Underground Mining of Metalliferous Deposits
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Lecture 42
Cut and Fill Stoping – II

CUT & FILL METHOD – Sill Level

Sill level development:

Sill level development starts from centre raise on both sides

Driven about 5m above the ore drive and full width of the ore body is exposed for a maximum vertical height of 4.8m.

Pneumatic loaders with tilting buckets are very useful at this stage.

Roof above Sill is supported with rock bolts (1.5m × 1.5m)

Ore Pass

A F/W haulage is driven on the F/W side of ore body and ore passes are excavated at 50 degree inclination at intervals of 30m along strike.

Difficulty in flow of muck

Steeper ore passes can be made from F/W

In the beginning existing H/W raise can be used to draw ore

Ore passes are underground passageways for the gravity transport of broken ore, waste rock from one level of a mine to a lower level. Inclination of ore pass varies widely within a range of 45^0-90^0, and most common angles are 70^0 and cross sections are mostly circular. Besides transport of ore it also sometimes serves as a storage which is required for efficient mines operation. Ore pass length range from 10 m to 200m or more

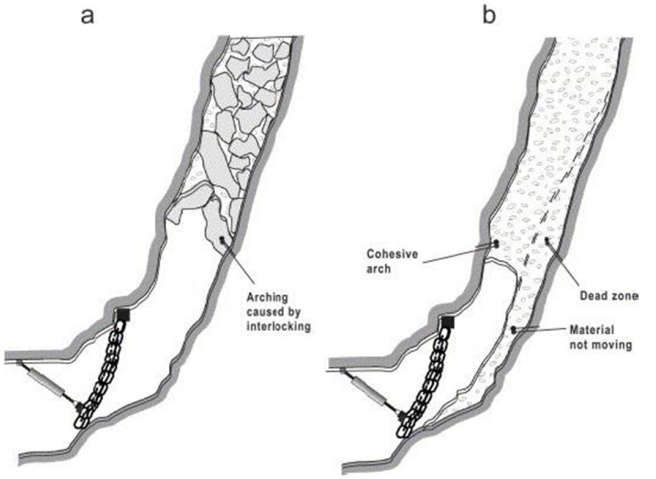

Fig. Hang-ups in an ore pass due to (a) interlocking; (b). cohesion arching.

