Capital Markets Day

November 2008

Mine cost drivers

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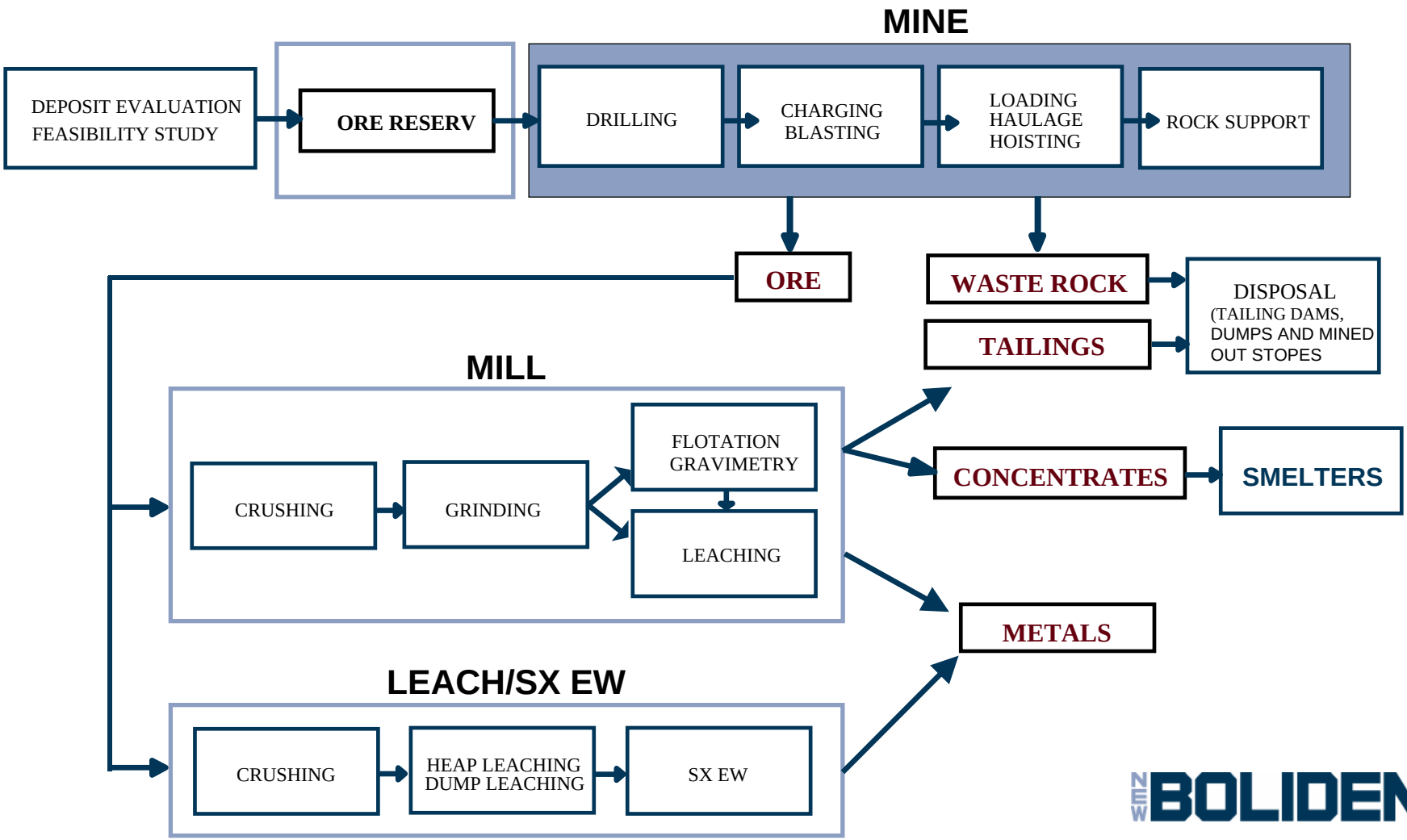
President BA Mines

NEW BOLIDEN

Mining


MINE
DEPOSIT EVALUATION
FEASIBILITY STUDY
ORE RESERV
DRILLING
CHARGING
BLASTING
LOADING
HAULAGE
HOISTING
ROCK SUPPORT
ORE
WASTE ROCK
DISPOSAL
(TAILING DAMS,
DUMPS AND MINED
OUT STOPES
TAILINGS
MILL
CRUSHING
GRINDING
FLOTATION
GRAVIMETRY
LEACHING
CONCENTRATES
SMELTERS
METALS
LEACH/SX EW
CRUSHING
HEAP LEACHING
DUMP LEACHING
SX EW

Two main types of mines

Open pit mining

- Roughly ten times lower in cost per ton compared to under ground mining
- Slope stability decide waste/ore ratio
- With low grades a high production rate is needed
- Big equipment for high volume production

