Underground Mining of Metalliferous Deposits

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Lecture 36
Room and Pillar Mining - 2

ROOM AND PILLAR METHOD

Drilling operations:

- Development drilling (ramps, crosscuts, and drifts)
- Production drilling (benching);
- Rock reinforcement.

❑ "V-cut" patterns or "burn cut" drilling patterns are adopted for development.

❑ Electro-hydraulic jumbos execute both development and production drilling.

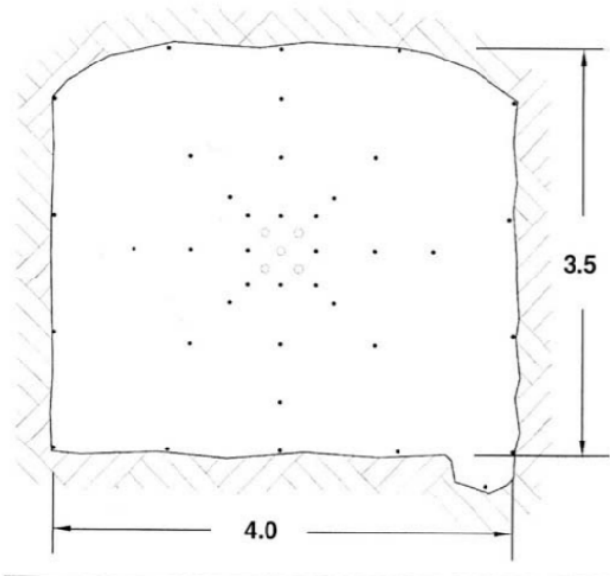

Figure 1. Drill pattern for 4- by 3.5m drift

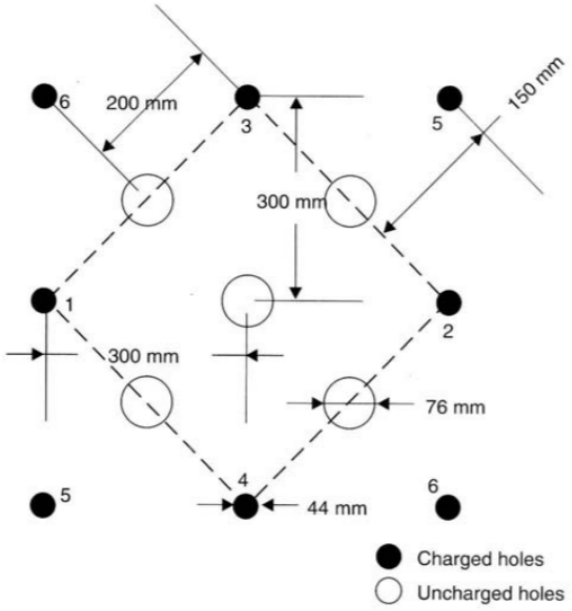

Figure 2. Cut arrangement for drifting round

- Two or three boom jumbos equipped with hydraulic drills are used for driving crosscuts and connecting them.

Blasting

- Preparations for a blast consist of drilling, flushing, charging, and connecting.

  Detonators: Nonel

  Bottom charge:Hydrogel

  Column charge: ANFO.

- Only about 40% of the rock should be broken with drilled swing patterns (rounds), breaking to only one free face.
- The other 60% of the rock should be broken by slabbing (by drilling holes parallel to the second free face).

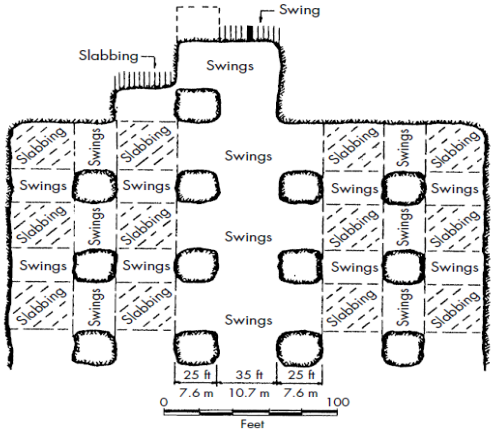

Figure 3. Swinging and Slabbing in room and pillar

- This type of blasting is known as a swing when there is only one free face available.
- Slabbing is used once a free face has been established so that there is a group of drill holes parallel to an open face.

- This free face allows the fragmentation of the rock to be the same as a swing with less explosives which leads to lower costs.
- SLABBING to be maximized for lowering cost

PILLAR DESIGN

Pillar support is intended to control rock mass displacements throughout the zone of influence of mining, while mining proceeds. Pillar design considerations that need to be taken into account include :

- Pillar load
- Strength of pillars (failure criteria)
- Orebody geometry
- Geological characteristics of a mine
- Load-deformation characteristics of the pillar and stiffness of the loading system

  Peak-pillar strength (load-bearing capacity)

  Post-peak or load-deformation characteristics of a pillar

Pillar load and load distribution need to be established and potential failure models must be always kept in mind.

