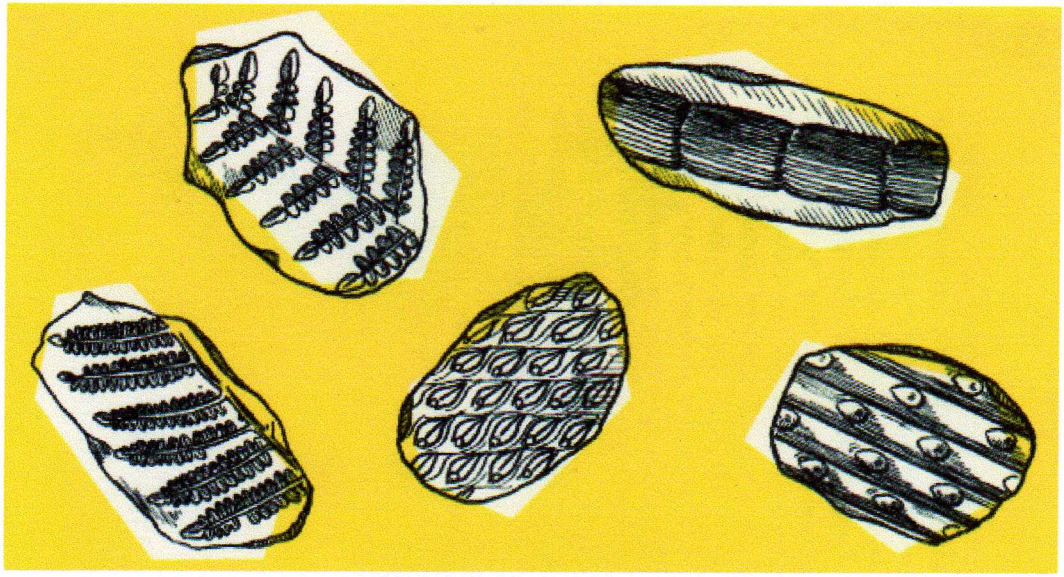
When as much coal as possible had been dug from one outcrop, a search was made for another outcrop and it was often found that there were several seams one above the other, separated by layers, or strata, of other kinds of rock.

It was noticed by these early coal diggers that the coal seams continued beyond the ends of their burrows, so when no more coal could safely be worked from the outcrops or edges of the seams, coal pits were dug to reach down to the coal further from the outcrop. These pits were like village wells near the top, but in order to uncover as much coal as possible, they were made wider as they got deeper, and because of their shape they were referred to as 'bell pits'.



FORMATION OF COAL

Imprints of leaves and stems of plants are often found in the roof of a coal seam - that is, in the rocks immediately above the seam, and sometimes a tree stump is found in this position.
In the pavement, or rocks just below the seam, dark worm-like markings are seen which prove to be the remains of tree roots. The imprints are **fossils**.



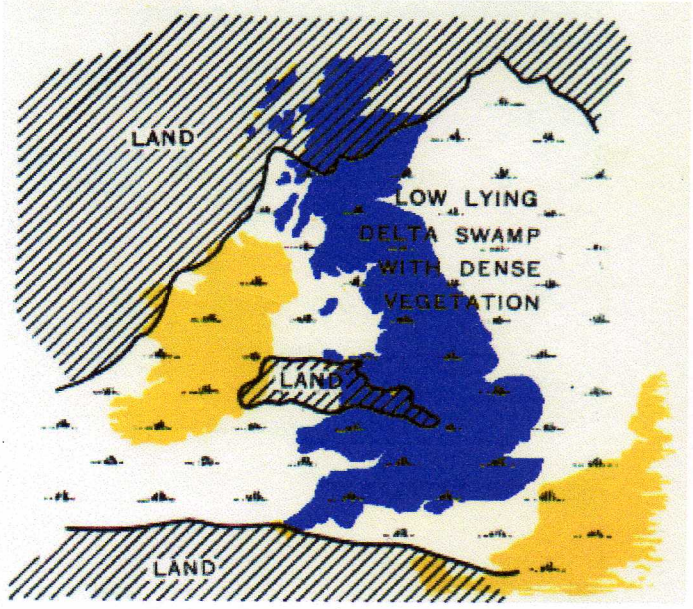
When a very thin slice of coal is examined under a **microscope**, it is seen to contain pieces of plants. When a **chemist** analyses a piece of coal he finds that is just a sort of **altered or changed wood**. These facts leave no doubt that coal is made up of **plant material** which has somehow been changed into a very different kind of material.

COAL - BURIED SUNSHINE

FORMATION OF COAL

If you could go back in time, say, over 250 million years ago, Lochore, Kelty, and the rest of Fife would have been a warmer, damper place which became covered with trees and giant ferns which died and eventually sank into the swampy land which was slowly sinking.

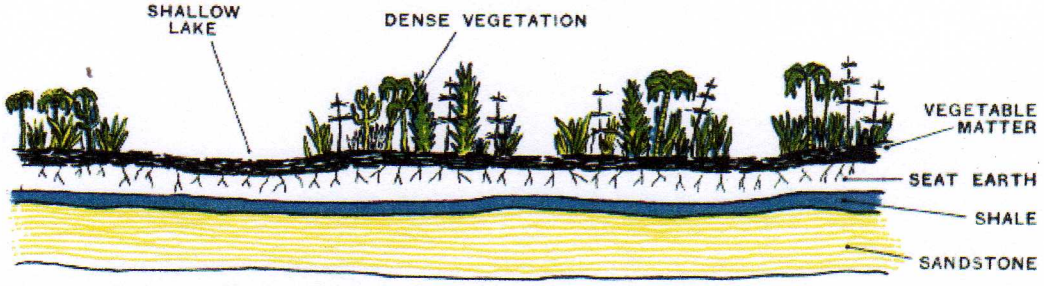
This forest swamp condition across Fife lasted for many centuries, during which time the trees, as they died, formed a thick sludge of partly-decayed, vegetable matter which was a kind of **peat**.



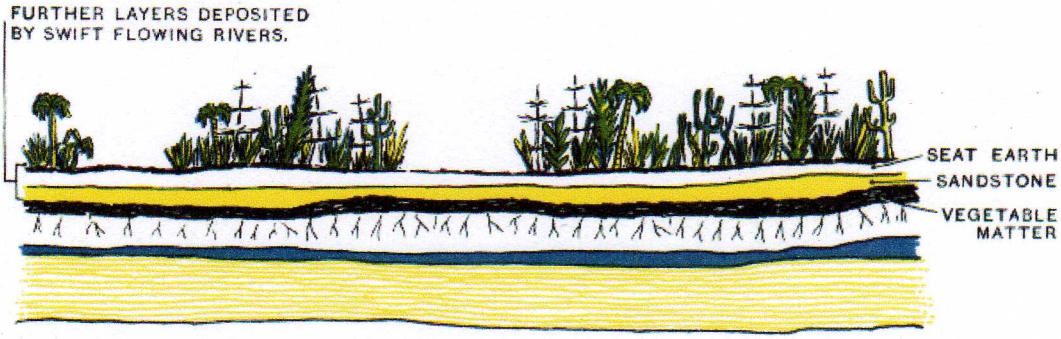
Do you know where Fife is on this diagram, where Scotland, England and Wales are coloured blue?

COAL - BURIED SUNSHINE

FORMATION OF COAL



Eventually sinking began again, the forests were overwhelmed by water, and the rivers again poured layer upon layer of sand and mud over the area.



After millions of years, these conditions came to an end. The areas of land and sea changed and, although thousands of feet of rocks were formed on top of the layers of peat, sand and clay, they never again contained any peat layers from buried forest swamps. Owing to the great pressures of the over-lying rocks, as well as to a slight rise in temperature due to being buried so deep, the peat layers became gradually changed into **coal**. The other layers also became hardened, the sand changed to **sandstone** and the clay to **shale**.

