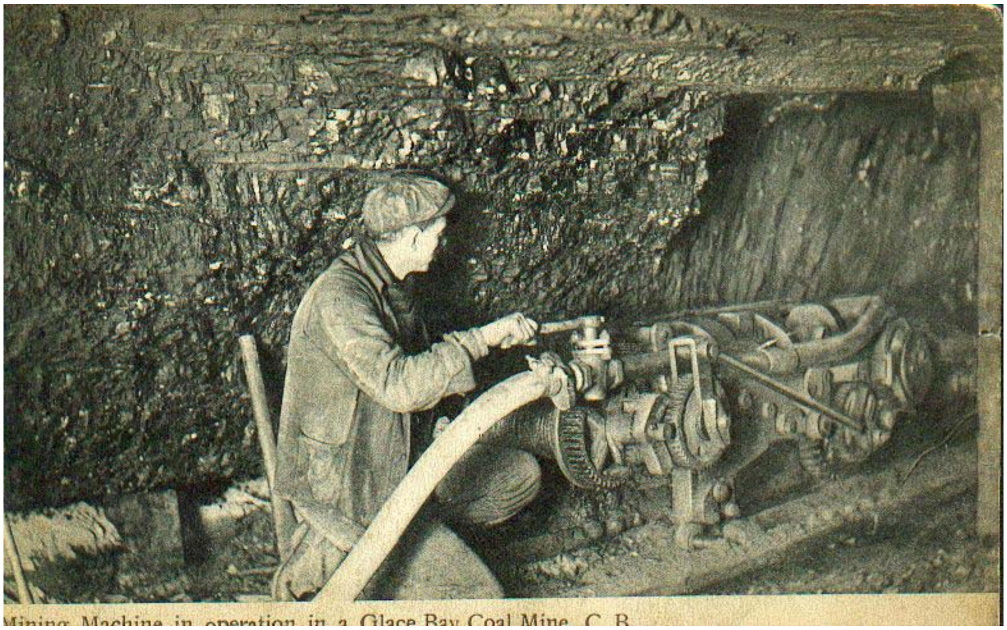
Mining Methods



Submarine Mining

Cape Breton’s coal fields lie close to the coastline and a large percentage of the fields extend under the ocean. As a result, Cape Breton's east coast mines, which were among the most extensive mining operations in the world, faced problems different from those encountered in other fields.

The biggest challenge in undersea mining is the possibility that the sea will break into the workings. Until a certain depth of cover is reached, pillars of a sufficient size to support the sea bottom must be left intact. Nova Scotia mining law prohibits coal removal at a depth of less than 180 feet of solid cover under the sea.

The cover line for most Cape Breton workings is 700 feet, and until this level was reached, the width of the rooms was restricted and pillars were left intact. After this level was reached, the longwall method of mining was usually used as long as 100 feet of solid cover remained for each foot of thickness of the removed coal.

An advantage of an underground mine working under land rather than under the ocean is that when the working area is a long distance from the surface entrance, another shaft can be sunk to the working face. Obviously this is not an option with submarine mining and the shaft must continue out under the sea until a distance has been reached that is not economically feasible to mine the coal.

How far the mine extends under the sea depends on a number of factors: the nature and thickness of the seam, the character of the roof and floor, the rate of dip (determines depth), and the amount of coal which can be economically removed from the mine.

Mining Methods

Generally speaking, there are two main methods of extracting coal from a seam. The first, and most generally used in the earlier years of coal mining, was the "room or bord and pillar" method of extraction and the second is the "longwall" method, which was used in the collieries of Cape Breton most recently.

Room and Pillar Mining

Once the coal was reached by means of a slope or shaft, levels were driven through the solid coal and headways and deeps branch out from these to permit the breaking off of rooms. The rooms ran parallel to the levels and at right angles to the headways.

Crosscuts were then made joining the rooms as they advanced which formed the pillars of coal which were so vital to roof support. With the use of doors and brattice, the air was directed throughout the working places and kept the mine ventilated and hopefully free from a dangerous gas build-up.

The rooms or working faces varied in width (12 feet to 21 feet) and were responsible for the chief output of coal.

