

CLASSIFICATION OF MINING SYSTEMS

Types of Mining Methods

Methods and procedures

DIFFERENT TYPE OF UNDERGROUND MINING METHODS

Supported methods	Unsupported methods	Caving methods
1) Cut and fill stoping	1) Room-and-pillar mining	1) Longwall mining
2) Stull stoping	2) Stope-and-pillar mining	2) Sublevel caving
3) Square set stoping	3) Shrinkage stoping	3) Block Caving
	4) Sublevel stoping	

TABLE: METHODS FOR UNDERGROUND MINE

Underground methods	<i>Unsupported</i>				<i>Supported</i>		<i>Caving</i>		
Factor	<i>Room and Pillar</i>	<i>Stope and Pillar</i>	<i>Shrinkage Stoping</i>	<i>Sublevel Stoping</i>	<i>Cut and Fill Stoping</i>	<i>Square Set Stoping</i>	<i>Longwall Stoping</i>	<i>Sublevel Caving</i>	<i>Block Caving</i>
Ore strength	Weak / Moderate	Moderate/ Strong	Strong	Moderate/ Strong	Moderate/ Strong	Weak	Any	Moderate/ Strong	Weak/ Moderate
Rock strength	Moderate / Strong	Moderate/ Strong	Strong	Fairly Strong	Weak	Weak	Weak / Moderate	Weak	Weak / Moderate
Deposit shape	Tabular	Tabular / Lenticular	Tabular / Lenticular	Tabular / Lenticular	Tabular / Irregular	Any	Tabular	Tabular / Massive	Massive / Thick
Deposit dip	Low / Flat	Low / Moderate	Fairly Steep	Fairly Steep	Fairly Steep	Any	Low / Flat	Fairly Steep	Fairly Steep
Deposit size	Large / Thin	Any	Thin / Moderate.	Thick / Moderate	Thin / Moderate	Usually Small	Thin / Wide	Large Thick	Very Thick
Ore grade	Moderate	Low / Moderate	Fairly High	Moderate	Fairly high	High	Moderate	Moderate	Low
Ore uniformity	Uniform	Variable	Uniform	Uniform	Variable	Variable	Uniform	Moderate	Uniform
Depth	Shallow / Moderate	Shallow / Moderate	Shallow / Moderate	Moderate	Moderate / Deep	Deep	Moderate / Deep	Moderate	Moderate

Major UG Mining Equipments

□ *Winning & Loading*

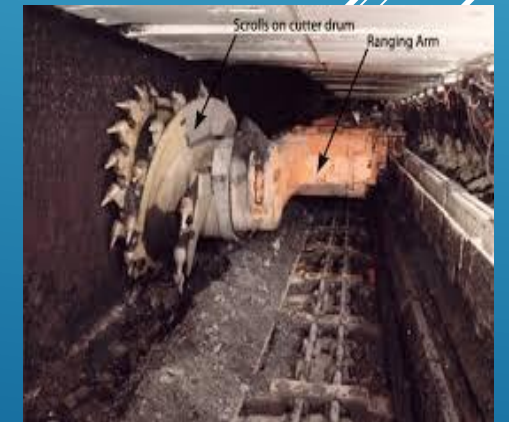
1) Drilling Machines-Hand held, tyre/crawler mounted