Under ground mining

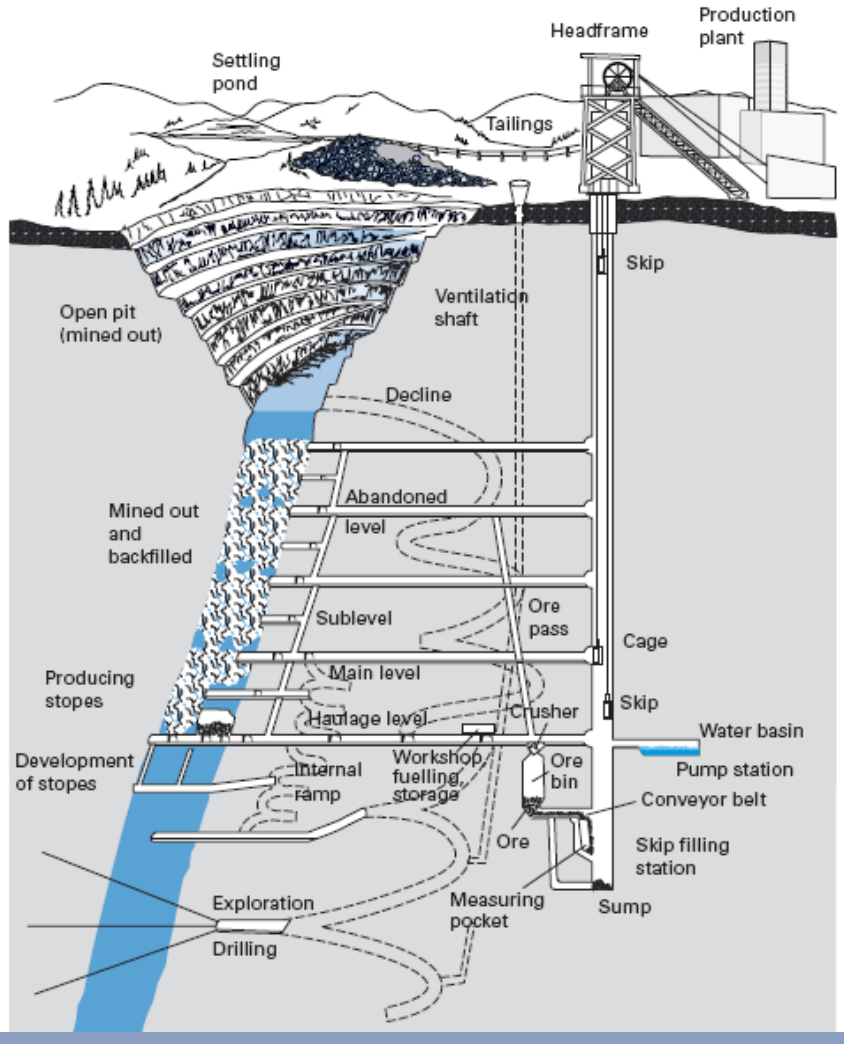
- Under ground mines commonly have lower production rate
- Increased cost to infrastructure and ground support
- More up front development work
- Often smaller ore bodies but with higher grades

Mine design

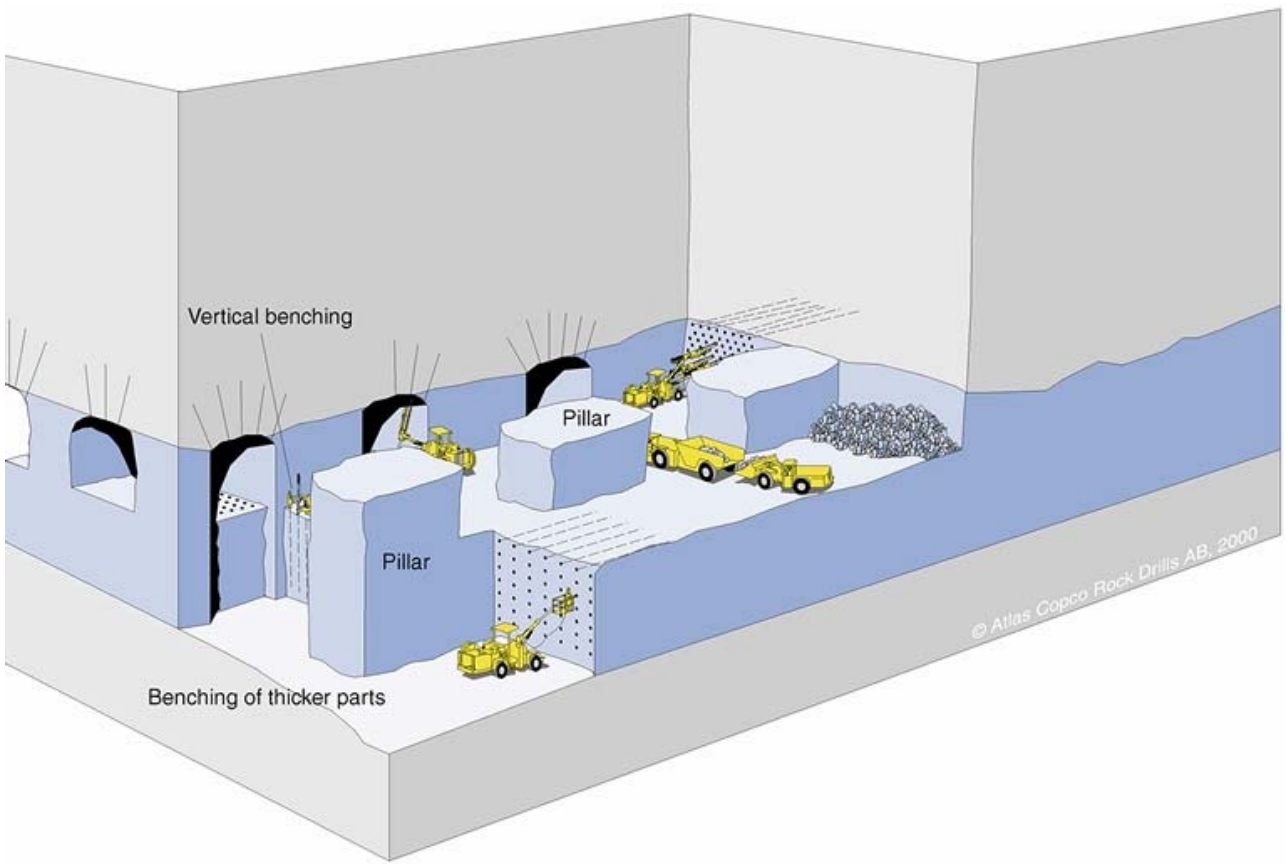
- Most important factors
  - Knowledge of ore body and rock conditions
  - Efficient mine infrastructure
  - From basic design establish plans in long and short term for mining out the ore reserve
- Mining method
  - Method selection crucial
  - Many criteria for method selection
  - Shape of ore body and rock quality
  - Best suited scale of equipment and stopes
  - Amount of ground support needed
  - Control of ore recovery and waste dilution
- Infrastructure
  - Type of hauling and hoisting
  - Ventilation and water handling
  - Size and conditions of drifts and ramps
  - Possibility for automation


