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- ✓ STOPING PROCEDURE
- ✓ HAULAGE OF MINERALS
- ✓ METHODS OF DEVELOPMENT OF MAIN HORIZON
- ✓ ARRANGEMENT OF RAISE

Stoping

Stoping is the process of extracting the desired **ore** or other **mineral** from an **underground mine**, leaving behind an open space known as a **stope**.

- Stoping is used when the country rock is sufficiently strong not to cave into the stope, although in most cases artificial support is also provided.
- Stoping is considered **"Productive work"**, and is contrasted with **"Deadwork",** the work required merely to access the mineral deposit, such as sinking shafts and winzes, carving adits, tunnels, and levels, and establishing ventilation and transportation.

Stoping

Transportation

Stope

Overview of Stoping

A stope can be created in different ways. The specific method of stoping depends on a number of considerations:-

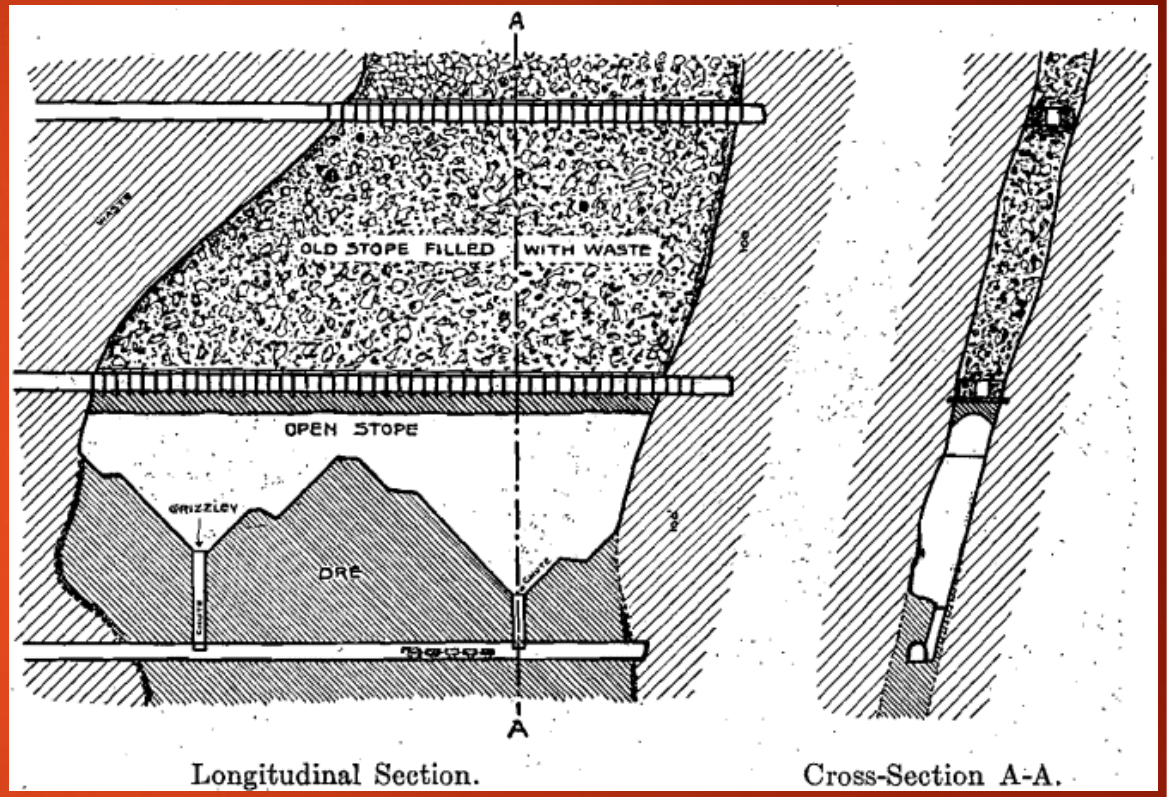
- ✓ Both technical and economical-based largely on the geology of the ore body being mined.
- ✓ These include the incline of the deposit (whether it is flat, tilted or vertical)
- ✓ The width of the deposit
- ✓ The grade of the ore
- ✓ The hardness and strength of the surrounding rock, and
- ✓ The cost of materials for supports.