COAL - BURIED SUNSHINE

TYPES OF COAL


1 PEAT

Peat is included here because it is the first stage in the formation of coal. The type of peat usually dug for fuel consists of partly-decayed reeds and mosses.


2 LIGNITE

Lignite or 'brown coal' results from the first stage of alteration of buried peat. It is brown and crumbly and can often be seen to be made up of decayed woody material.


3 BITUMINOUS

Bituminous coal, used in houses and factories, is the most common type of coal in Britain. It is always black and is made up of bands or layers which vary from bright and glassy, to dull and sooty. This type of coal generally breaks easily into rectangular blocks along planes of easy splitting (cleavage) which the miner calls the 'cleat' of the coal.

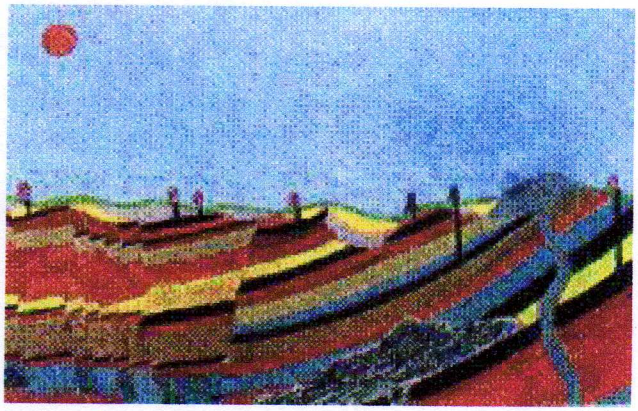

4 ANTHRACITE

Anthracite, shows the greatest amount of change from peat. It is hard and shows little sign of banding but has a lustre (shine) like dull steel.

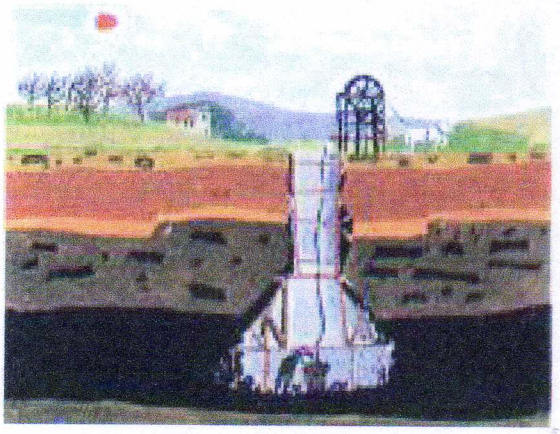

5 CANNEL

'Cannel' coal, is a dull, hard coal with no bands or cracks, so-called because it burns with a long smoky flame as does a candle made from paraffin wax.

COAL SEAMS



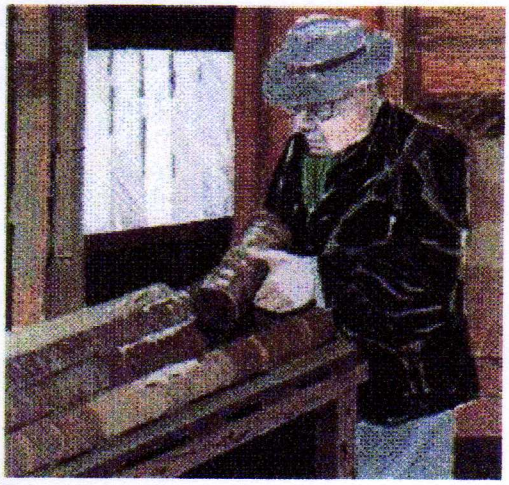
Coal exists as a series of layers called 'seams', separated by layers of other rocks. These rocks - mainly sandstones, limestones, shales, fireclays and coal seams - are called the **Coal Measures**, and they form the upper part of a large series of rocks to which the name **Carboniferous**, which just means '**coal bearing**', has been given.



Coal seams do not occur throughout the full thickness of the Coal Measures but they are usually concentrated in approx. 500 - 1000 ft. of rocks. Within this thickness there may be over 100 layers or seams of coal but many of them, from an inch [about 2.5 cm] up to 2 ft. [about 60 cm] are too thin to be worked profitably. Most British coal seams of workable thickness measured from between 2 ft. [about 60 cm] and 10 ft. [about 3 m].

FINDING THE COAL SEAMS

When crop coal seams were completely worked out or exhausted, the position of new seams was often determined by drilling **bores** (deep, narrow holes) in the coal bearing strata (layers).



Here you see a geologist examining the cylindrical 'cores' produced by the boring operations.

Coal is found not only under our land in Fife but also beneath our coastal waters. Undersea mining has been carried out since the early 17th century. There is a record of King James VI of Scotland descending a coal mine on shore, near Culross, and being brought to the surface on an artificial island or moat pit in the Firth of Forth. Finding himself surrounded by water, King James suspected a plot on his life.

'Treason!', he shouted.

That was in 1617.

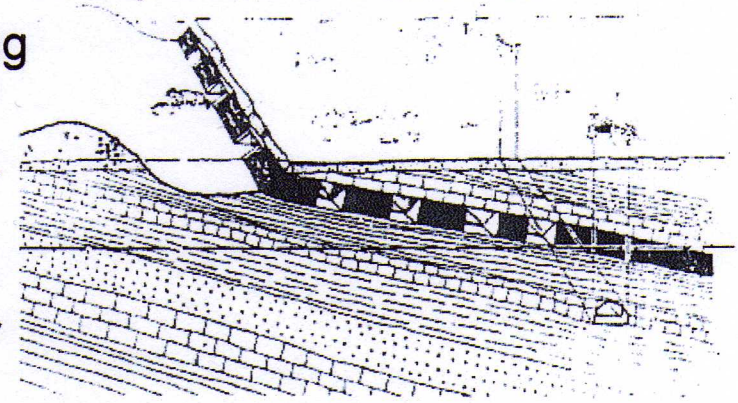
A modern off-shore drilling and exploration platform

MINING THE COAL

Stoop and Room (Pillar and Room)

Even the simple bell pit gave the miners warning of one hazard - 'cave-ins' and falling rocks and earth. So when deep-mining began to develop, the first problem to be solved was that of keeping the pit from falling on one's head!
The 'Stoop and Room pit' was the answer.

A bell pit was dug and squared off to form a 'room'. Another 'room' was added next to it and another after that.



The roof and walls of the resulting honeycomb were kept up simply by leaving standing 'stoops' or pillars of coal.
This system was used in the coal mines of Fife in the early centuries. There are many references to such pits from the 13th and 14th centuries on and even in the late 19th century many pits in Fife collieries continued to work coal this way.

MINING THE COAL

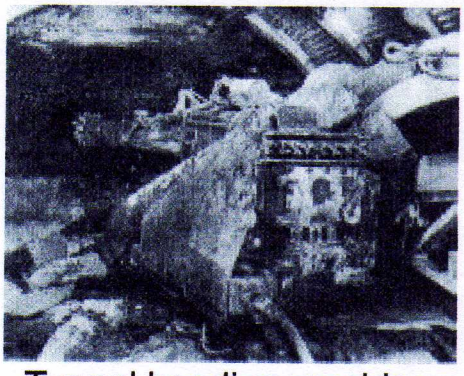
Longwall Mining

One defect of the Stoop and Room mining system was its wastefulness: the stoops themselves were made of solid coal and in an efficient coal-mine all the coal should be got out! Longwall mining involved working along the continuous face of the coal seam allowing the roof to settle as work advanced.