Under ground mining

Under ground mine infrastructure

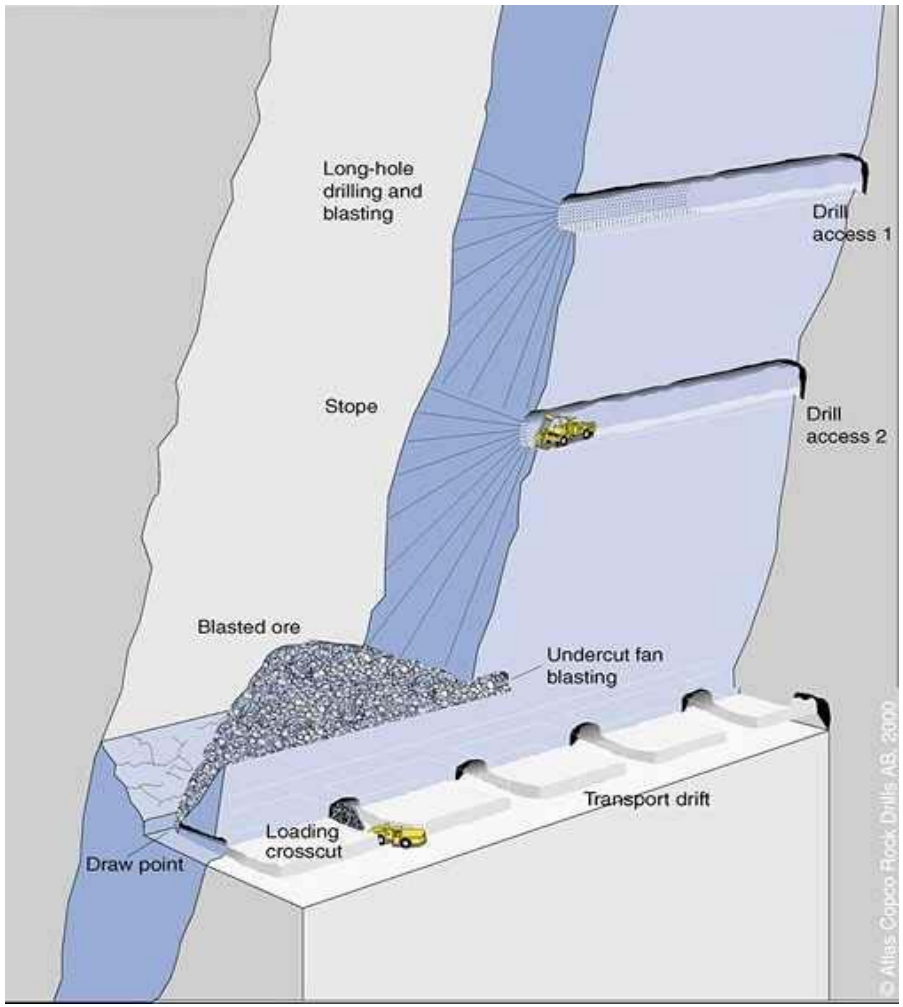


Under ground mining methods – Room and pillar mining



- Common for flat ore bodies
- High production and low cost
- Good productivity
- Ore lost in pillars

Under ground mining methods – Open stoping



- Common for steeply dipping ore bodies
- Can be deep
- Good production rate
- Moderate to high cost
- Higher dilution
- High capital cost

