**Underground Mining of Metalliferous Deposits**
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**Lecture 56**
**Sublevel Caving – II**

**DESIGN OF SUBLEVEL CAVING:**

1. Transverse Sublevel Caving:

    For thick bodies.

    Perimeter drift is driven along (transverse layout) the strike of the ore body.

    Production drift is driven perpendicular to the strike of the ore body.

2. Longitudinal Sublevel Caving:

    For narrow bodies and sharp dip.

    Perimeter drift is driven perpendicular (longitudinal layout) to the strike of the ore body.

    Production drift is driven along the strike of the ore body.

For either layout type, the supporting development is similar with a perimeter drift containing either orepass tipping points or truck-loading stockpiles.

**TRANSVERSE SUBLEVEL CAVING:**

The transverse layout is generally applied in wider ore bodies, greater than approximately 50 m, where the parallel production drifts are driven across the ore body.

In a wide ore body, the sublevel drifts start from the footwall drift and are driven until they reach the hanging wall.

The transverse layout is generally more productive than the longitudinal because of the number of active production faces that can be made available.

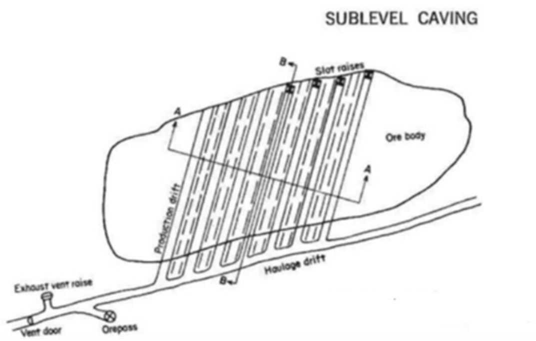


Figure 1. Transverse layout

**LONGITUDINAL SUBLEVEL CAVING:**

For widths below 50 m, the production drifts are generally driven along the strike of the ore body in a longitudinal fashion.

The longitudinal layout may contain as few as one drift on a level depending on ore-body width.

In this variant, drifts branch off in both directions from a center crosscut.

The choice of orientation is predominantly determined by the width of the ore body but can also be influenced by geotechnical and economic factors.

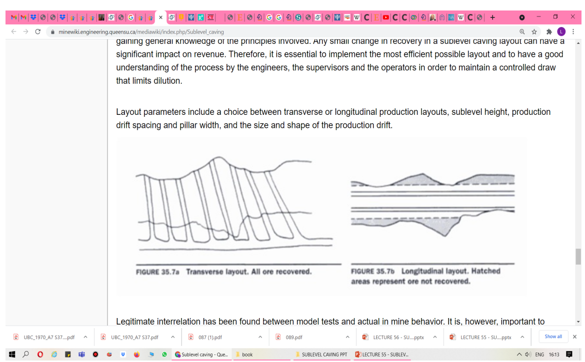


Figure 2. Longitudinal layout

**Cycle Of Operations**

Drilling: Fan drill jumbos used, two- or three-boomed with pneumatic, hydraulic (oil), or water-powered drills; air or diesel power; hole sizes 2 to 3 in. (50 to 76 mm); drilling factor 0.7 ft/ton (0.2 m/tonne) (Hamrin, 1982).

Blasting: ammonium nitrate and fuel oil (ANFO), slurries; bulk charging by pneumatic loader or pump; firing electrically or by detonating fuse Secondary blasting (on sublevel): drill and blast, mudcap, impact hammer.

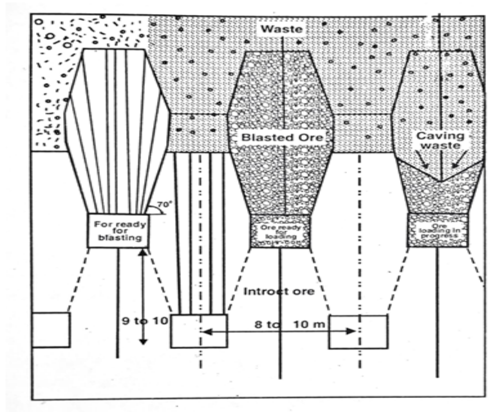


*Fig. 2.27 Typical section of sublevel caving with fan drilling.*

Figure 3. Typical section of sublevel caving with fan drilling

**Secondary Blasting (in haulage drift):** Boulders size are decreased by Impact hammer, dynamite bomb, drill and blast mud cap.

**Loading (through drawbells or orepass):** Gravity flow to chutes; LHD, Front end Loader, slusher at drawpoints.

**Haulage:** LHD or front-end loader on the sublevel; gravity flow through ore pass; rail or conveyor on haulage level.

Prior to actual production blasting, a slot is usually developed at the fàr end of the orebody by drilling and blasting to the sublevel overhead.

The slot is blasted and mucked in individual slices to allow for the swell of the blasted ore.

These slices are blasted upwards until the waste cap or pit muck of the overhead level begins to enter the extraction drift.

The ore is then ring drilled in a predetermined pattern from the production tunnels in an upward direction. Blasting of the rings proceeds from the caved slot toward the haulage drift. (10 degrees bent forward)

After a ring or series of rings has been blasted, the broken ore caves into the production tunnel, where it is loaded and transported to an ore pass.

As the ore caves and flows into the production tunnel the waste wall rock continuously caves on top of the blasted ore. This results in dilution to the caving ore; the dilution increasing as more muck is extracted from the heading.

**TYPICAL EQUIPMENT:**

- **Drilling :** Pneumatic or hydraulic powered percussion Jumbos, top hammer drills.
- **Loading :** LHD, Front end Loader, slusher at drawpoints.
- **Haulage (on main level):** LHD, grizzly, rail, truck, belt conveyor.
- **Ground support:** Bolters for providing support for the drift.

**Automation**

**AUTOTRAM LOADER:**

This system is composed of laser sensors and on-board computers that allow the machine to be guided from a designated point, as well as by tele-remote control. (e.g.,WMC Leinster underground operation in western Australia).

Communications systems are run onto the production levels for radio communications, as well as to control any automated or semi-automated mining equipment, including production drill rigs and LHDs in some of the larger-scale sublevel caving operations (LKAB mines, Sweden).

In Kirunavaara Iron Mine, automated driverless locomotives are used in the main haulages, and remote control of LHDs improves the efficiency of the loading operations. Robotized drilling machines further improve the efficiency of the underground operations and reduce exposure of operators to injury.

**ADVANTAGES:**

1. High production rate
2. High production rates possible due to the large number of drawpoints.
3. Fairly high recovery (80 to 90%).
4. Possibility of high degree of mechanization.
5. Adaptable, flexible, and selective; no pillars are required.
6. Method safe for operation.
7. Low Cost: Fil1 is not required and manual labour requirements are low.
8. Mine production occurs concurrently with development.
9. Automation may be easily integrated to this method thereby improving its overall efficiency and reduce operators injuries.

**DISADVANTAGES**

1. High development cost. (Varying from 1:3 to about 1:10 nowadays)
2. Must provide stope access for mechanized equipment.
3. Draw control is critical to success of method.
4. Dilution may be high(10-35%)
5. Low recoveries (75-85%)
6. Intensive drilling and diassemble to generate a suitable granular product to flow ore
7. High consumption of explosives
8. Consideration must be given to surface conditions and ground water locations.
9. Caving and subsidence occur, destroying the surface ecosystem.