Stope Systems

There are various Stope systems practicing in mining industries, these could summarized as follow:-

- **A) Open-Stope Systems-**Open stoping is generally divided into two basic forms based on direction: overhand and underhand stoping, which refer to the removal of ore from above or below the level, respectively.

Underhand stoping, also known as horizontal-cut underhand or underbreaking stoping, is the working of an ore deposit from the top downwards. Like shrinkage stoping, underhand stoping is most suitable for steeply dipping ore bodies. Because of the mechanical advantage it offers hand tools being struck downward (rather than upward, against gravity), this method was dominant prior to the invention of rock blasting and powered tools

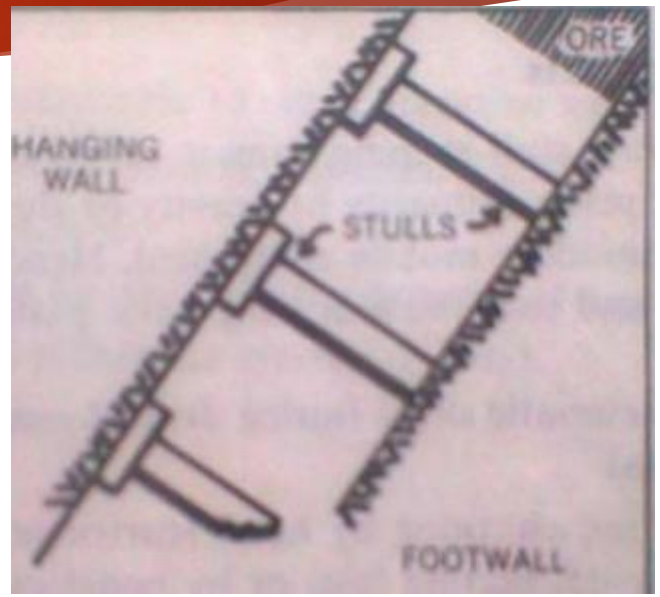


Overhand stoping: In overhand stoping, the deposit is worked from the bottom upward, the reverse of underhand stoping. With the advent of rock blasting and power drills, it became the predominant direction of stoping

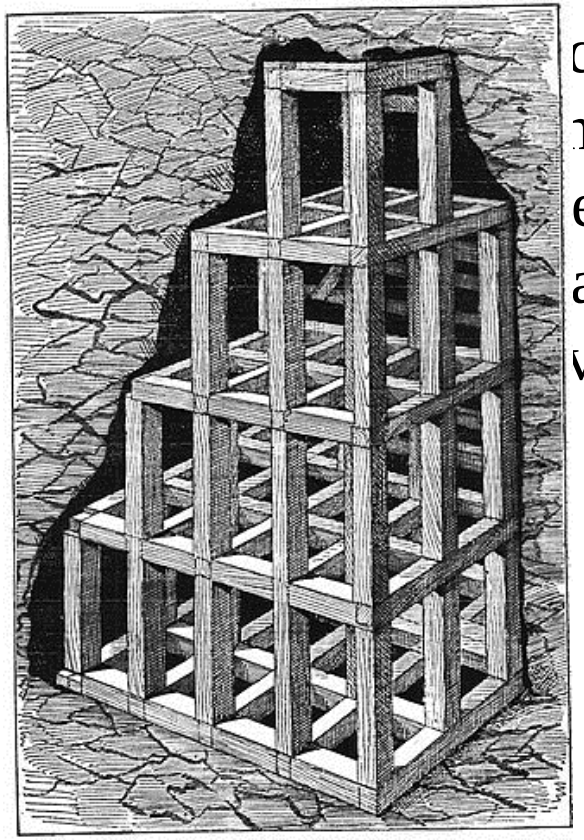
Combined stoping: In combined stoping, the deposit is simultaneously worked from the bottom upward and the top downward, combining the techniques of overhand and underhand stoping into a single approach

Breast stoping: Breast stoping is a method used in horizontal or near-horizontal ore bodies, where gravity is not usable to move the ore around. Breast stoping lacks the characteristic "steps" of either underhand or overhand stoping, being mined in a singular cut. **Room and pillar** is a type of breast stoping

- **B) Timbered-Stope Systems-** A stope made of square-set timbering or any of its variation is called timbered-stope system.

