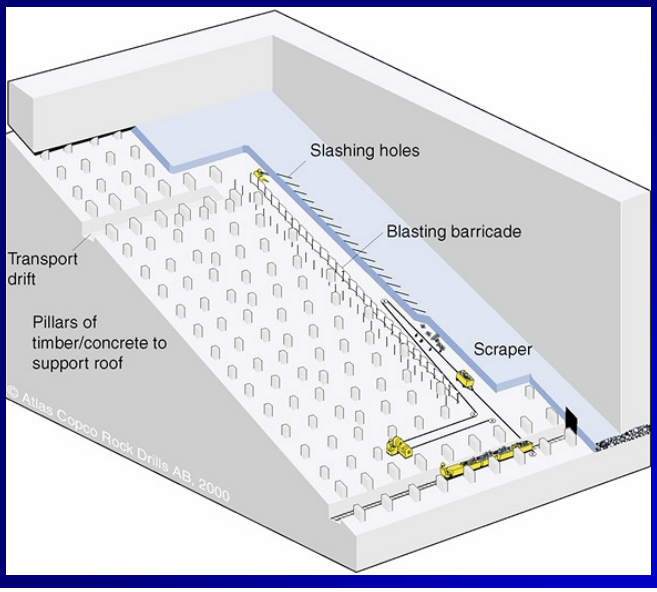
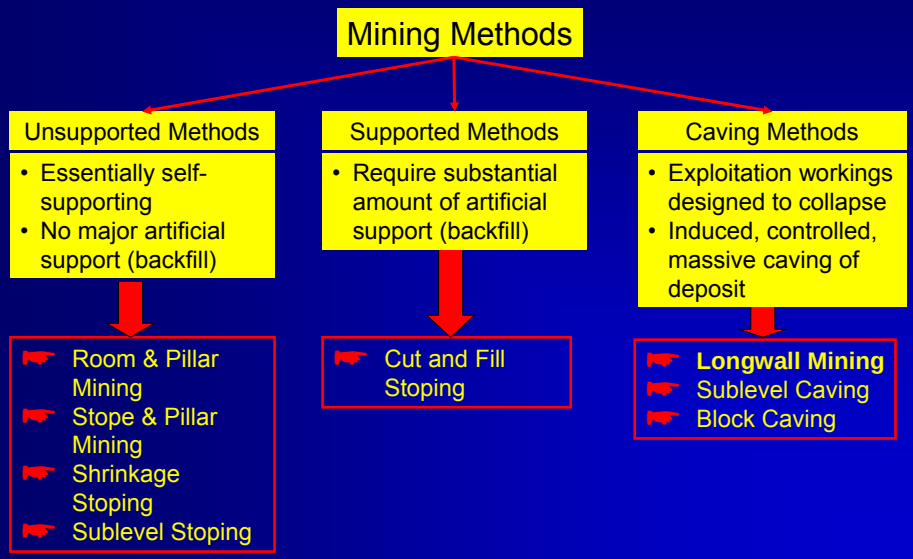
Longwall Mining



Longwall Mining

Classification of Mining Methods



Basic Facts

- Caving method
- Mining of a long face between sets of entries
- Material is mined in thin slices along the advancing face
- Very often continuous mining systems
- Used in flat-lying, thin and tabular deposits

Conditions

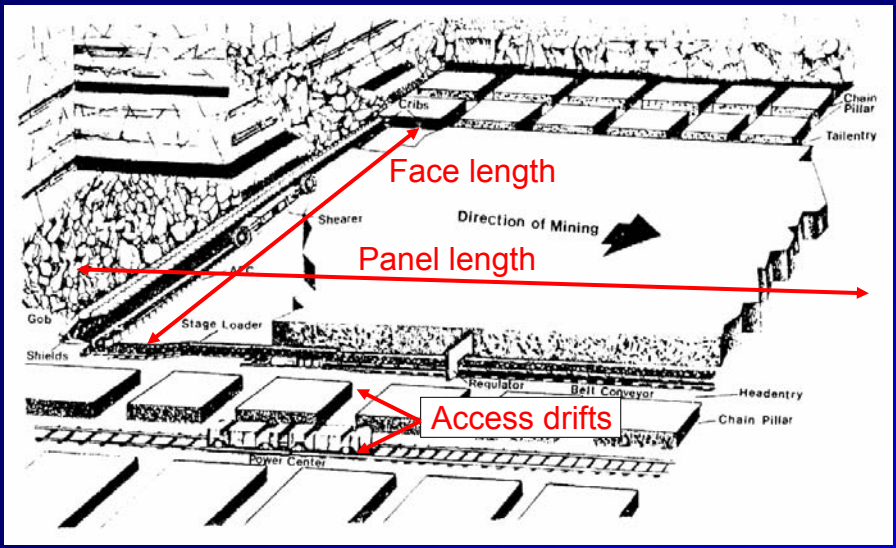
- Ore strength: preferably weak for continuous mining systems
- Rock strength: weak to moderate (cavable!), firm floor
- Deposit shape: tabular
- Deposit dip: preferably flat and uniform
- Deposit size: large areal extent, thin bedded, uniform thickness (1...5 m)
- Ore grade: moderate
- Ore uniformity: moderate
- Depth: moderate to very deep (up to 3500 m for non-coal mining)

