

Mining 101

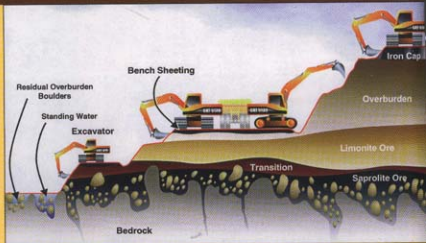
Although we're a mining company, many employees have never had the chance to actually see a mine in action. Here's a look at a few of the mining methods Inco uses in its operations around the world.

Mining laterites

Open pit or side-hill mining methods are generally used to extract laterites. A combination of truck, shovel and bulldozer is used to remove the low-grade overburden separately from the drill-defined ore material in the limonite and saprolite layers. The saprolite portion of the mined layer may be upgraded through screening stations to remove the boulders with low nickel content. They may require further screening at the process plant.

Where are Inco's laterite deposits?

New Caledonia and Indonesia



Another difference between laterites and sulphide ores ... There is no "concentrate" from a laterite deposit.

Explosives are seldom used in laterite mining because of the unconsolidated nature of the soil and weathered rock.

Miners' lingo

Definitions of some common mining terms

Backfill: Waste sand or rock used to support the roof or walls after removal of ore from a stope. Also the process of sealing and filling a borehole to prevent water seepage into rock formation or mine workings.

Borehole: A hole with a drill, auger, or other tools to search for minerals, for water supply, blasting purposes, for proving the position of old workings and faults, and for releasing accumulations of gas or water.

Concentrate: The clean product recovered in froth flotation.

Drift: A horizontal "tunnel" used to move around on a single level within the mine. The tunnel follows the course of a vein.

Muck: Unconsolidated soil, sand, clay, or loam encountered in surface mining and can generally can be moved without blasting.


Shaft: A vertical "tunnel" used to enter and exit the mine.

Stope: An excavation created by the removal of ore and consequent widening of the drift.

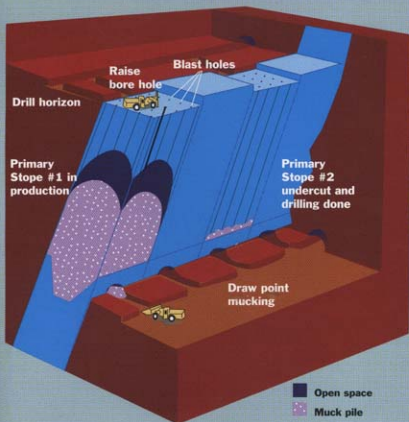
Mining nickel sulphides

Sulphide ore is found in hard rock and is extracted by drilling and blasting. It contains a large group of metallic minerals with sulphur (including pentlandite which contains nickel) hence the name. To extract the nickel, concentrating, smelting and refining are required. Generally it has a much higher grade than lateritic ore and can support the higher mining cost.

Ontario and Manitoba

Bulk mining is the main method used in Ontario and Manitoba. The most commonly used technique is Slot/slash, a variation on Vertical Crater Retreat mining pioneered by Inco in the '80s. Mechanized cut and fill methods are used for irregular orebodies when selective mining is required. Both methods have taken advantage of new technology in equipment and blasting. 

Slot/slash bulk mining



Slot/slash mining: Suitable for moderate to steeply dipping ore bodies. Depending on orebody geometry, it has a higher production rate and is less expensive than modern mechanized cut and fill mining. It also offers limited selectivity.

The basic process ...

1. Sink a **shaft** to gain access underground.
2. Develop **drifts** at 100' vertical intervals (approximate) throughout orebody to access ore.
3. Drill a **raise bore hole** from top of stope to bottom.
4. Blast a series of small holes breaking ore into raise bore hole.
5. **Muck** ore to draw point.
6. Hoist ore up shaft.
7. **Backfill** empty cavity with rockfill, sandfill, or paste fill.

Thanks to **Dwayne Kroll**, superintendent mines technology, Manitoba, for his help in creating these graphics.

Mechanized cut and fill mining:

Excavates the ore in horizontal slices, starting from a bottom undercut, advancing upward. Suitable for orebodies of irregular shapes and scattered mineralization. It allows selective mining, separate recovery of high-grade sections, leaving behind sub-economic material (low-grade rock).

The basic process ...

1. **Stope** is accessed from a drift coming off a ramp.
2. Ore is blasted in 16' wide x 14' long x 15' high blasts (varies).
3. Ore is mucked into trucks and hauled up ramp.
4. Ore is dumped into ore pass and hoisted up shaft.
5. Empty cavity backfilled with rockfill, sandfill, or paste fill.
6. Another drift driven from ramp to access next cut. Cycle is repeated.

Cut and fill mining