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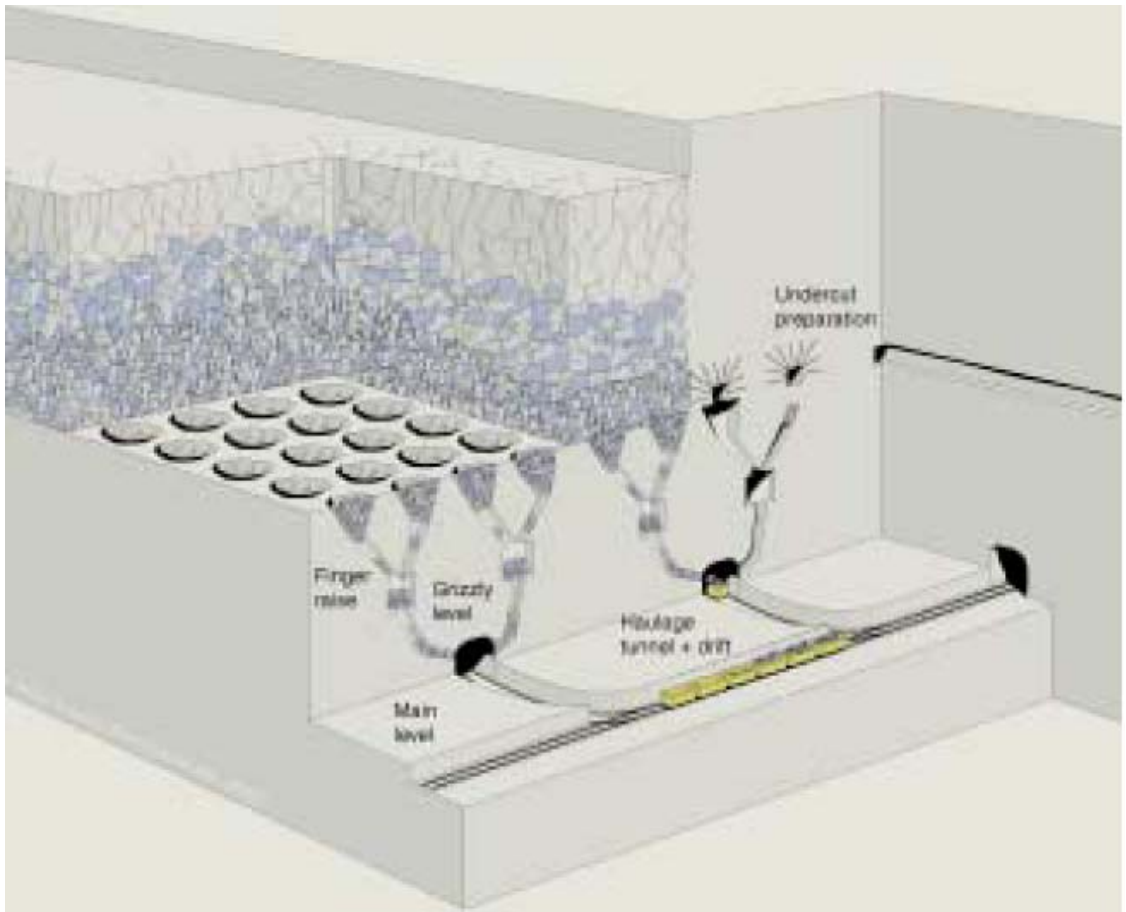
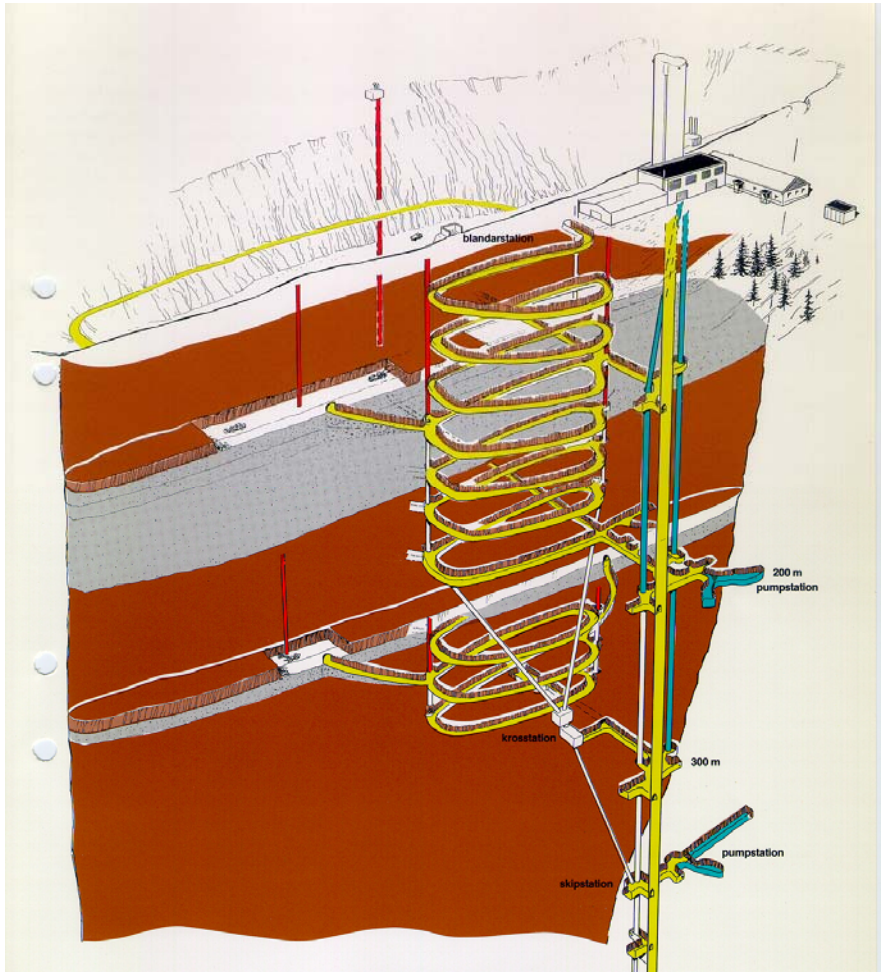
Under ground mining methods – Block caving



- Common for massive ores
- Caveable rock
- Can be deep
- High production
- Low cost
- Very high capital cost
- No selectivity
- High dilution
- Surface subsidence

Under ground mining methods – Cut and fill mining



- Common for steeply dipping irregular ore bodies
- Higher grades needed
- Moderate production
- Higher cost
- More ground support with depth
- Good recovery and controlled dilution
- Flexible method

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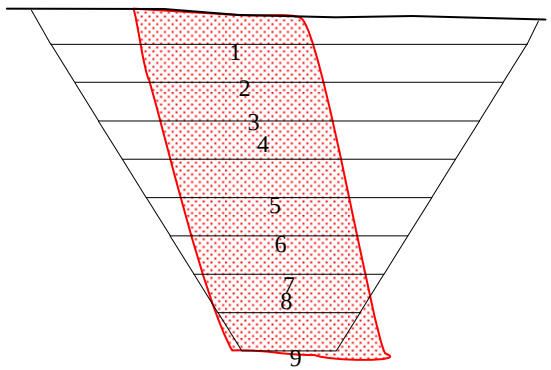
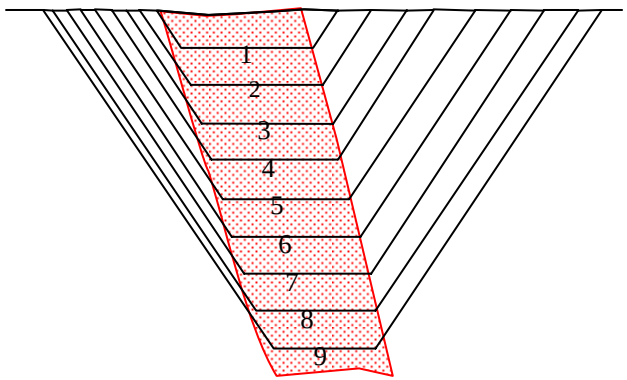
Open pit mining