Development 1

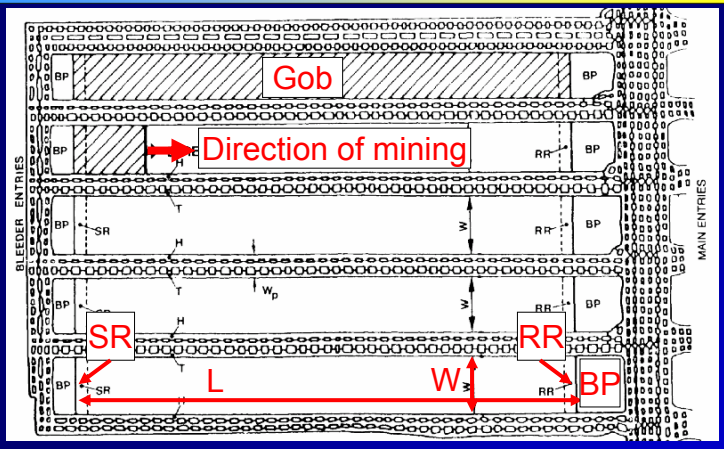
- Development with conventional drilling and blasting, roadheaders or continuous miners
- Main entries across the mining lease
- One or more access drifts along each panel
- Possibly additional bleeder entries for degassing
- Typical dimensions of a panel

Panel length	900...2700 m
Face length	150...300 m
Face width	2.4...3.6 m
Seam thickness	1...5 m

Development 2



Development 3



L	Panel length	BP	Barrier Pillar
W	Face length	SR	Start Room
		RR	Recovery Room

Mining Operations

- Plough takes thin cut (5...25 cm) off the face (for thin seams of soft rock)
- Shearer takes thick cut (50...100 cm) off the face (for thick seams of soft rock)
- Ore is drilled and blasted in a discontinuous operation (for hard rock mining)
- Ore is conveyed with armoured face conveyors and belt conveyors (for soft rock)
- Ore is hauled with scrapers and LHDs (for hard rock mining)

New Developments

- Research and development in South African gold reefs
- Goal: continuous mining and haulage of hard rock
- Breakage of rock using impact rippers or activated disc cutters
- Main benefits: more continuous operation, less needed labour and better health and safety conditions

Equipment 1

- Development:
  - Drill rigs
  - TBMs
  - Roadheaders
  - Continuous miners
- Mining:
  - Shearer (for thick seams)
  - Plough (for thin seams)
  - Drilling and blasting (for hard rock mining)
- Haulage:
  - Armoured face conveyor
  - Scraper (for hard rock mining)
  - LHD (for hard rock mining)

Equipment 2

- Face support:
  - Self-advancing hydraulic shield support
  - Timber, steel or concrete posts (for hard rock mining)
- Ground control in drifts:
  - Rock bolts
  - Steel arches

Equipment 3

Eickhoff shearer

Equipment 4

DBT plough

Equipment 5

Heintzmann Continuous Longwall Miner

Equipment 6

DBT hydraulic shield support

Equipment 7

Joy continuous miner

Equipment 8

DBT armoured face conveyor with twin inboard chain

Equipment 9

Steel arches as support in a main entry

Subsidence 1

- Surface is lowered by about the thickness of the mined seam
- Subsidence is an environmental hazard and can damage the surface and underground workings
- Subsidence trough is created at the surface
- Damages can be controlled by a uniform and limited face advance rate

Subsidence 2

Tilted houses in a mining area

Advantages

+ Highest underground productivity
  (≈ 5 t per employee hour in coal mining!)
+ Good continuity of operation
+ Low mining cost (relative cost 15%)
+ High production rate, large-scale method
+ Suitable for total mechanisation and automation
+ Low labour requirement
+ High recovery (70...90 %) and low dilution (10...20 %)
+ Concentrated operation with good conditions for transport, ventilation and supply of material
+ Applicable to deep seems with bad roof conditions
+ Very good health and safety conditions

Disadvantages

- Subsidence can damage the surface in a wide area
- Inflexible and rigid in layout and execution
- No selectivity
- Uniform mining rate necessary to avoid problems with roof support and subsidence
- High capital cost (≈ 100 000 €/m face length)
- Concentrated production can cause costly delays
- High moving cost
- Problems with temperature, humidity, dust and spontaneous combustion in the gob

Conclusion

Very efficient mining method for thin tabular deposits of soft rock, e.g. for coal, potash, soda ash, phosphate etc...