2) Road Header



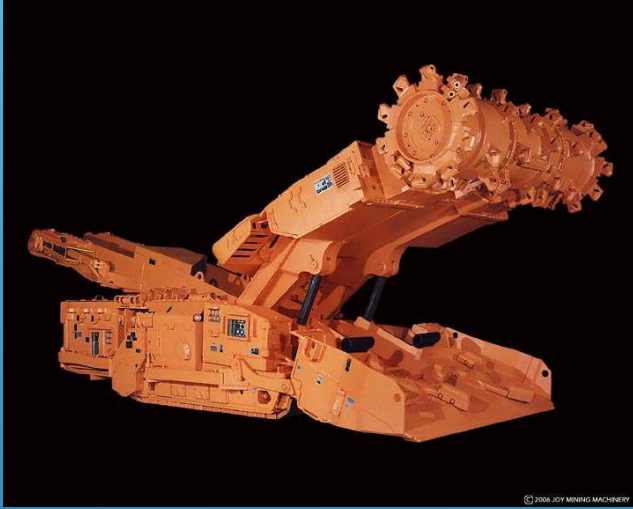
3) Shearer



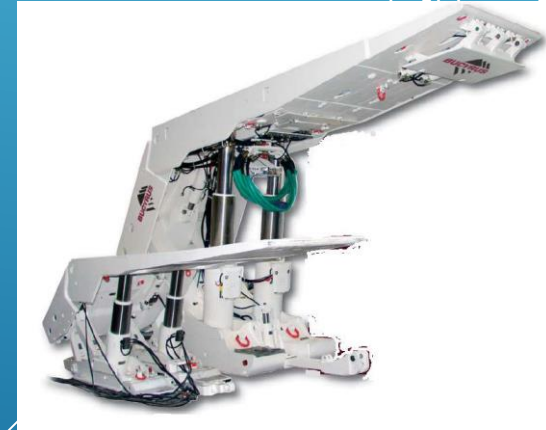
4) Continuous Miner

5) Side Discharge Loader (SDL)

6) Load Haul Dump (LHD)




- Shuttle car
- Roof Bolter
- Powered Support



Drilling machines, road header, shearer, continuous miner, side discharge loader, Load haul dump