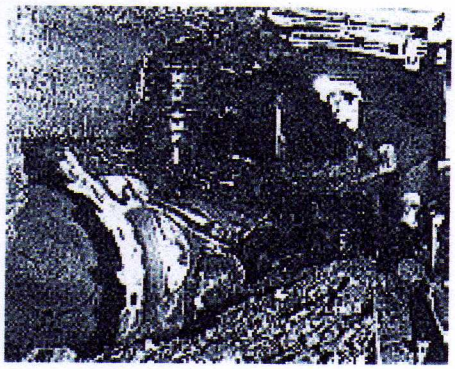
This steadily replaced the 'stoop and room' method. Early mining was carried out with the coal pick as the main instrument used for coal extraction.

In time, machines were developed to do the job of hewing the coal and driving the pit roads.

Powered supports were used instead of old wooden pit props for supporting the roofs and, in all areas, rapid improvements were made to maximise the coal output from the collieries.



Tunnel heading machine



Longwall machine

(Trepanner)

THE EARLY DAYS

There were various ways of cutting the coal. The primitive methods of earlier days were laborious and accidents were frequent. Thanks to the ability of engineers and constructors, the modern miner no longer took unnecessary risks when he descended a pit shaft, and new methods and tools lightened his labours. However, underground mining is and always will be heavy work, attended by unexpected threats.

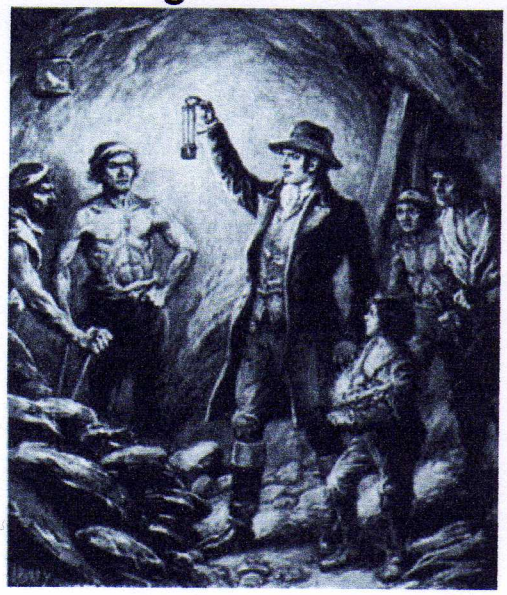
Although work in modern coal mines was still attended by a certain measure of risk, in the early days of industrial development mining was highly dangerous work. There were few safety guards, and often supporting work was rough and ready.

Every operation was carried out by hand with the simplest of tools and utensils. The shaft cages were rickety; falls of coal and stone, and underground explosions were common; and working conditions were dirty and inhuman. Women and little children worked below ground, and small boys pushed the coal tubs along the poorly-made haulage roads, like animals. It was, in the early days, when newly arising industries demanded more and more coal, a dreadful life for the miner and his family; and only very slowly were conditions improved.

DANGERS OVERCOME

A miner using the pick, which was at one time the only way of quickly winning the coal from the bowels of the earth!

The coal miner's most treacherous enemy has always been gas - an odourless gas which creeps up like a stealthy beast of prey and suffocates before its presence is perceived, or explodes and buries all within the area of its action. Methods to defeat this enemy were slowly developed. But, when Sir Humphry Davy invented his safety lamp, a move was made in the right direction.



A step on the road to mining safety - Sir Humphry Davy tests out his new invention. George Stephenson also invented a lamp. The flame was behind a metal gauze to stop explosions taking place.

From then, great advances have been made!

GOING DOWN THE PIT

Procedures probably varied slightly between pits.

Miner with lamp and headgear

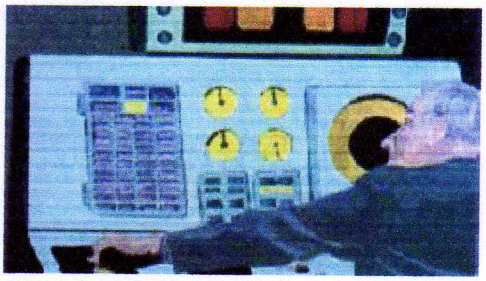
First, pick up your protective headgear, kneepads and gloves, and electric lamp. Now you must undergo a search for contraband, that is, cigarettes or matches!

Into the cage . . and down you go, very fast indeed!

Off to the cage!

Down to the pit bottom - perhaps 1,000 feet down. Now, hop aboard the diesel 'Underground' . . . it takes you to the coalface.

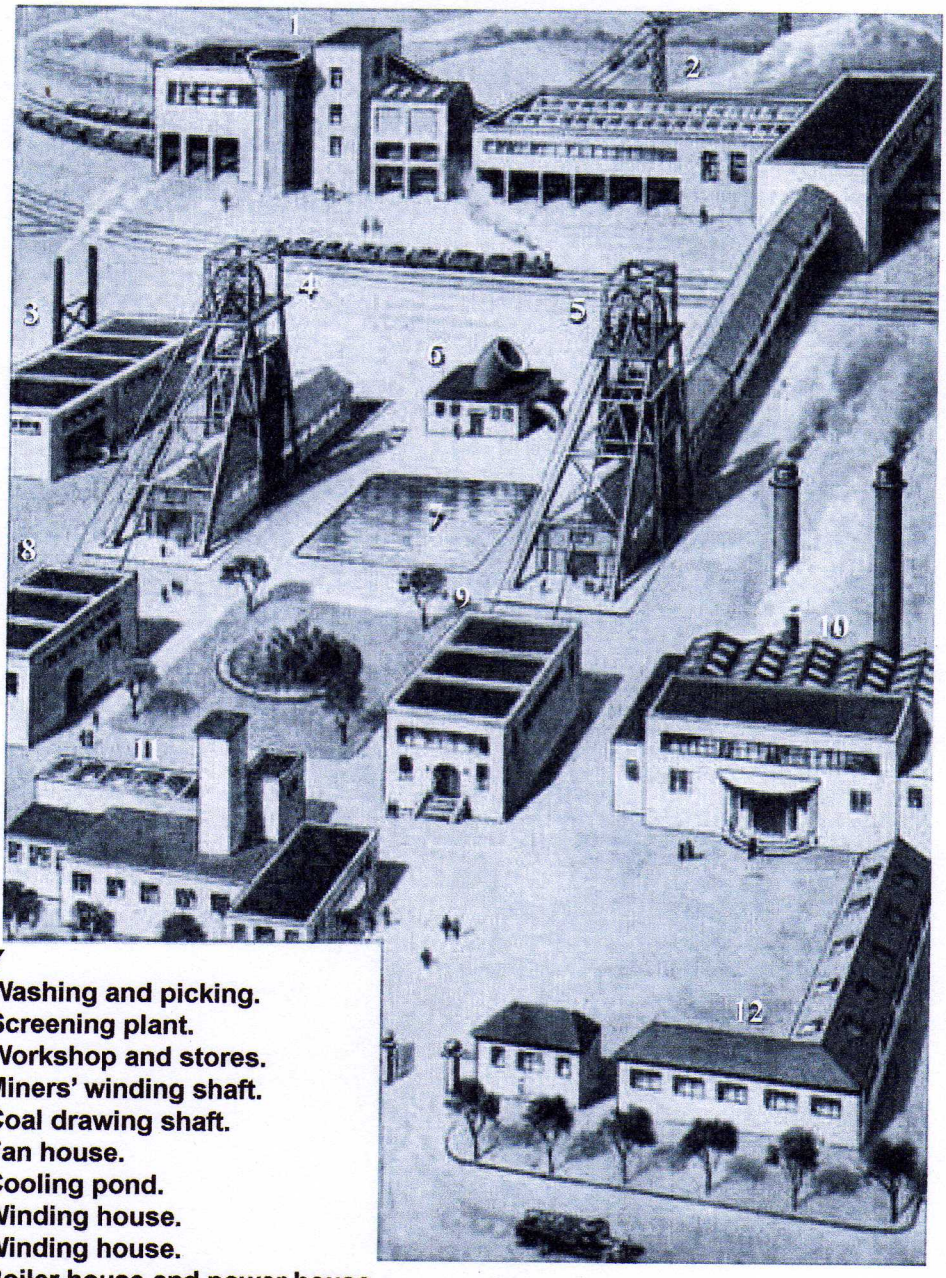
Miners on the 'Underground' sometimes travel several miles to their places of work