Open pit sequencing – push backs

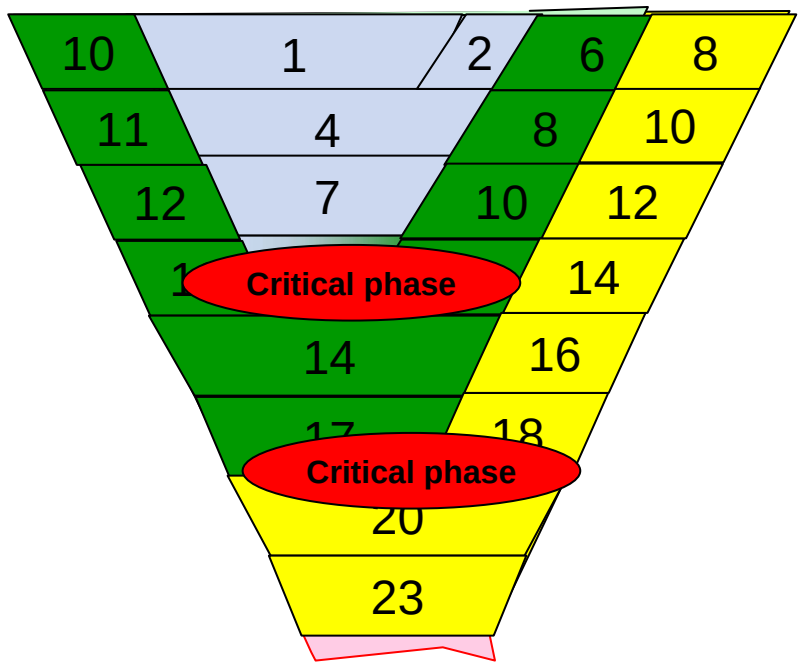
Production flow



Economy cash flow



Solution
push backs

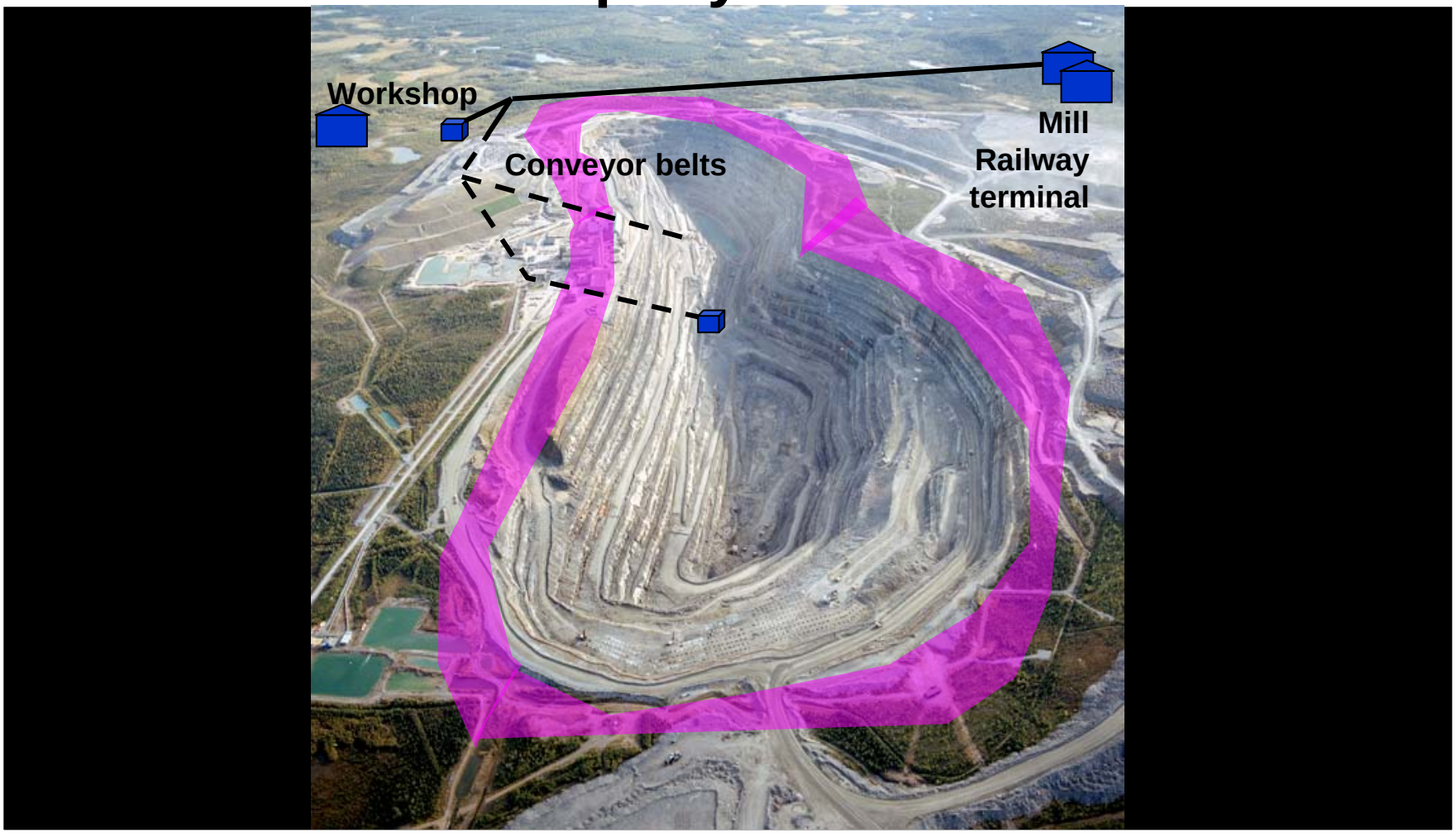


The Aitik Mine 1968
– 2 million tonnes per year

The Aitik Mine early 70's – 6 million tonnes per year

The Aitik Mine 2000
– 18 million tonnes per year

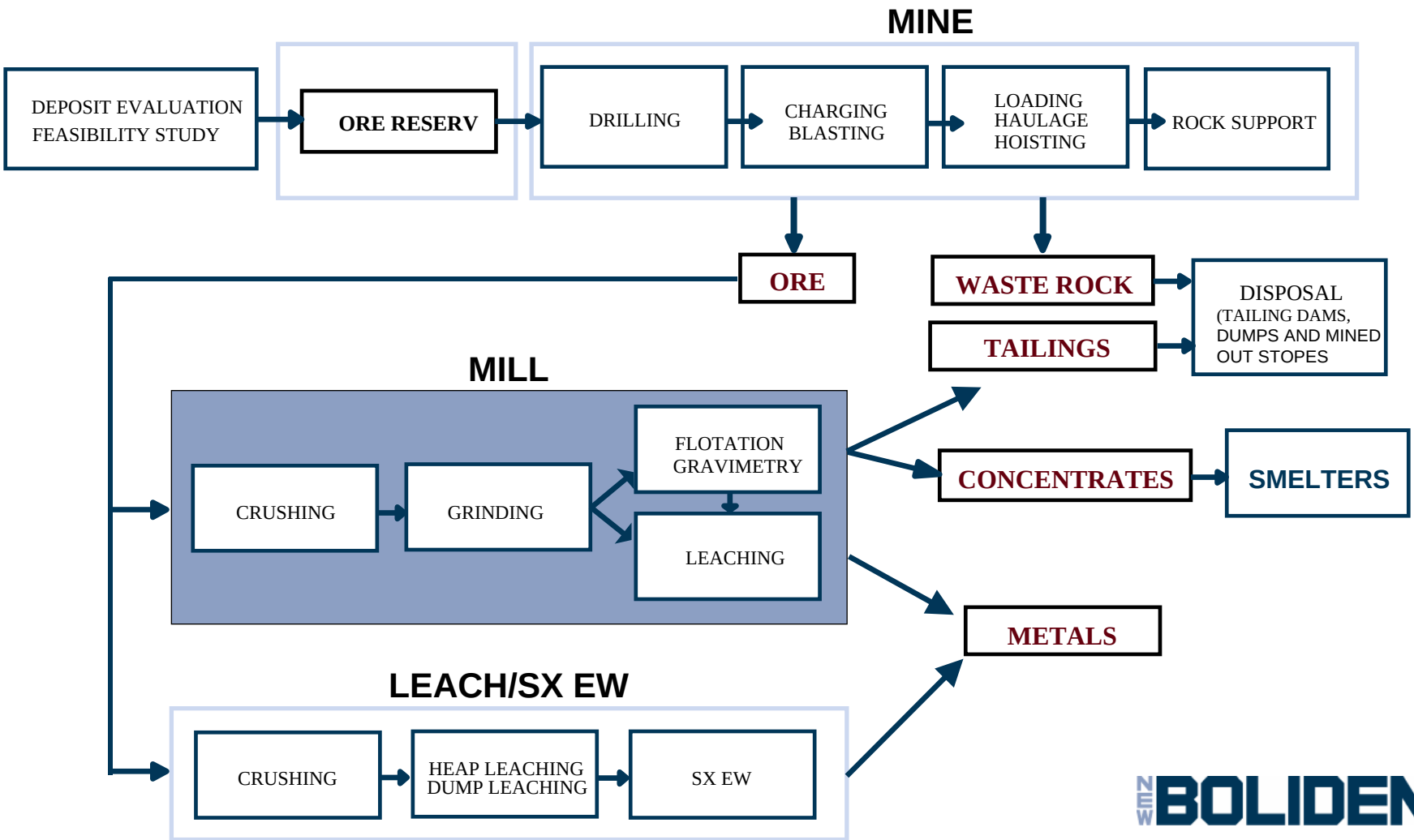