Figure 1. Ore pass in stopes

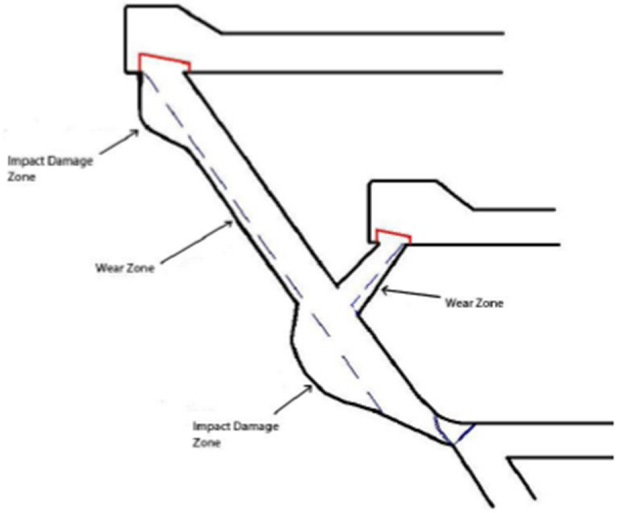

Figure 2. General ore pass for multiple levels

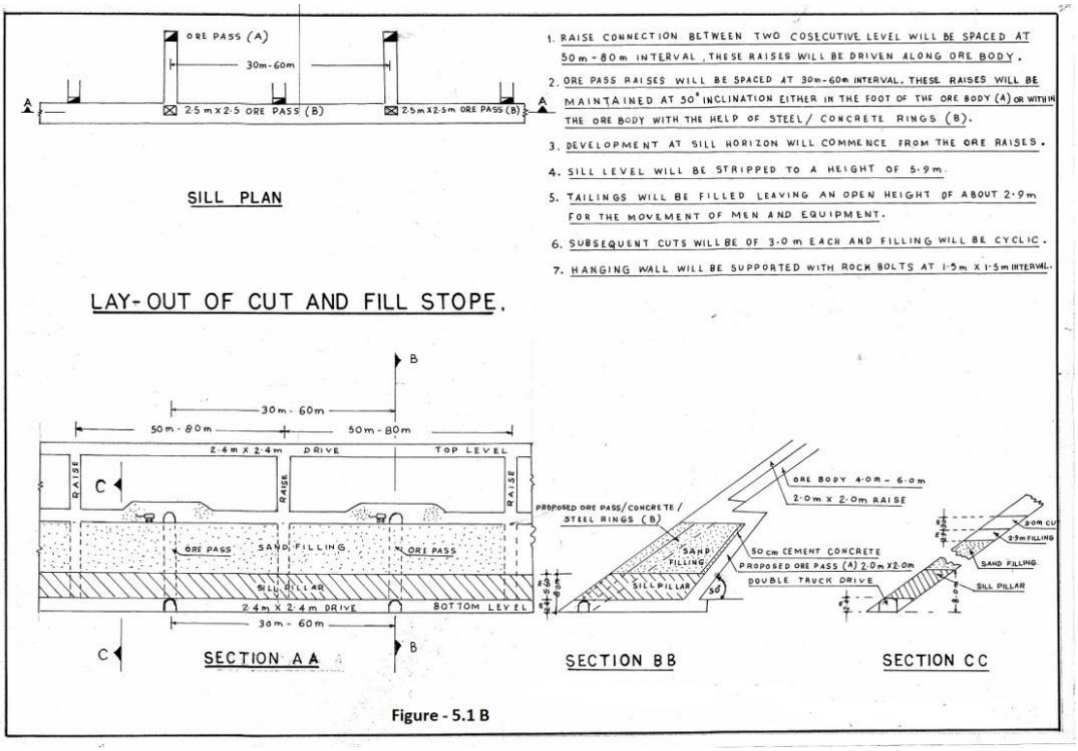

Figure 3. Layout of cut and fill stopes

In this method the ore is excavated in successive horizontal slices starting from the bottom of the stope and advancing upwards. Back stripping is carried out in panels with 2.4m vertical cut at a time

Cycle of operation

Drilling:

The ore slice can be drilled in two different ways

1. with horizontal stope holes,
2. or with upward holes for which certain headroom is required between the back and the fill surface (usually 2-2.5m).
    a. For drilling light rock drills (**Jack hammers**) are often used though **mechanized Jumbo drills** are also used. An advantage of upward drilling method is that large sections of the roof can be drilled without interruptions and large round can be blasted.
    b. 32mm ø, 1.8m long holes.

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Blasting:

Blasting round consists of horizontal or inclined/vertical holes and charging the cartridge or slurries. For even distribution of explosives inside the hole, ANFO charging with compressed air operated ANFO Loader is highly recommended.
ANTI-STATIC Protection, Stope must be well ventilated (Auxiliary fans)