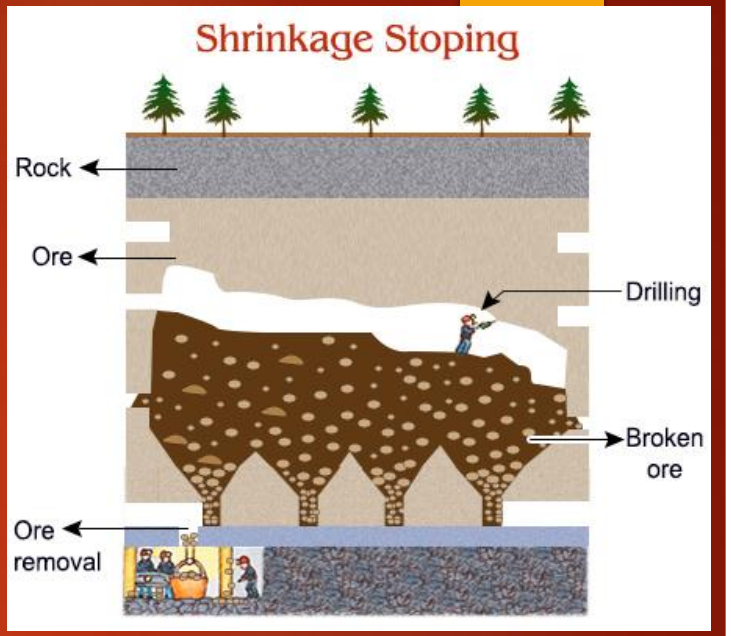


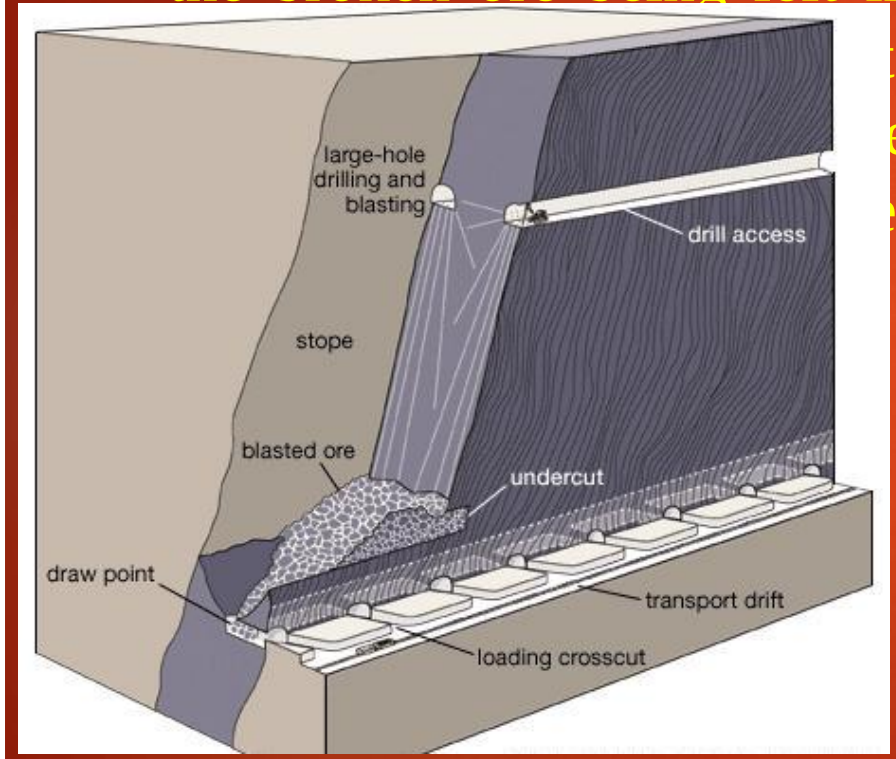
Stull stoping: Stull stoping is a form of stoping used in hardrock mining that uses systematic or random timbering ("stulls") placed d hanging wall of the vein. The method nging wall and often the footwall be of e stulls provide the only artificial support. as been used up to a depth of 3,500 feet vals up to 12 feet (3.7 m) wide.



