Underground Mining of Metalliferous Depoists
Professor Bhibhuti Bhushan Mandal
Department of Mining Engineering
Indian Institute of Technology, Kharagpur
Lecture 50
Long Hole Stoping

LONG HOLE STOPING: INTRODUCTION

- In this method the steeply dipping orebody is horizontally divided into blocks.
- **A rib pillar** is left in between two adjacent stopes.
- This method is a variant of sublevel open stoping in which longer blast holes with larger diameters (140 to 165mm) are used. The holes are normally drilled using the in-the-hole (ITH) technique.
- Long hole stoping employs a combination of drop raising and ring drilling

Applicability

Geotechnical parameters:

Ore strength: moderate to strong (> 40 MPa UCS)
Host rock (Footwall and hang wall rocks) are also strong

Geometry, disposition & orientation:

Deposit shape: tabular or lenticular, regular dip and defined boundaries
Deposit dip: steep (>50 degrees, preferably 60-90 degrees)
Deposit size: Thick >20m wide, fairly large extent

Ore grade: moderate

Stope Development:
(Case example: 20m wide, 80 deg dip)

- Two Levels, one each in footwall & hang wall sides of sizes 4m height × 5m width are driven along the strike direction through the ore body.
- Below these levels, at a vertical interval of 40m, another two levels of the same size are driven following the same configuration as upper level.
- At each level x-cuts are driven at an approx. interval of 30m to connect footwall & hanging wall drives (4m height × 5m width).
- Raises are driven (2.4m dia) to connect both the upper and lower level (H/W and F/W both sides).
- Options: Raise borer/Drop raising
- The x-cut at the upper level is expanded and heightened to accommodate large drill machines such as ROC-306 (DHD).

- Large dia drills are used for making slot raise and subsequent parallel blast holes to create the slot at the end the block.

  Spacing – 3m
  Burden – 1.5m
  Rate of drilling ~ 30-40m per shift
- Generally, if the stope width (HW-FW) is greater than 15 m, separate FW and HW development drives are used; otherwise, only a center drive in the middle of the stope is developed.

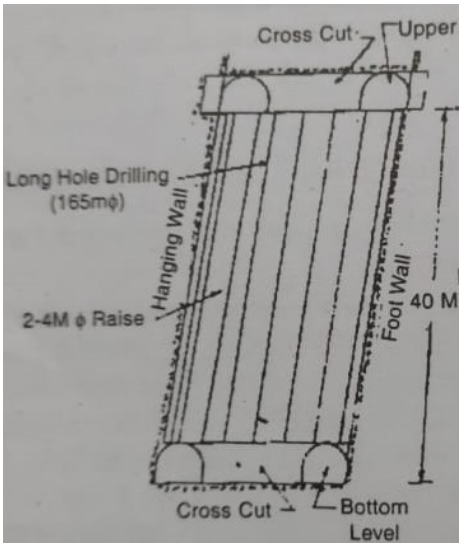

Figure 1. Longhole stoping

Drilling:

- Long-hole stoping largely eliminates the intermediary level (or sublevels) with the draw and drill horizon interval governed by the length of hole that can be drilled with minimal drill-hole deviation (under 2%).
- The drill-hole diameter ranges from 75 to 150 mm using ITH hammer bits
- Hole lengths approach 30–60 m in length.
- The drill drives are limited to the upper drill level and the draw level (Draw point development), as the intermediary level has been removed.

Blasting:

- **For SLOT making,** ANFO, Pentolite cast booster and **Raydet**-shock tube based initiation system are commonly used for blasting.
- For stoping, one ring is blasted at a time. Pressure loader is used to load ANFO in to the blast holes and drill cuttings can be utilized for stemming.
- Drilling is extensive but overall it is economical.
- Explosive consumption is about 0.4 to 0.45 kg per ton of ore blasted.

Mucking:

The blasted ore is collected by LHD from the bottom haulage drifts through the mill holes. The blasted ore is, naturally, swelled. After drawing sufficient quantity of ore, the next ring is blasted. (Retreating pattern) And the ore is again drawn from the chute or the haulage drift as the case may be. Ore from mill holes or trough passes down to draw point cross-cuts. Secondary blasting of boulders, if required is done in the draw point cross-cut. The draw point cross-cuts can directly lead to the haulage level where ore loading is done by loaders into mine cars. But with the introduction of LHDs it is a common practiced today to connect the draw point cross-cuts to a gathering drive which is in turn connected to the haulage level below through a transfer raise. Where availability of LHDs is poor, a gravity transfer system with a grizzly level is preferable because of its reduced cost of ore transfer. For wider ore bodies, LHDs of 2.3 m^3 bucket capacity are commonly used for transporting 250 t/hr depending on lead distance. An OMS of 20-30 m is quite common in Sublevel stoping method. DILUTION needs to be reduced with controlled drill and Controlled blasting. Additional support at drill level and draw levels are to be provided wherever required using Rock Bolts and Cable Bolting.