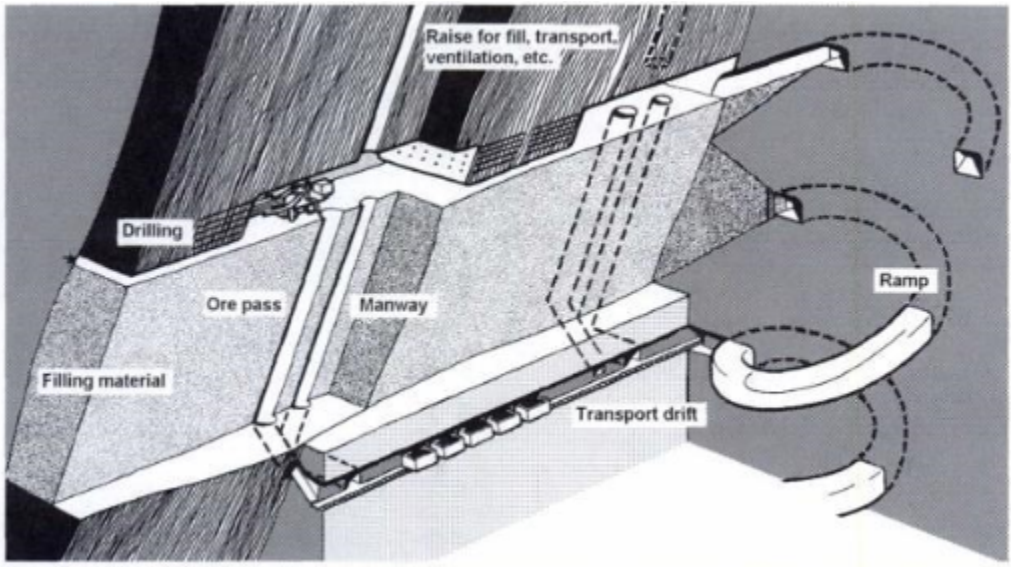

Figure 4. Steep ore body, connected with ramps.

Loading :

Previously scraping (Slusher/Scraper) was used in the stope to bring the blasted muck from two ends up to the central ore pass. Since being able to work directly on a hydraulically filled surface auto loaders are very suitable for loading in stopes where the operation is characterized by a short haul. In comparison to scrapers, these loaders are more versatile, clean the stope efficiently and work unaffected by curves and supports. In highly mechanized stopes with hydra boom jumbos for drilling, the loading and transport are often done with or LHD's. The average distance of travel is generally 60m but has also been as high as 240m. This has made it possible to space the ore passes far apart and save their cost. They are extremely rugged, highly manoeuvrable and exceptionally productive. More than 75% of world's underground mines use LHD for handling the muck of their excavations.

Figure 5. Load haul dumper (LHD)

Support

1. Temporary supports with props are sometimes necessary at the face before permanent supports are installed.
2. Hangwall, Roof or back needs to be artificially supported with Rock Bolts.
3. Cemented/grouted Rock bolts are extensively used (1.5m × 1.5m)
4. Raisin capsules are used where first setting is required

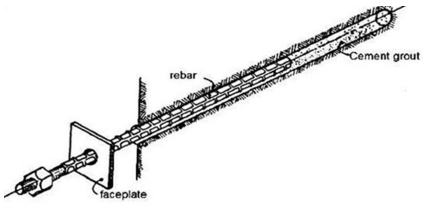

Figure 6. **Cement grouted Rock bolts**

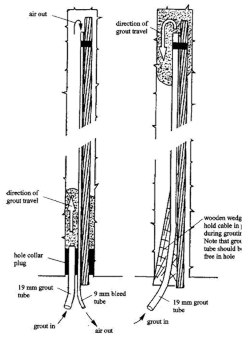

Figure 7. Cable bolts

Filling preparation

1. Ore passes are extended (Steel or Concrete)
2. Barricades are constructed where leakage possibilities are there
3. Machines are shifted to other panel for production
4. Pipelines are laid for supply and discharge of tailings/sand etc.
5. Perforated GI pipe network is extended all over the stope floor for fast and effective drainage of water from slurry fill materials
6. Special drainage technique is required since the slurry (Tailing and water mixture)contains 30-40% water.
7. To provide proper drainage of the fill while it sets percolation drains (perforated pipes) are installed along the stope sill and decantation towers are maintained through the fill;
8. Run-off-water must be disposed off in the drainage system on the haulage level below the stope

Advantages

- Moderate productivity (OMS)
- Moderate rate of production
- Permits good selectivity, sorting possible
- Low development cost
- Adaptable to mechanization
- Recovery is high, low dilution
- Waste recycled as fill material
- Good safety record

Disadvantages

- Fairly high mining cost (Filling/Support wastage)
- Handling of waste – extra cost
- Filling complicates cycle of operation causing occasional discontinuous production
- Ventilation is often poor
- Must provide stope access for mechanized equipment
- Compressibility of fill causes some ground settlement issue