The winding engineman at the controls at the pit-head

COAL - BURIED SUNSHINE

ON THE SURFACE OF A PIT



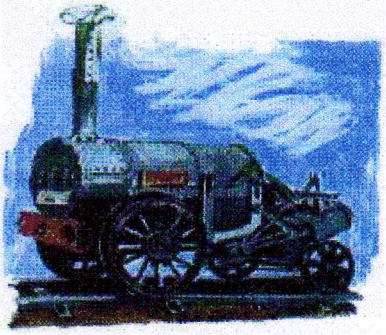
KEY

1. Washing and picking.
2. Screening plant.
3. Workshop and stores.
4. Miners' winding shaft.
5. Coal drawing shaft.
6. Fan house.
7. Cooling pond.
8. Winding house.
9. Winding house.
10. Boiler house and power house.
11. Pit-head baths and canteen.
12. Colliery offices and gate house.

Do you think you know what went on in each of these colliery departments or areas?

COAL MEANT POWER

The Industrial Revolution - what really caused it? What was it that revolutionised the 19th century and set the pattern for later ones?



Stephenson's 'Rocket'

If you were obliged to give a one-word answer, your safest reply would be 'COAL'. For it was the promise in a lump of coal that spurred the inventors and engineers; that made possible the new factories, industrial production and transportation. Beyond everything, coal now represented power. Power for engines that worked machines. Power for trains to carry manpower, raw materials and finished products.

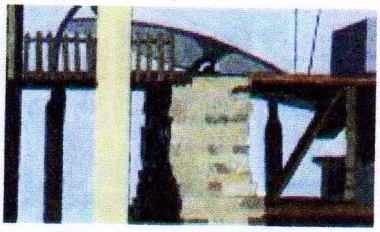
Bessemer Steel Converter

Power that made possible the first production lines. The power ~ by gas obtained from coal ~ to light towns, factories and homes. The power to go fast, to do many things at once, to exert forces greater than man or any other animal could hitherto produce. Power from COAL to produce and use still more COAL.

COAL'S INVENTORS

Every coal pit or mine needed power . . . Thomas Savery developed the "Miners' Friend", a steam engine that could pump water at a rate of sixty gallons a minute (1698).

Thomas Newcomen developed the beam engine, the first steady-running atmospheric engine (1705). It was used particularly for pumping. Newcomen, it was said, saved the coal mines and the nation's prosperity.

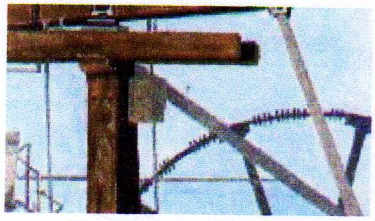


Newcomen's Engine

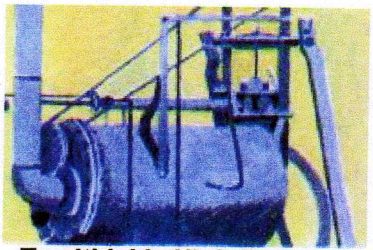
George Stephenson made a steam pump and engines that solved the problem of pulling tubs of coal from the coalface to the pit bottom. He also improved colliery railways and built the first practical locomotives. James Watt made the separate condensing engine, a much improved and more powerful Newcomen engine (1770).

James Watt
(1736-1819)

Richard Trevithick further improved steam engines in the early 19th century enabling them to use high steam pressures.



Boulton and Watt's Rotative Steam Engine



Trevithick's High Pressure Engine and Boiler

These engines raised coal and men from the pit bottom to the surface and made possible the first railways ~ pit railways.

COAL FOR WARMTH

The beauty of a coal fire - has been appreciated from the first. But the old-fashioned open fire was not all beauty!

For one thing, it was wasteful. Probably 80% of the coal's heat went up the chimney! For another, it demanded attention ... and, of course, it made **smoke** which contains acids, tars and other by-products that are very valuable when put to their proper use but very damaging - even dangerous - if left to pollute the air! Even in those days when Britain was much less densely populated and coal (and the labour that won it) was cheap, it was realised that it was silly to burn coal in an open grate. The Victorians developed some really excellent 'patent grates' - including one with heat-radiating metal bars, a deep pit to hold several days' ash and with a controlled convection and chimney-draught system. But coal was so cheap that this sort of grate remained a good idea rather than a general reality. After the Second World War, **coal**, like everything else, was very **scarce**.
Waste was intolerable! Fogs became smogs!

Something had to be done!

SMOKELESS FUELS

When the Clean Air Act (1956) was announced, reaction was despondent and cynical. Today, the objects of the Act are being fulfilled. We do have cleaner air. We don't have smogs. We can fuel our homes and factories without choking on smoke. And this apparently minor but really very important revolution is in a large part due to the rapid development of new sorts of coal fuels.

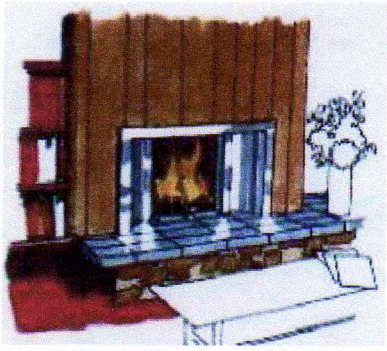
Anthracite and steam coal were two smokeless fuels that could be won straight from the pits - but not in unlimited quantities.

Coke - the first man-made smokeless solid fuel gained from coal - was the product of heating coal to a certain temperature in the absence of air. This liberated by-products for use elsewhere (see coal's treasure trove) and at the same time gave us the familiar silvery-grey, clean and economical solid fuels for the home.

There were many grades of coke for the industrial user. But over the last few years, more of these man-made fuels have been steadily developed for solid-fuel heating - and an equally striking range of appliances both for home and industry.

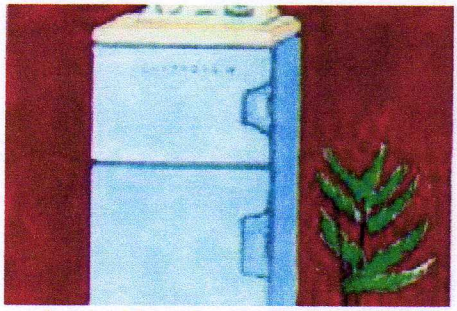
HOUSEWARMERS

A variety of appliances were available for those using the 'new' smokeless fuels ...

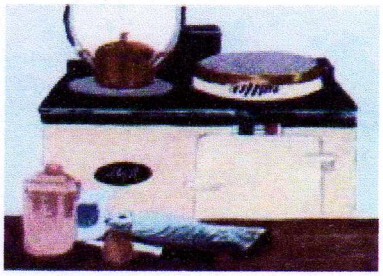


A modern open fire

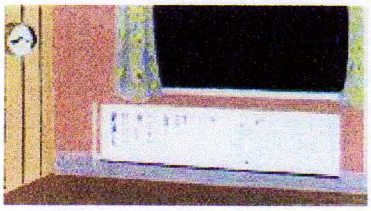
High-efficiency fires of the type above could burn without attention for 10 hours at a time. Modern types of controls meant that these fires could be regulated to give as much or as little heat as you wanted.



Central heating boilers were at the heart of the very popular small bore system.