The objective in placement of pillars is to locate them in areas of low-grade ore or waste rather than follow a systematic mining plan so long as adequate roof support is provided.

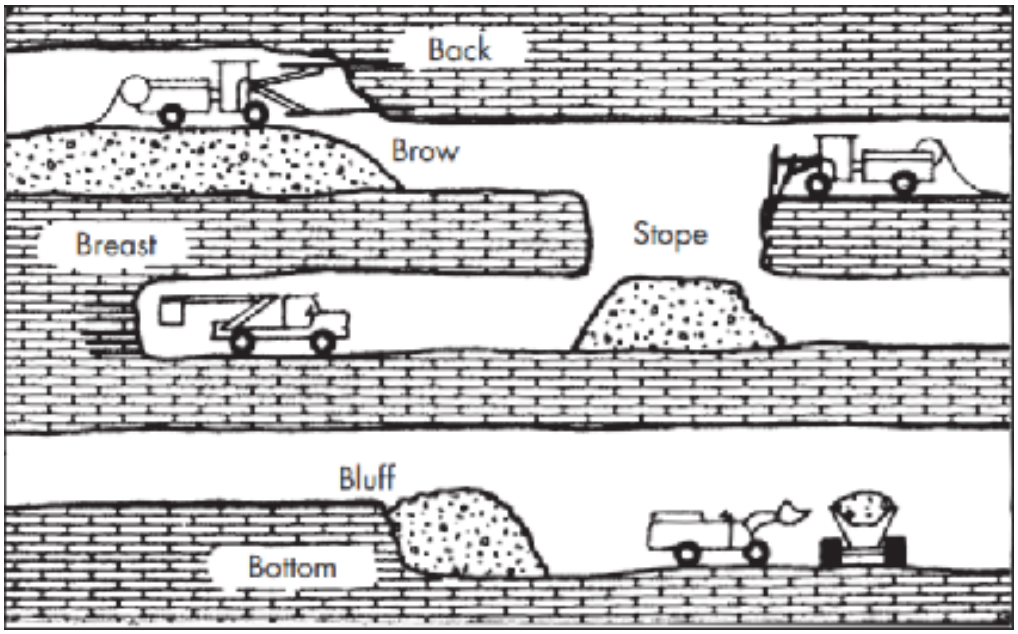

Figure 5. Various types of stoping action involved in R&P metal mines

Dilution

- When it is necessary to mine low-grade zones or even excavate barren rock when developing toward economically attractive zones.
- The waste is separated and used as fill in other areas.
- For most of the blasts, dilution can be controlled by relating the extracted volume to the information available from diamond-drill holes, sill development, and previous benches.
- The geological data from the upper bench are very helpful for planning the mining of the next bench
- Other primary factors for dilution control are close supervision of blasting and handling the blasted rock.
- For Room & pillar method dilution has been found to range from 6% to 10% of total extraction.

Pillar Recovery

There are four main pillar extraction methods depending on the variation of room and pillar being used and the ore body characteristics:

- High grade material can be slabbed off from pillars during a retreat of the mine.
- Pillars can be completely removed in a retreat.
- Select valuable pillars can be completely removed
- Massive backfill can be used to support the mine, while pillars are typically mine from a sublevel beneath.
- Partial extraction of pillar is called **ROBBING**, which is practiced particularly if pillars are larger than necessary to support the back allowing more ore to be recovered safely.

Advantages

- Flexible – Can utilize multiple faces, and therefore be selective of production and grade. Especially advantageous with base metals that have cyclical price cycles.
- Highly Mechanized – Not very strenuous on the workforce. Allows for high efficiency and productivity.
- Easy Maintenance – Usually utilizes mobile, trackless equipment which is easy to transport in and out of maintenance areas. Equipment can also be transferred easily between levels.
- Low Operating Costs – Largely due the mechanization and productivity, operating costs are usually considerably lower than most underground mining methods.
- Low Development Costs – Most of the development work takes place within the orebody, which means ore production and development work are carried out simultaneously.
- Good Working Conditions – Work takes place in large open stopes with good footing. Room and pillar does not force workers to have to go into confined stopes and stand on top of broken muck.

Disadvantages

- Roof Maintenance – A large portion of the roof is exposed making monitoring and maintenance very time-consuming and costly.

- High Capital Costs – Initial infrastructure and equipment fleet can be expensive, although total costs are typically cheaper in the long run with lower operating costs.
- Low Recovery – Room and Pillar can have one of the lowest recovery rates of any underground mining method.
- Lack of flexibility in structural planning – It is difficult to make structural changes part way through production because most of the previously mined out rooms must be supported for the duration of the production life.
- Traffic Safety Concerns – Due to the large mechanised fleet of equipment required for room and pillar, many piece of equipment must work in close proximity. Traffic accidents and safety of the workers can be an issue.