□ *Transportation*

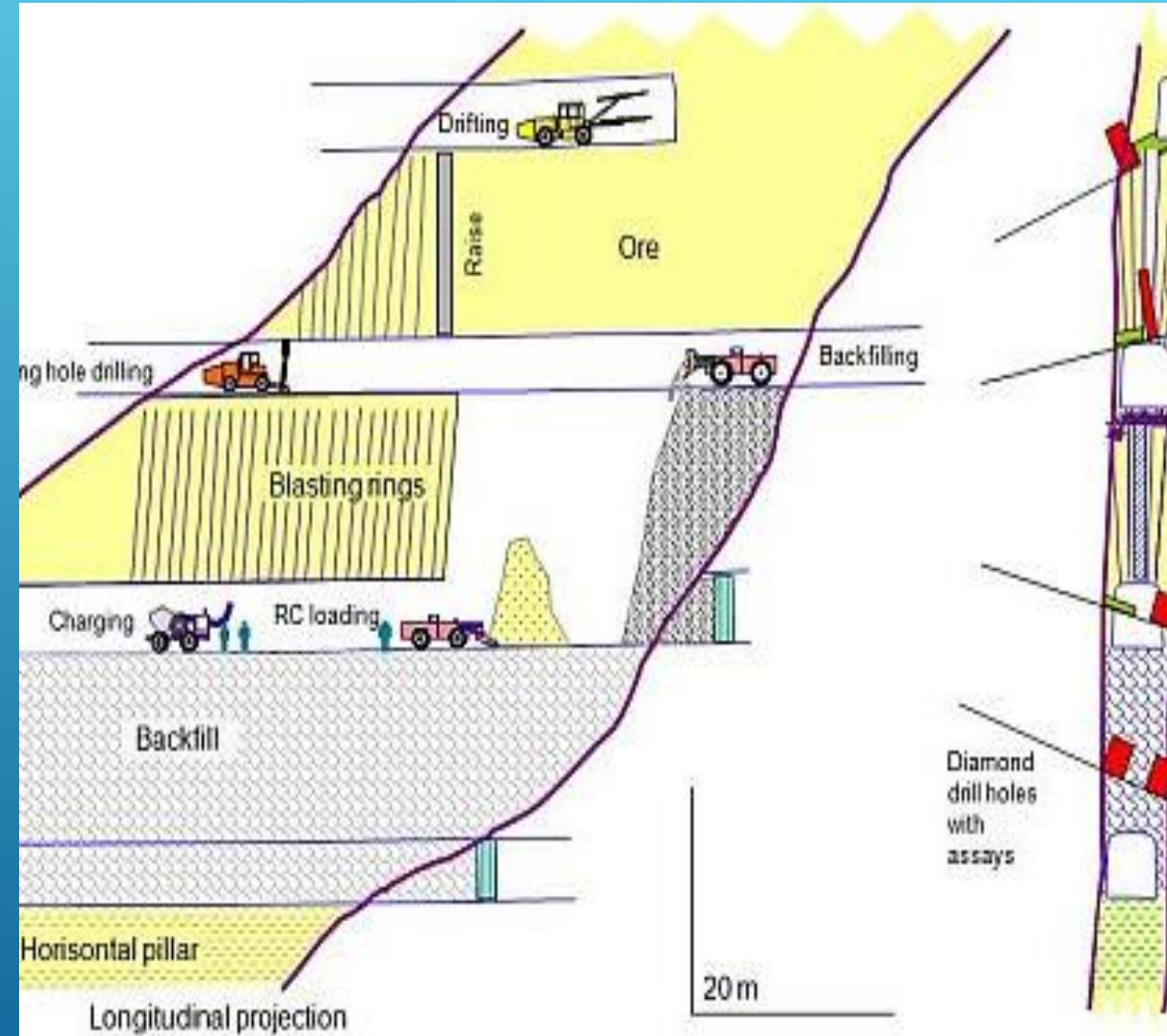
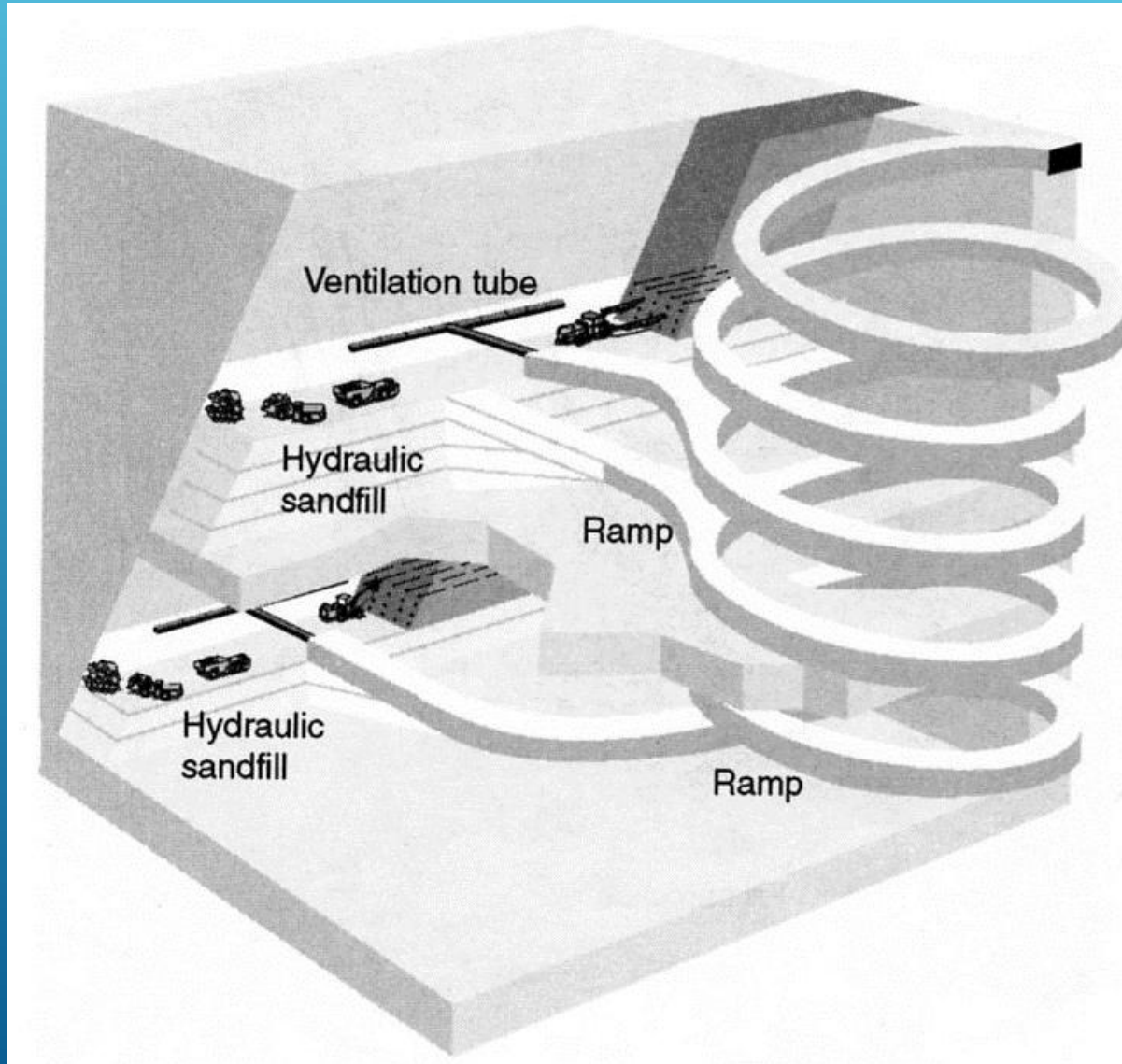
- ❖ Conveyors
 - ❖ Haulages
 - ❖ Winding systems
 - ❖ Man Riding systems
 - ❖ Shuttle cars/Ram Cars
 - ❖ Locos
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- A decorative graphic consisting of several parallel white lines of varying lengths, slanted upwards from left to right, located in the bottom right corner of the slide.