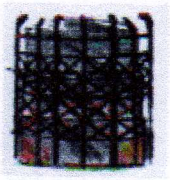
Heat-storage cooker/water heaters like the "AGA", cherished by good cooks - two hotplates, two ovens, very hot and simmering hot. They heated the water and warmed the kitchen too - yet only used about three and a half tons of coke or "Phurnacite" type fuels a year.



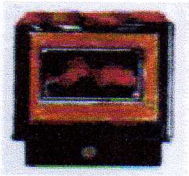
A typical wall-mounted radiator

MAJOR COAL USERS 1969-1970

Power Stations
76 million tons



Gas Works
6 million tons



Domestic Supplies
17.9 million tons

Coke Ovens
(mainly iron and steel works and NCB)
25.4 million tons

Manufactured Fuel Works
4 million tons

Collieries' Miners' Coal
4.9 million tons

Factories, Offices, Hospitals, etc
21.1 million tons

Exports
3.5 million tons

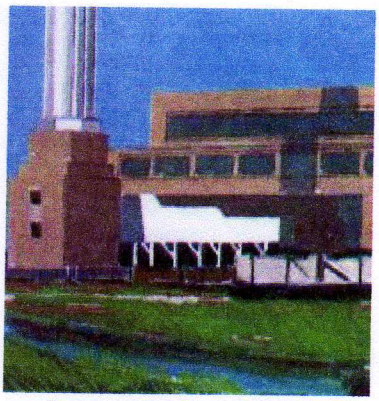
Other inland uses
3.9 million tons

'Older readers' will remember 1 ton = 20 cwts

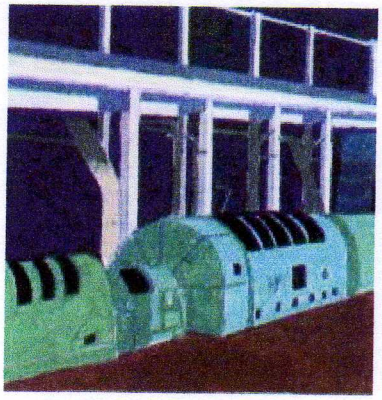
'Younger readers' know that 1 tonne = 1000 kg = 0.984 ton

COAL TO ELECTRICITY

Power stations used to use coal to supply heat to boilers and so produce steam which is, in turn, used to drive turbo-generators. In the most modern power stations, all these operations were completely automatic and largely electronic.



A typical power station



Turbines -
the machines that transform
coal power into electrical power

The coal, pulverised to a powder, was then fed to boilers pneumatically, as if it were a gas. The boilers were, of course, massive affairs - some converting more than a million pounds of water into steam each hour! You have probably seen the gasholders that supply your district with gas; but you may not have seen the actual power station that supplies you with electricity. This is because electricity not needed locally is fed into a **national grid** or supergrid carrying electricity all over the country through about 8,000 miles of high-voltage transmission lines. Longannet Power Station is now closed.

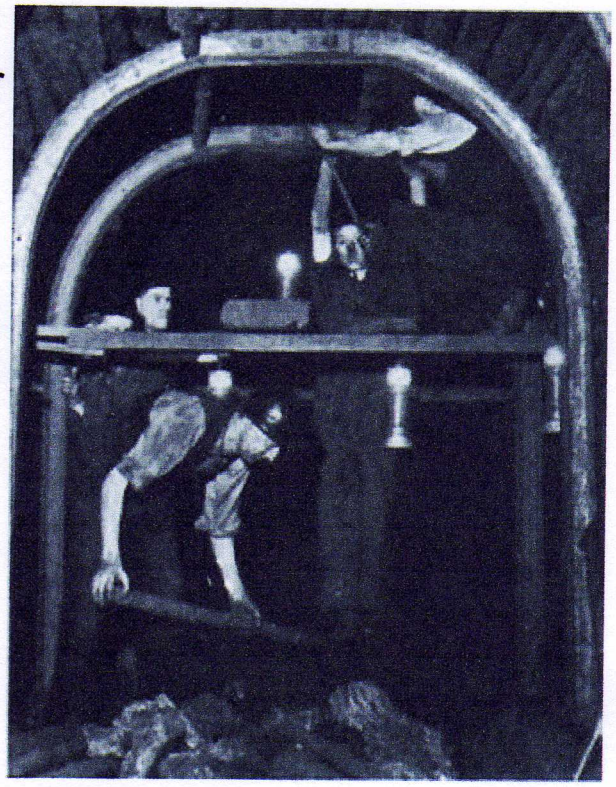
COAL - BURIED SUNSHINE

COAL'S TREASURE TROVE

COAL is such a valuable raw material that deep mines may have to open up again after all the oil and gas have gone! Did you know that COAL can be made into: Fertilisers - Plastics - Detergents - Paints - Dyes - Printing Inks - Perfumes - Drugs Chemicals - Medicines - Explosives - Sulphuric Acid - Pesticides

GETTING THE COAL

When tackling a coal seam, the miner first cut into the bottom, the mass of coal above being supported by sprags, or props, which were removed when the undercutting was completed. The pit props, or timbers, eventually changed to improved steel supports which were also used to support the roof along the tunnels and working places.



Miners putting up a 'ring' or shoring

Steel wedges were then driven into the top of the seam and the coal was thus broken down; but this method did not always succeed, and so explosives had to be used, and sometimes special coal bursters had to be employed.

USING EXPLOSIVES

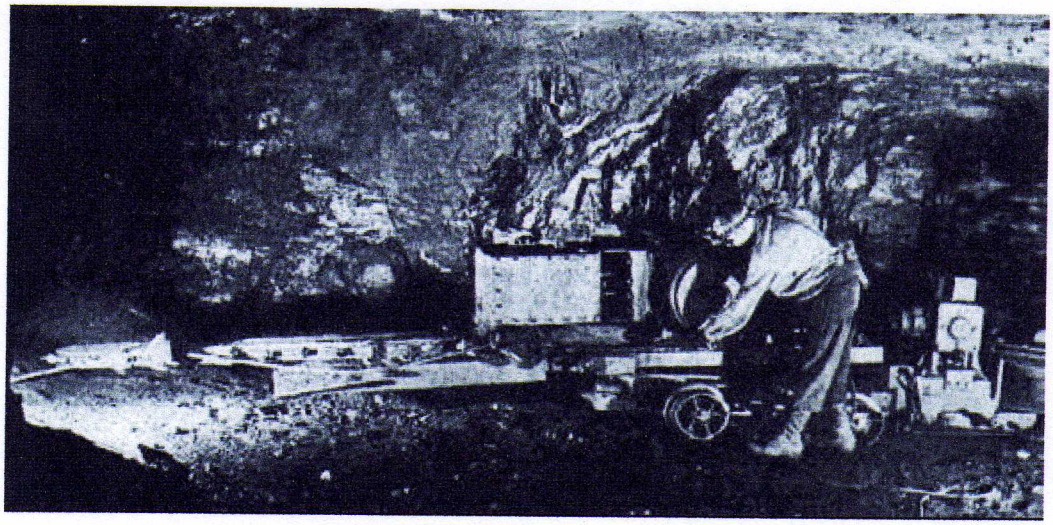
To use the explosives, holes were drilled into the seam about three feet deep and several yards apart. Then, before the charges were inserted, a test was made for gas. If this was negative, and no gas appeared to be present, detonator-wires were attached to a battery and the spark produced exploded the charge.