Square-set stoping: Square-set stoping is a method relying on Square-set timbering. Square set timbers are set into place as support and are then filled with cement. The cement commonly uses fine tailings. This is a highly specialized method of stoping requiring expert input

- **C) Shringkage Stoping-** It is most suitable for steeply dipping ore bodies (70°-90°). In shrinkage stoping, mining proceeds from the bottom upwards, in horizontal slices (similar to cut and fill mining), with the broken ore being left in place for miners to work
ope is reached all the ore is
e stope may be backfilled or
rock conditions.





- **D) Long hole Stoping-** Long hole stoping as the name suggests uses holes drilled by a production drill to a predetermined pattern as designed by a Mining Engineer. Long hole stoping is a highly selective and productive method of mining and can cater for varying ore thicknesses and dips (0 - 90 degree).

Haulage of Minerals

Haulage: Haulage is the business of transporting goods by road or rail.

In mining, the horizontal transport of ore/resources, supplies, waste and man is called haulage. So haulage of minerals is the transportation system of mineral in mine.

The vertical transport of the same is called **hoisting**.

Transport developments followed two distinct routes in each of the major functions, namely

- The movement of ore/mineral resources
- Persons, materials and equipment

Classification of Haulage and Hoisting

The haulage and hoisting can broadly classified as follows:-

- ❑ Surface Mining

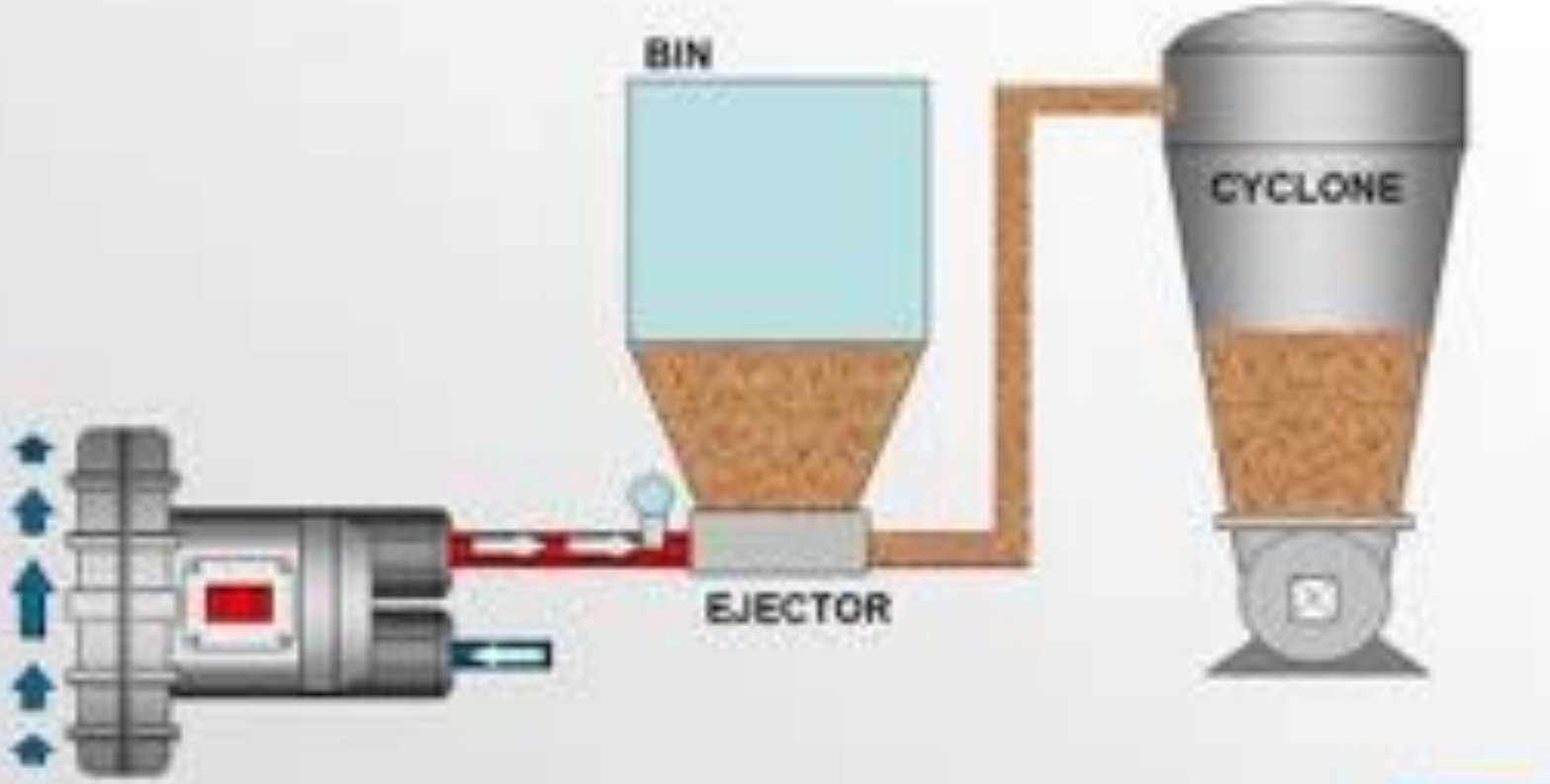
Cyclic	Continuous
Rail (train), Truck, Trailer	Belt conveyor
Front-end loader	High-angle conveyor
Dozer	Hydraulic conveyor (Pipeline)
Skip	
Aerial tramway	