The Aitik Mine 2010
– 36 million tonnes per year



Open pit mining cost distribution – industry average

- Mining 50%
  - Drilling 5%
  - Blasting 6%
  - Digging 9%
  - Hauling 30%
- Milling 50%
  - Grinding 30%
  - Flotation 10%
  - Dewatering 10%

Mill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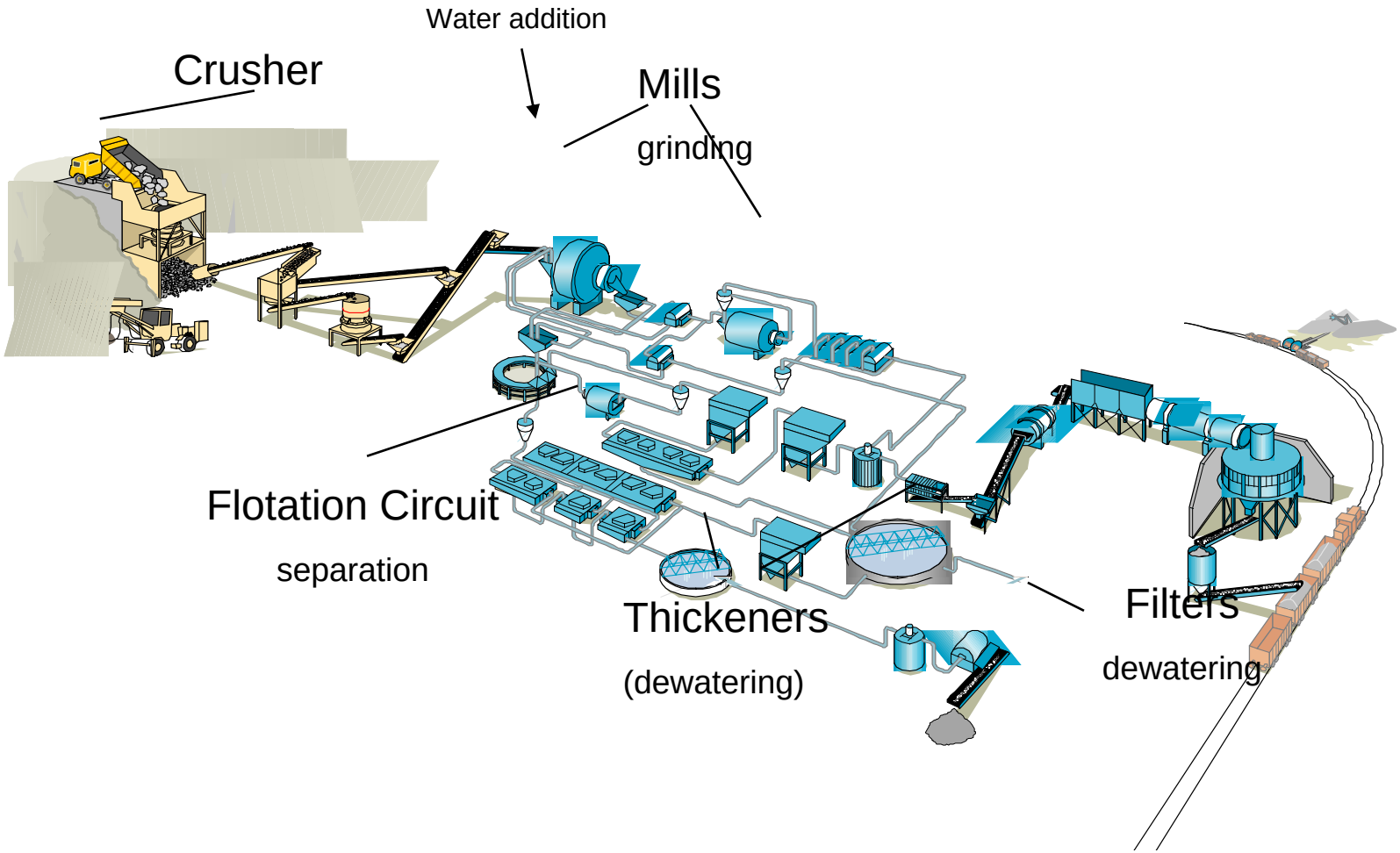
SX EW