Preparing for blasting with the use of a compressed-air drill

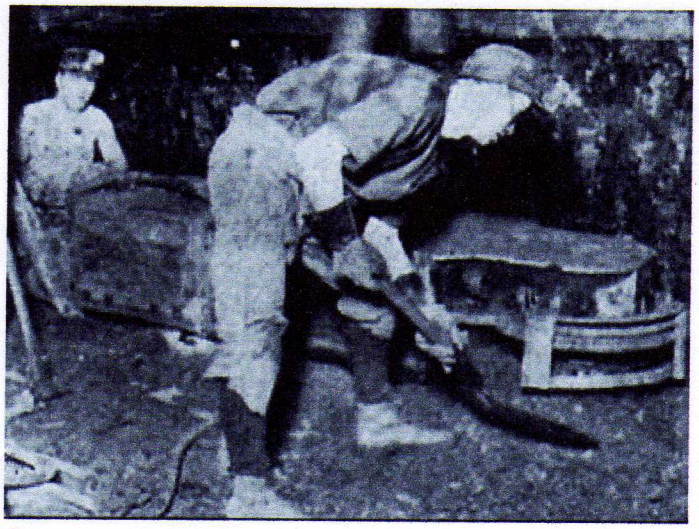
An important man in the pit was the shot firer, shown here, with a canister of shots

COAL CUTTERS

Preparing an undercutting machine which cut a notch under coal in preparation for blasting ...



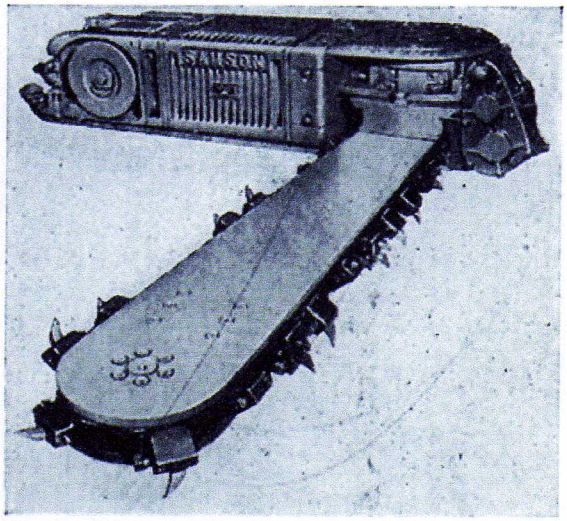
The coal-cutting machine moved slowly along the ground, and short picks, on a revolving chain, 'ripped' the coal. The machines were very strong and were effective where handwork was a severe strain for miners.

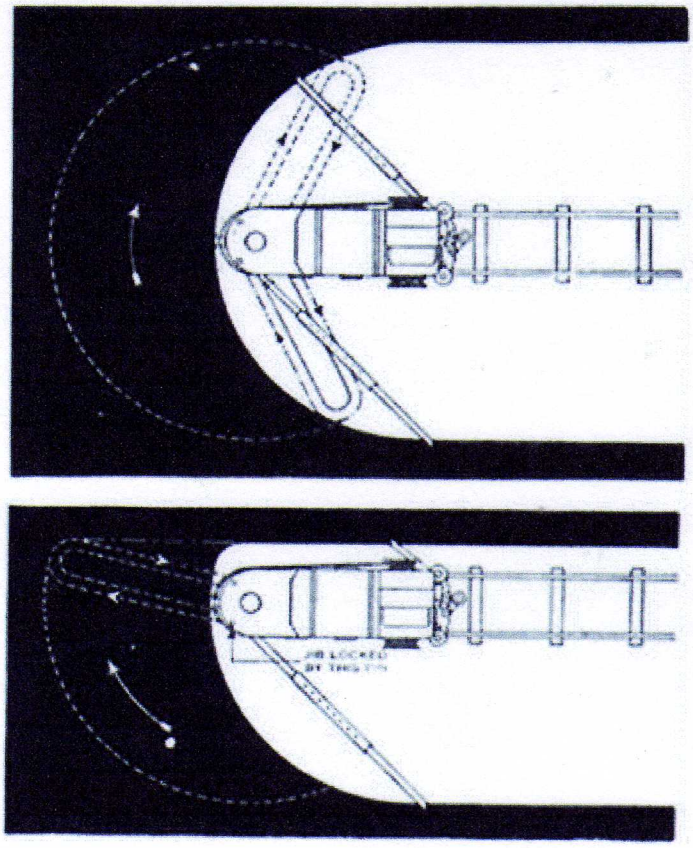


A modern coal cutter, which was used in many pits to speed up vital production. The use of the cutter, however, was restricted by the nature of the coal or the conditions of the underground workings.

COAL CUTTERS

Coal cutters were not so useful where coal was very soft, or the roof and pavement bad, or where seams were very thick. As the coal was removed, vacant space was packed with rock and rubbish to prevent "falls".





How the blades of a coal cutter work

top:

cutting full width

bottom:

cutting a reduced width

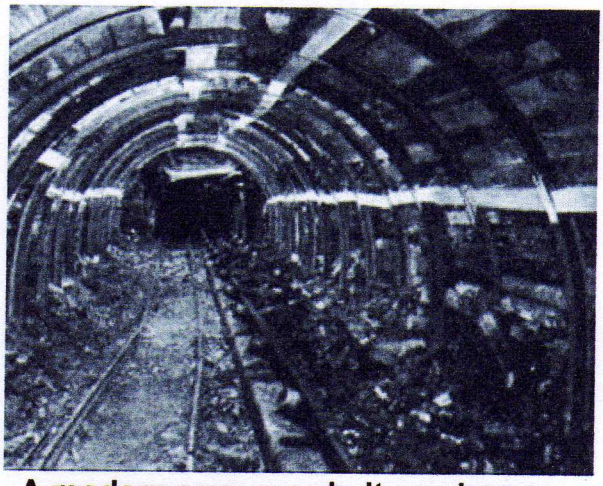
MOVING THE COAL

The coal, "won" by miner and machine, was brought to the surface by various means, according to the nature of the pits and the stage of mechanical development. First of all it had to be moved from the "face" to the main tunnel or **haulage road**, from where it was hauled to the bottom of the shaft up which it would be carried to the surface.

Modern conveyors worked on the moving staircase principle and tipped the coal into tubs or trains at the haulage road, whence it was taken along on rails, in trains driven by electricity, by compressed-air, or oil, or drawn by steel ropes connected to an engine situated near the bottom of the shaft.

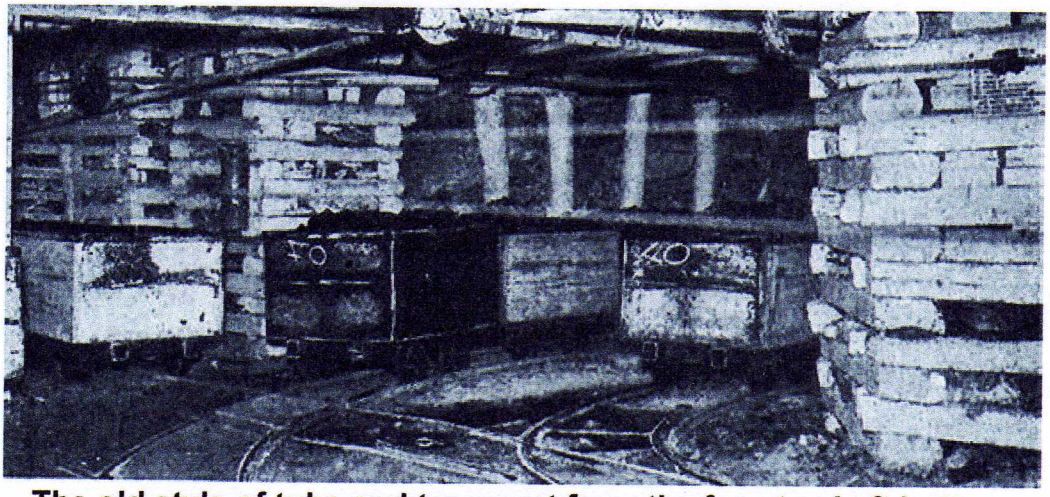
When the coal arrived at the top, it was weighed and checked, and then tumbled out on to **screens** where it was **graded** according to size. It then had to be **cleaned**, for if it were delivered just as it came from the pit, it would be mixed with dirt, shale and stone. All this useless material was removed, sometimes by **hand-picking**, but in the case of small, very dirty coal it had to be **washed** and dry-cleaned. This meant that it was spread out on tables which jolted back and forth while powerful air currents were passed over it **to separate the dirt from the coal**.