Aerial tramway

- Underground Mining

Cyclic	Continuous
Rail (train), Truck, Shuttle car	Conveyor (belt, chain and flight monorail)
Slusher (scraper)	Hydraulic conveyor
LHD	Pneumatic conveyor
Skip, cage	

Pneumatic Conveying



Factors to select haulage systems

Important factors that affect the selection of the materials and equipment transport system are as follows:-

1. Quantity (volume and weight) & size of materials and equipment
2. Access method to the destination
3. Transport roadway size (height & width)
4. Transport distance and loading points
5. Roadway conditions (gradient, undulation, soft floor etc.)
6. Relation to the personnel transport system

Details in pdf file……..

Development of Main Horizon

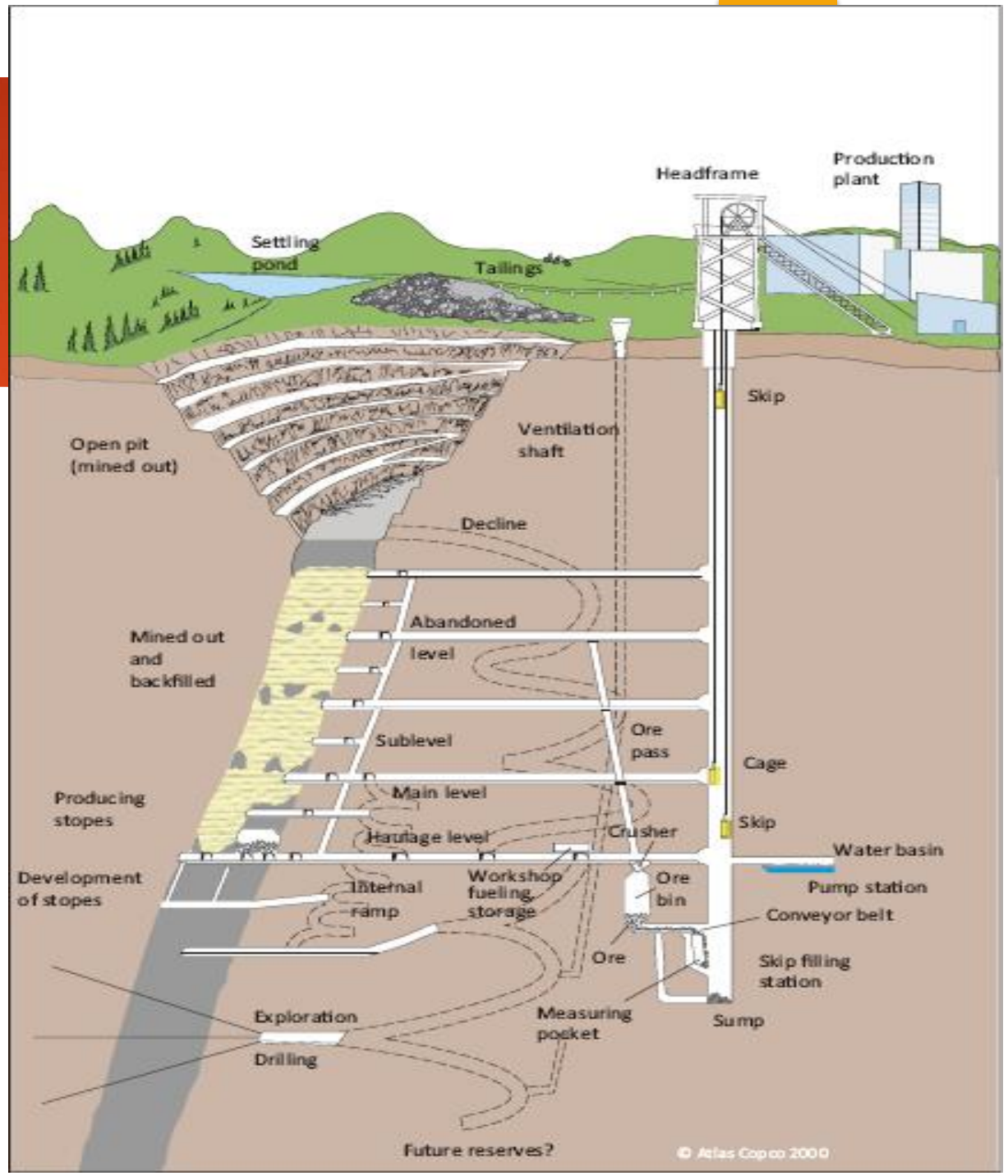
Once a mining lease has been awarded to an operator, **exploration** (i.e. evaluation of the resource) takes place, followed by a planning and development process before excavation or mining begins.