A team of two men who completed hewing, blasting and loading coal into tubs or boxes drove each room forward. The room was undercut, most often at the bottom of the seam for a depth of three to five feet and from side to side of the face.

When the coal was undercut, it was won by means of a handpick or sometimes wedging or blasting. When blasting was required, boreholes were drilled into the coal face, charged with powder and fired. The system of blasting varied within collieries and depended upon the thickness of the coal seam and the quality of the coal and surrounding strata.

The dimensions of the pillars or blocks of coal that were left intact between the rooms and crosscuts formed an important part of room and pillar mining. The width and depth of pillars varied considerably because they were dependant upon a number of variables. The depth of the seam from the surface was one of these variables because with increased depth and pressure of super incumbent strata, the dimensions of the pillars must be enlarged in order to give sufficient strength to support the roof and prevent heavy lifting of the floor.

If the coal was soft or easily broken, the pillars needed to be larger. Also, if the stone forming the roof was soft or weak, the superficial area of the pillars was large to distribute the weight of the strata over a larger surface.

The angle or inclination of the coal seam was another factor that had to be considered. A larger pillar was required where the dip of the seam was steep. In many earlier operations, the pillars left were much too small, sometimes six feet by twelve feet. This was bad mining practice and often led to roof fractures, heavy water seepage and crushing.

Eventually, pillar sizes were increased to 20 by 30 feet in width and later still, under the Dominion Coal Company, pillars of 100 by 100 feet were left under heavy cover. Needless to say, it was better to make pillars stronger and larger than necessary rather than risk the mines and lives of the miners.

One important aspect of laying out a mine was the possibility of recovering or drawing the valuable coal left in these pillars. This was usually done when one area of the mine was worked out or when the life of the colliery was coming to an end.

Longwalling

As workings advanced, not only did the pressure increase due to additional thickness of cover and make itself evident on the roof, but side pressure on the ribs also increased. It then became economically impossible to maintain roadways in room and pillar sections. It soon became evident that some method must be found to neutralize these difficulties and reduce the cost of operations. Longwalling, therefore, became the only means of continuing mining at depth.

In the longwall method, the chief principle is to extract the whole seam in one operation and to allow the super incumbent strata to settle in the void know as the gob or the goat. Longwalling may be divided into two classifications - longwall advancing and longwall retreating.

Longwall Advancing

In this method of mining, the extraction of the seam starts at the shaft pillar and works its way from the shaft bottom. The coal is removed in a long length or face.

In early operations, these faces varied in lengths from 50 or 60 feet to 200 feet and finally 400 feet and more, as methods became more secure. Access to the surface was assured by the maintenance of two roadways, one on either side of the working face. One of these roadways was used as a haulage level and the other for ventilation.

As the workings advanced, these roadways were constructed by means of continuous six by six feet softwood, stone-filled packs on either side of the road from the floor to the roof. The stone was usually obtained from the roof - brushed from the roadways to make height for horses and coal tubs. Sometimes, the stone would be taken from the gob and used to form the packwalls necessary for road maintenance.

The coal was undercut by handpicks, hand shovelled into cars at the face which were then drawn through cross-gates to the main haulage level. Later, these walls were highly mechanized with machines cutting the coal and face conveyors taking the coal from the face to the main haulage.

In earlier years, temporary roof props were put along the face at regular intervals from two to four feet apart. The props were not arranged opposite each other in these rows, but alternating, and in this way a larger surface of roof could be supported. These props were eventually replaced by hydraulic roof supports that were mechanically advanced with the winning of the coal.

Longwall Retreating

In the longwall retreating system, the levels, haulage roads and airways are driven to their outer boundaries of the area to be worked. When these extremities are reached, the longwall faces are worked back in the direction of the shaft.

As the roads giving access to the shaft have already been constructed, the roof is allowed to fall completely as the face retreats and no roads are maintained through the gob or goat. The face is supported in the same manner as with the advancing method and the props are withdrawn as the face recedes.

This method of mining involves a high initial development cost and a small output until the mine is completely developed.