UNDERGROUND TRANSPORT



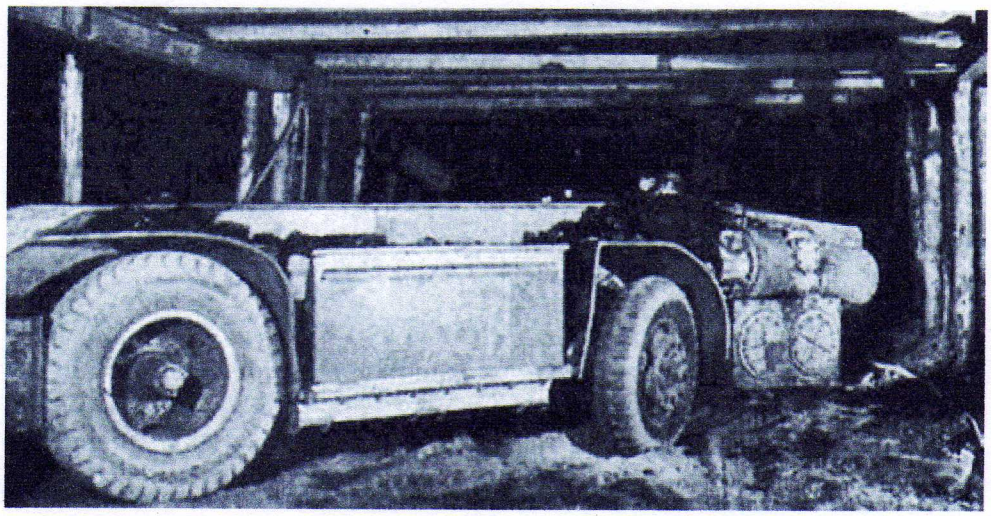
A modern conveyor belt can be seen on the right

The self-loader thrusted its nose into the mass of broken down coal and shook the material back along the conveyors, or, as with a self-propelled loader, with its scraper chain conveyor, two mechanical arms gathered up the coal and pushed it on to the conveyor. The conveyor, working at the face, discharged its load on to a main conveyor, or into shuttle cars run electrically, or into tubs, where these were not replaced by main conveyors. These took the coal to the shaft bottom.

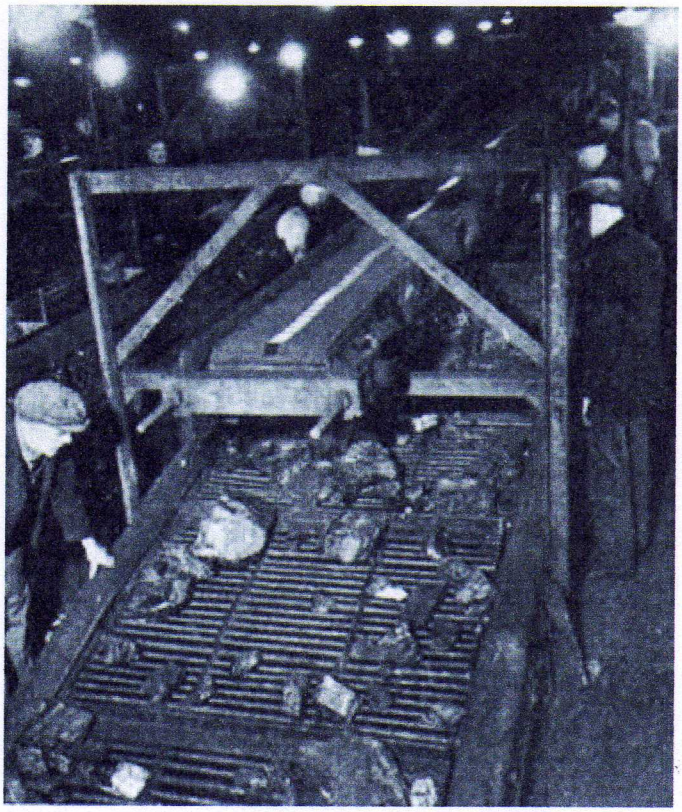


The old style of tubs and transport from the face to shaft bottom

TRANSPORT & SCREENING



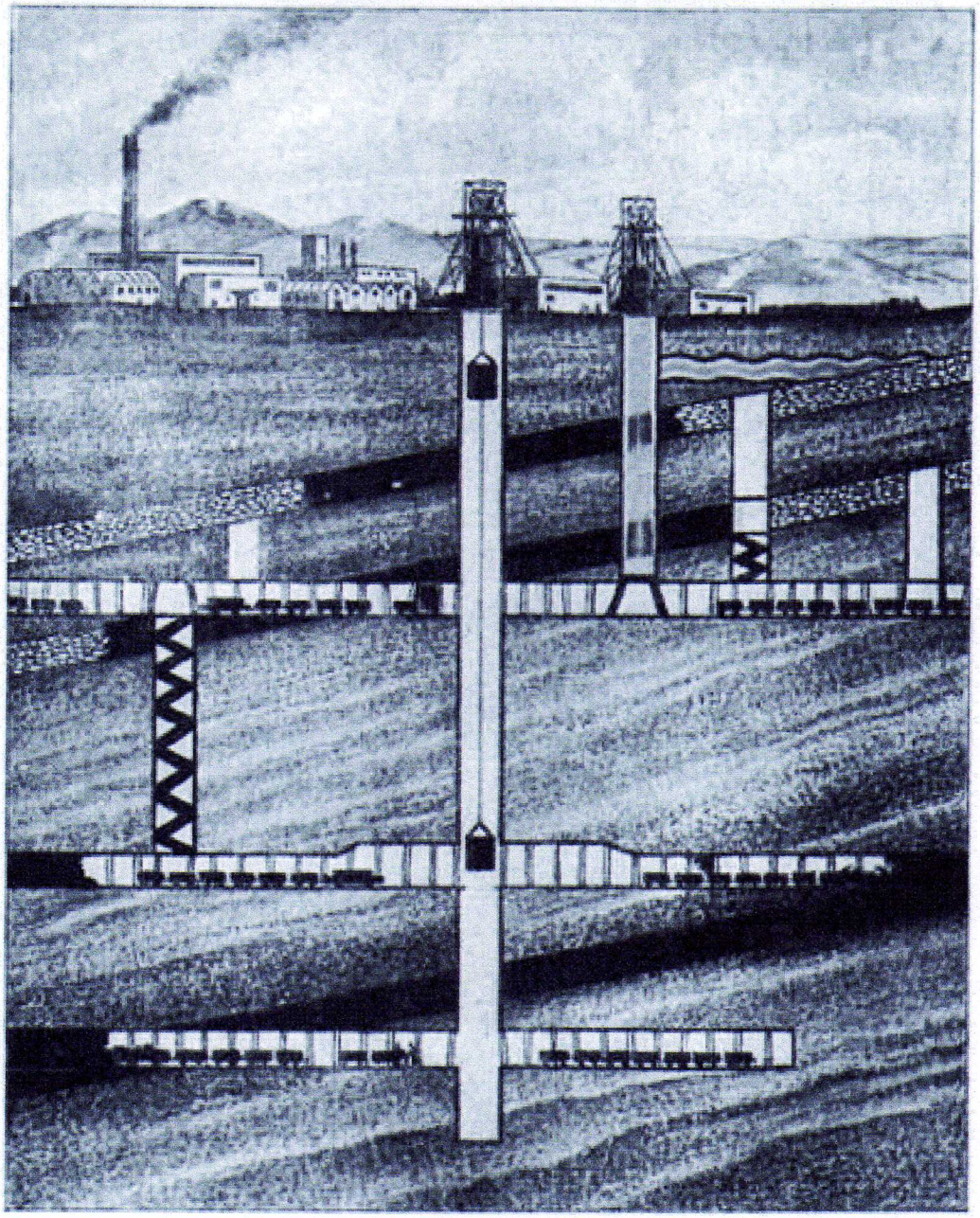
A battery-driven shuttle car moving coal from face to shaft bottom