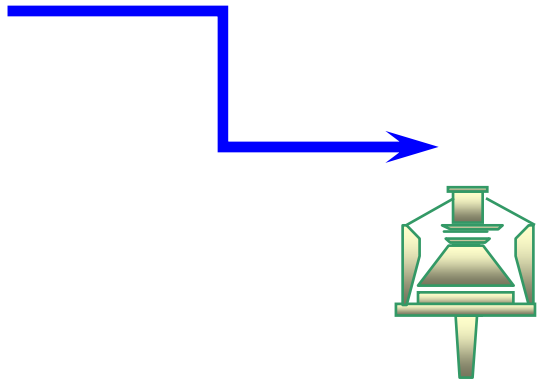
About the mill process

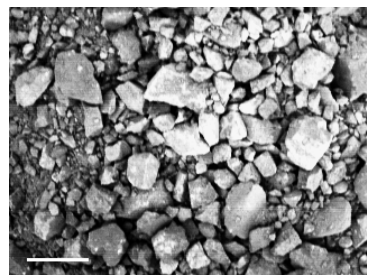
- Grinding is the major part in milling costs
- The choice of grinding technology is crucial, Boliden type of autogenous grinding (AG) has proved to be the most cost efficient
- Semi autogenous grinding (SAG) is by far the most used technology
- Flotation separation, based on surface chemistry, is the outmost important technology to separate base metal minerals from waste rock – products are called concentrates
- The flotation process is adopted to the specific ore type when it comes to equipment, circuit lay outs and reagent regime
- Since flotation is a wet process the concentrates must be dewatered, dewatering technology can vary depending on proprieties of the concentrate and customer demand
- Leaching process is used solely to recover the gold/silver content that not reports to concentrates

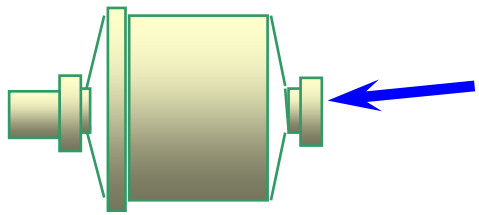
Mill (Ore Dressing Plant, Concentrator)