The initial task is to gain **access** to the seam from the surface by some means (**shafts**, **drifts**, etc.)

Once access has been gained into the resources, **workings** are developed by mining a series of **roadways** (or "**headings**"). These roadways are tunnels largely, if not totally, within the seam, usually rectangular in shape though on occasions they may have an arched or even circular profile. The first opening or horizon is called the **main horizon**.

The primary opening into an underground mine to provide access for people, materials, and equipment and to enable the ore to be brought to surface can be a shaft sunk vertically or on an “incline”; a “decline,” which is a ramp driven into the earth usually in a spiral fashion; or an “**adit**,” which is a main horizon/main access opening.

The main horizon also developed through drilling, blasting, mucking, transporting the ore and gradually all opening or levels developed accordingly.

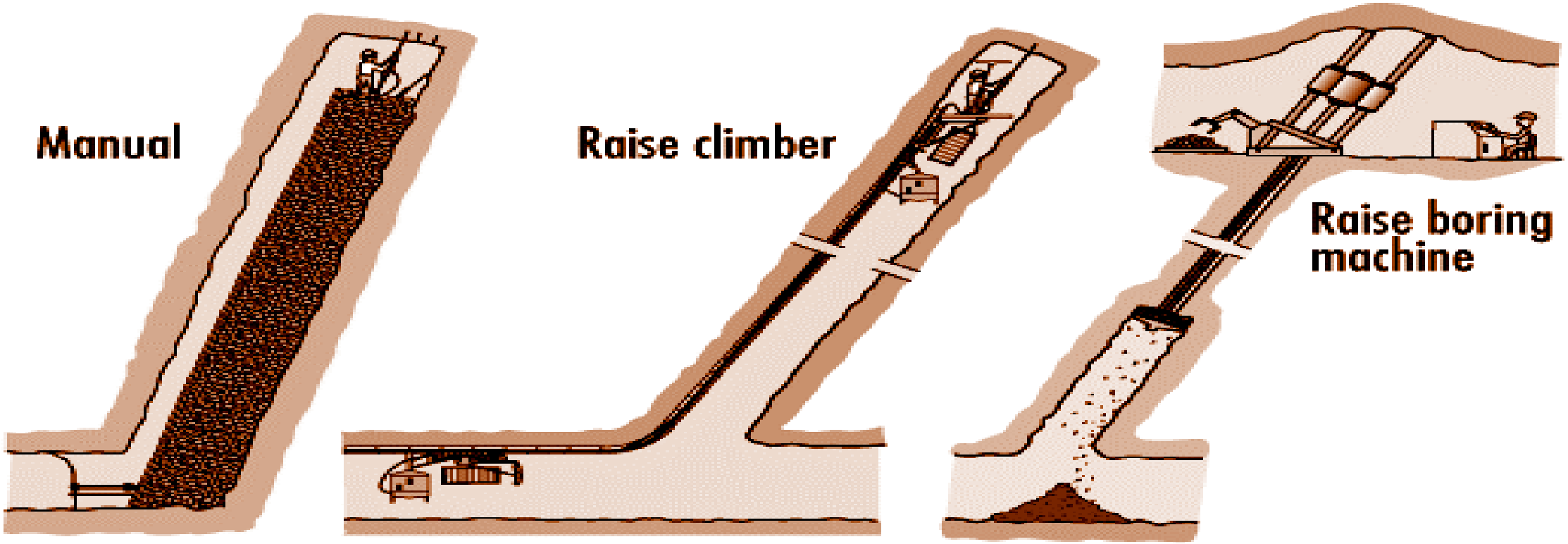


Arrangement of Raise

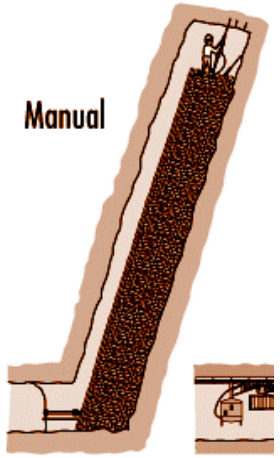
Raise: In underground mining, a **raise** refers to a vertical or inclined excavation that leads from one level, or drift, to another. A raise may also extend to surface.

Raises with different diameters of i.e. 2 to 5 metres (7 to 16 feet) and lengths up to several hundred metres are often drilled by powerful raise-boring machines. The openings so created may be used as **ore passes**, **waste passes**, or **ventilation openings**.

Raising is a difficult and dangerous, but necessary job. Raising methods vary from simple manual drill and blast to mechanical rock excavation with raise boring machines (RBMs)

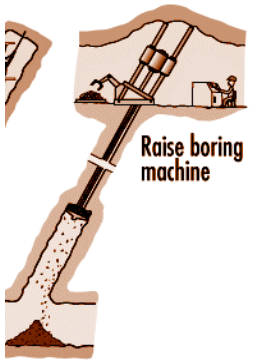