Automatic screening of coal for dirt and shale

COAL - BURIED SUNSHINE

A TYPICAL COLLIERY SHOWING PITHEAD INSTALLATIONS, MAIN SHAFTS, HAULAGE WAYS AND COAL SEAMS



Sectional drawing through a typical coal mine

COAL - BURIED SUNSHINE

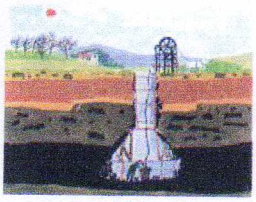
'Self-test' your knowledge or organise a quiz!

1. 'Unjumble' the letters to get the name of a Fife Colliery: **EOHOLRC**

2. What is this monk carrying in his basket? _____

3. What name is given to the place where a coal seam comes up to the surface? _____

4. What is another name for lignite? _____



5. What name was given to some early pits (see picture) because of their shape? _____

6. What covered the whole of Fife 250 million years ago? _____

7. What does the word '*carboniferous*' mean? _____

8. What type of scientist would examinine rocks and coals from a bore? _____

9. What name was given to the underground pillars of coal left standing to keep up the roof of a coal mine? _____

10. Which tool was used by miners in the early coal pits to 'win' the coal? _____

11. Who is this famous inventor who made the use of lamps in coal mines much safer?

_____

12. Miners going down a pit were first of all searched for cigarettes and matches. Why?

_____

_____

13. What does this miner have fixed to his helmet?

_____

14. Who operated the controls to raise and lower the pit cages?

_____

... and there's more on the next page! ...

15. Give the nickname of the engine that pumped 60 gallons water per min? _____

16. Which <u>two</u> coals taken straight from the pits could be used as 'smokeless fuels'?

_____

17. Who is said to have saved the coal mines and the nation's prosperity? _____

18. Modern fires, like the one shown here, had to be attended to every three hours. TRUE or FALSE?

_____

19. What fuel was popular in AGA cookers? _____

20. How many million tons of coal were used in 1969-1970 to produce gas? _____

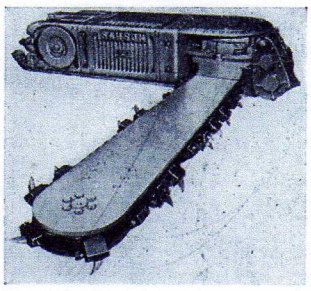
21. Power stations used most coal that same year. TRUE or FALSE? _____

22. In coal pits and mines, who was responsible for the firing of the explosives?

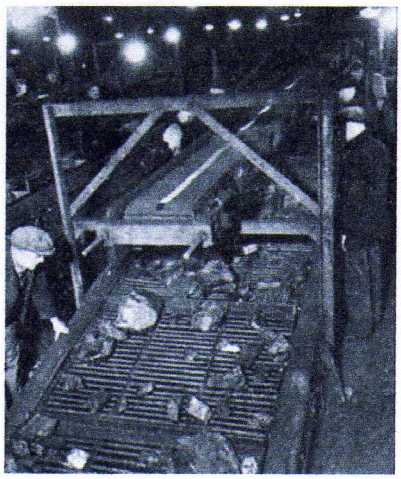
_____

23. Where was your nearest coal-burning power station? _____

24. This is a picture of a _____ .



25. Describe the job being done by the men and women in this picture.



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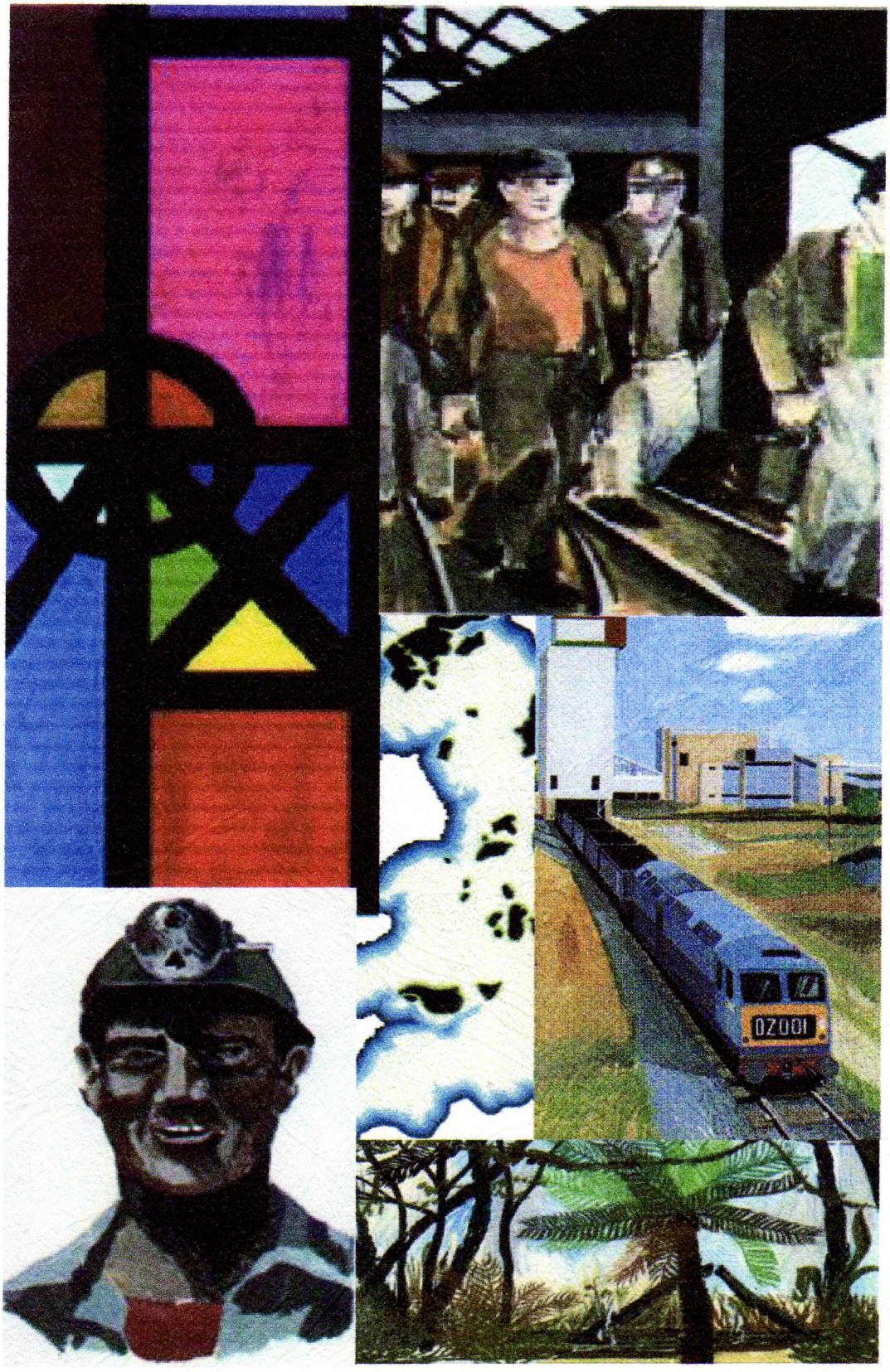
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