HOW IS COAL MINED?

**OPENCAST MINING**

*Opencast mining* = mining that takes place from surface quarries (or open pits)

All of the overlying rock (*overburden*) must be removed, this will be critical to the economics of the process. The sides of an open pit are **dug at an angle and stepped** in order to increase stability and prevent collapse. The flat parts of the steps are called **benches**.

The angle of the sides depends on:

- **Rock type**: weak, incompetent rock like clay requires a shallower angle to prevent slumping.
- **Weathering**: heavily weathered rock will be weaker and need shallow sides to prevent rock falls and slumping.
- **Structures** such as faults and joints (lineations) weaken the rocks so may need rock bolts, shotcrete, wire netting, rock drains or other ground improvement strategies.

The *overburden* is removed and piled up at the sides of pits. These piles are known as **spoil heaps**. **Blasting** is used to break up the coal and large excavators called **dragline excavators** are used to extract it (each scoop can remove up to 450 tonnes of coal in one pass, using a large bucket on the end of the dragline). After the mining operation is completed, the mines are refilled with the overburden. In Britain, the thickest coal seams being mined are ~2.5m whereas, in the USA, the thickest seams are ~30m.

**UNDERGROUND COAL MINING**

- **Spoil heaps** comprise of waste rock piled up on the ground beside a mine.
- **Longwall mining** is a highly mechanised method of underground mining.
- A **shaft** is a vertical opening of an underground mine.

**Longwall mining** (the main method used in the UK) involves **digging a shaft** from the surface to the reserve and **digging tunnels or roadways** away from the shaft. A **ventilation shaft** is also vital.

In Longwall mining, **two horizontal roadways** are driven out to the furthest of the area of coal being extracted in order to **assess geological conditions** before extraction.

After this, a **coalface (up to 400m)** (a longwall) is established **between the two roadways** and a **rotating machine** called a **shearer** moves to and fro **along the coalface**, cutting slices of coal. **The coal falls onto a conveyor belt** and is **transported** to the shaft and up to the surface.

The roof is held up by **mobile hydraulic steel supports called chocks**. Once a slice is removed, the **chocks move forward** and the mined-out area is allowed to **collapse**. This system of **deliberate collapse** can cause **subsidence** on the surface.

Mining will **retreat towards the shaft** so that the mine can be used in the event of a collapse – it does not obstruct the route to the shaft. However, if the mined-out area **does not collapse immediately** then a **cavern can open up**, putting **immense pressure on the chocks**.
<table>
<thead>
<tr>
<th>Geological factors making coal mining difficult and uneconomic.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faults displacing a coal seam</td>
</tr>
<tr>
<td>Folds and steep dips.</td>
</tr>
<tr>
<td>Washouts resulting from river channel switching on the delta top</td>
</tr>
<tr>
<td>Seam splitting</td>
</tr>
<tr>
<td>Sandstones</td>
</tr>
<tr>
<td>The build-up of methane gas</td>
</tr>
</tbody>
</table>

**Opencast coal** mining is very efficient and high rates if production can be achieved. This is vital as coal is a cheap, bulk commodity. It can be extracted down to depths of 100m or exceptionally 200m provided the ratio of the stripped overburden to the coal is less than 20 to 1.

**Longwall underground coal** mining is highly mechanised and so can achieve similar yields as open cast mines provided the geological conditions are favourable.

Opencast mining is cheaper than underground mining; the setup costs are lower and a smaller workforce is required. Although the machinery can be expensive. It is much cheaper than the high-tech machinery needed in longwall mining. Moreover, thinner coal-seams can be extracted at a profit as they are easier to extract. Opencast mining is also safer than underground mining. Ventilation equipment is not required for an open pit.

Underground mining is a dangerous occupation. The main dangers are cave-ins and tunnel collapses, explosions caused by methane gas and flooding. Rescue of mine workers trapped in an underground mine is also difficult.
Faulting
Zone of weakness and permeability - may cause collapse or flooding
Coal seam has been displaced by movement of fault - disrupts production
Fault plane

Washout
Washout - river channel on delta top has switched and eroded away the peat/coal
Coal seam replaced by hard channel lag conglomerate and sandstone

Seam splitting
This part of the delta underwent more rapid subsidence

Coal seam
No coal - shearer cannot cut through hard sandstone

Thick coal seam
Thin, unworkable coal seams