Manual raising is difficult, dangerous, assigned only to experienced miners in good physical condition. The raise section is divided into two compartments by a timbered wall. One is kept open for the **ladder** used for climbing to the face, air pipes, etc. The other fills with **rock** from blasting, as a **platform** when drilling the round. The work involves ladder climbing, timbering, rock drilling and blasting, all done in a poorly ventilated space. It is all performed by a single miner, as there is no room for a helper. Mines search for alternatives to the hazardous and laborious manual raising methods.



The raise climber is a vehicle that obviates ladder climbing and much of the difficulty of the manual method. This vehicle climbs the raise on a guide rail bolted to the rock and provides a robust working platform when the miner is drilling the round above. Very high raises can be excavated with the raise climber with safety much improved over the manual method. Raise excavation, however, remains a very hazardous job.

The RBM is a powerful machine that breaks the rock mechanically. It is erected on top of the planned raise and a pilot hole about 300 mm in diameter is drilled to break through at a lower level target. The pilot drill is replaced by a reamer head with the diameter of the intended raise and the RBM is put in reverse, rotating and pulling the reamer head upward to create a full-size circular raise.



Methods of Raising

There are four excavation methods for raises:

1. Conventional or open raise
2. Long-hole or drop raise
3. Alimak
4. Raise boring

Raises serve a number of purposes including:

1. Transportation of ore and waste rock
2. Ventilation
3. Creating a free face for mining
4. Movement of workers via manway ladders