Mine Equipment

Mine Lighting

With the growth of the mining industry came the evolution of equipment and machinery to make miner's tasks easier and more profitable.

Lighting mechanisms were continually being modified to make the job safer from explosions caused by open flame and to provide better visibility. However, the evolution of lighting mechanisms was often slowed because of the miner's resistance to use a lamp that was not yet proven reliable.

Mine lights can be divided into seven general classifications: saucer-type open grease lamps, hanging oil lamps, candles, oil wick lamps, safety lamps, carbide lamps, and electric lamps.

Saucer-type Open Grease Lamps

The first type of mine light, the open saucer-type grease lamp, was popular in the 1700's and was often decorated with ornamental figures such as roosters. These figures acted as good luck charms for the miner.

Candles

Later, candles made of hard tallow became a popular source of light within the mines. The candle-holder was adopted for use in the mines as well. It consisted of a 3/8-inch iron rod twisted into a looped handle at one end and a sharpened point at the other. Often there was a hook on the holder and when the point could not be driven into a suitable support, the holder could be hung from any overhang or protrusion in the mine.

Oil Wick Lamps

As mining progressed, oil wick lamps became increasingly popular because they were cheaper to burn than tallow candles and easier to balance and carry in the mines. Manufactured between 1860 and 1920, these lamps differed in size and shape but operated on the same basic principle.

A small conical font 1_ to 2_ inches tall and about 1-inch in diameter held the fuel and a hinged snap cap sealed the top. The long neck or spout extended up and outward from one side on the font. Opposite the spout, a wire hook was fastened to the font to fit on a miner's leather or cloth cap. It looked like a small teapot with a brush hanging out the spout. The wick brought the fuel from the font to the tip.

Dangers of Open Flame

As the mines grew larger and the miners worked deeper underground, new dangers presented themselves, the most dangerous being gas. Gas could be easily ignited by the open flame of a miner's light source and so came the desire to develop a source of light which could provide enough illumination to work by, yet not ignite the gas, which was ever present in coal mines.

Safety Lamps

The man who made the real breakthrough in this area was Sir Humphry Davy when he invented what is known as the Davy Lamp or a gauze-enclosed lamp. Although gauze alone could not guarantee that the flame would not come into contact with gases outside the screen, Sir Davy reasoned that a metal mesh would cool down the flame before it came into contact with any fire damp. These gases explode at certain temperatures but will extinguish a flame that is cooler.

To prevent miners from opening their safety lamp underground, considerable attention was paid to locks. Most safety lamps were equipped with a padlock, keyed setscrews, melted soft-metal locking inserts or magnetic spring-loaded latches.

Carbide Lamps

In 1892, while working with lime, coal tar and a carbon mixture, Major James T. Morehead and Thomas L. Willson developed a brownish-grey substance that gave off a pungent smelling gas when mixed with water. This gas burned with a bright yellow-white flame and they called it acetylene. Within eight years the first carbide lamp was offered to the public.

The first carbide cap lamps weighed approximately four ounces and were four inches high and 1 inch in diameter. The lamp consisted of two compartments that screwed together. The upper part contained water whose flow into the lower chamber containing the carbide, was controlled by a drip valve. A three-inch reflector directed a light of ten-foot candle power and was a great improvement over the tallow candle.

Electric Lamps

Miners are now equipped with battery powered or electric lamps. At first the electric light was too heavy and required a liquid electrolyte, which proved undesirable for several reasons.

A portable lamp is composed of two parts, the battery which furnishes the current, and the bulb. The bulb was perfected quickly but the battery was troublesome. In fact, none of the early experimental lamps proved successful, as the bulb required too heavy a battery. Also, leakage of acid was a serious problem. Today, the cap lamp uses a non-spillable battery and a parabolic reflector equipped with safety features that hooks onto the miner's cap. Electric lamps came on market around the year1902 and have a lifespan of approximately five years.

The dawn of the electric lamp allowed the miner to work in any position without restraint, as it did not interfere with the free motion of the body. Lamphouses at the various collieries had facilities for charging, cleaning, and filling both electric lamps and oil safety lamps.