METHODS AND PROCEDURE

Cut and Fill Stoping: This method is used in vertical stopes and in mining high-grade irregular ore bodies.

- The rock mass surrounding the ore deposit is usually weak
- Unable to support loads over an extended stoping height
- Successive cutting of the ore into horizontal slices is carried out starting from the bottom and progressing upwards towards the surface
- The ore is extracted in horizontal slices and replaced with backfill material
- The fill material varies, depending on the support required, and the material available

CUT AND FILL STOPING: (CONT.)



CUT AND FILL STOPING: (CONT.)

- ▶ It is one of the popular and expensive but selective mining method, with low ore loss and dilution
- ▶ Is done only in high grade minerals/resources (why)
- ▶ Ore is drilled, blasted and removed from stope
- ▶ The ore is mined in slices
- ▶ Voids are backfilled with a variety of fill type to support the walls ---rock waste, tailings, sand or other suitable materials

MINING PROCEDURE OF CUT AND FILL STOPING

- ❖ In cut and fill stoping, the orebody is retrieved in horizontal slices beginning at the very bottom and advancing upwards towards the surface.
- ❖ Ramps (inclined tunnels) are excavated to connect the surface to the underground ore body.
- ❖ Drifts are excavated to come in contact with the ore slices. The slices are drilled using a jumbo, blasted by charging the drill holes with explosives, and ore is removed by using dump trucks or Load Haul Dump (LHD) vehicles.
- ❖ The ore is dumped into an ore pass, an inclined tunnel where ore is transported to a lower elevation in the mine.

- ❖ The ore is picked up at the other end of the ore pass by a LHD to be transported out of the mine through a ramp (inclined tunnel).
- ❖ Once a slice is completely mined out, the empty space is partially backfilled hydraulically.
- ❖ The backfill material used can be a mixture of sand and rocks, waste rock with cement, or dewatered mill tailings (rejected low grade ore from processing, usually fine and sandy).
- ❖ The backfill underground serves to keep the mine walls stable and also as the floor for mining the next slice.
- ❖ Mining continues upwards towards the surface until the orebody is depleted.

It is practiced both direction-

- ✓ Overhand (Upward) cut and fill
 - ❖ Is applied to ore lies underneath the working area and the roof is backfill
 - ❖ Involves a work area of cemented backfill while mining ore from the roof
- ✓ Underhand (Downward) cut and fill
 - ❖ Is applied to ore lies beneath the working area and the roof is cemented backfill
 - ❖ Ore overlies the working area and the machines work on backfill

Advantages:

- ✓ Minimum developments before mining starts.
- ✓ Possibility of selective mining.
- ✓ Versatility under varying conditions.
- ✓ Openings are small therefore low dilution.
- ✓ Change to another method can be achieved readily.
- ✓ Investment in machinery is small.
- ✓ Large extent ground movements such as subsidence are kept to minimum.

Disadvantages:

- ✓ Ore production is highly cyclical.
- ✓ The method is labour intensive and especially skilled labour intensive.
- ✓ Use of mechanization is low therefore low productivity.
- ✓ Personnel work under freshly cut roof that can cause safety problems.
- ✓ Degree of ground control is very high making the method an expensive one.