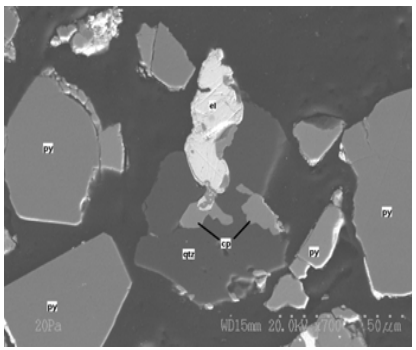


Fragmentation, crushing and grinding









Communition – industry average cost distribution

Blasting 1%

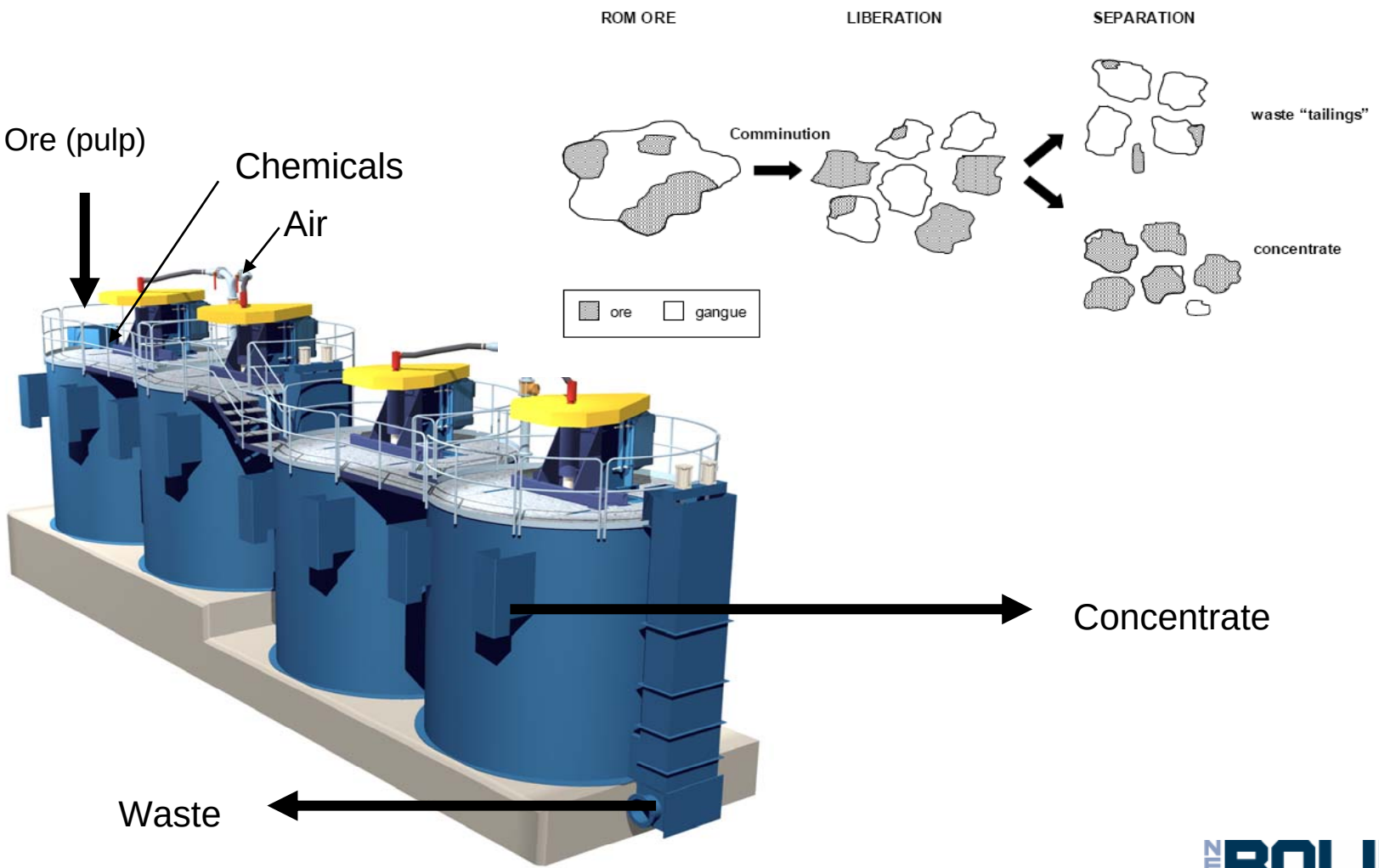
Coarse crushing 2%

Fine crushing 20%

Grinding 77%

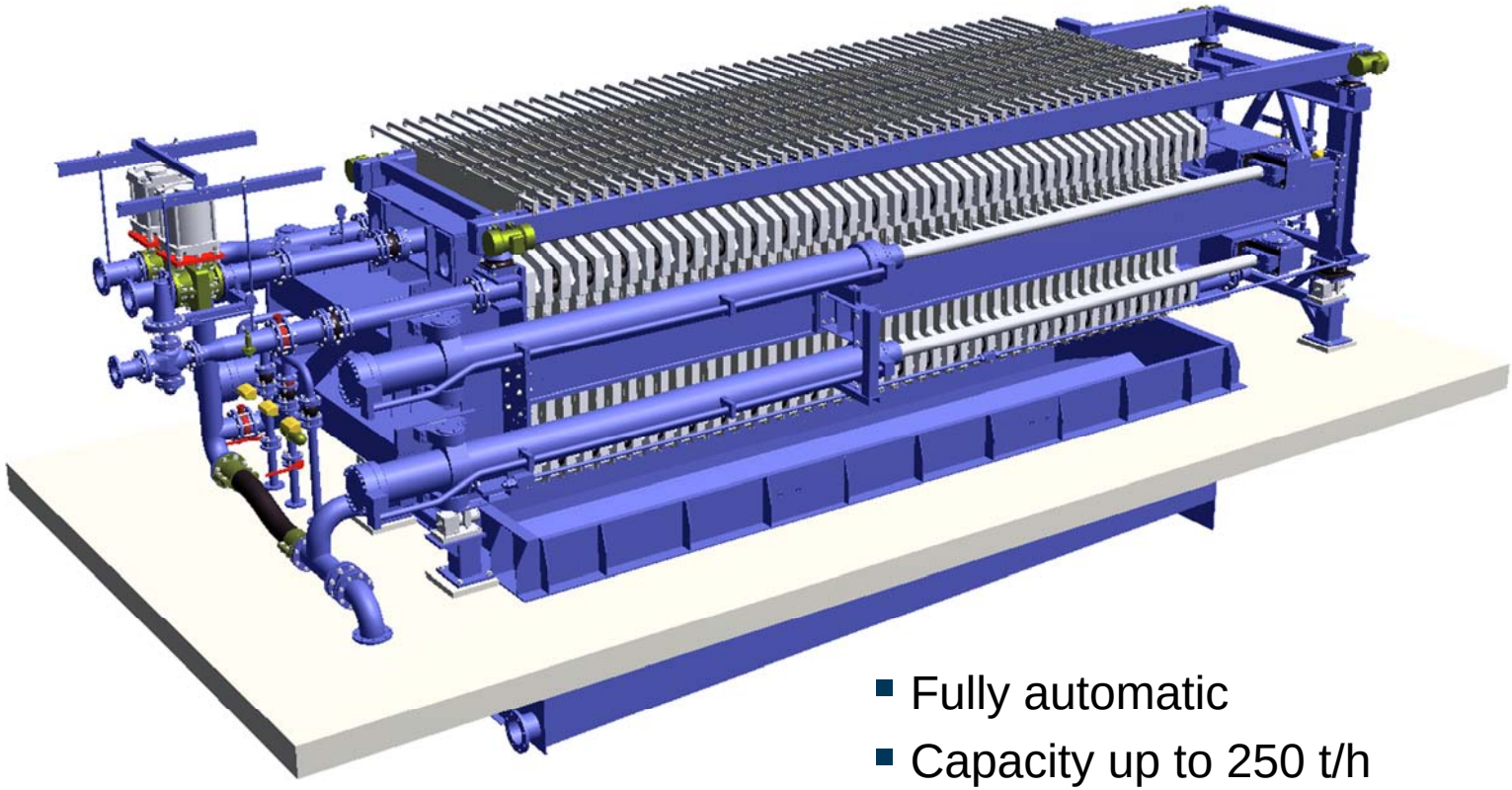
Grinding mill

Flotation cells



Dewatering - thickeners

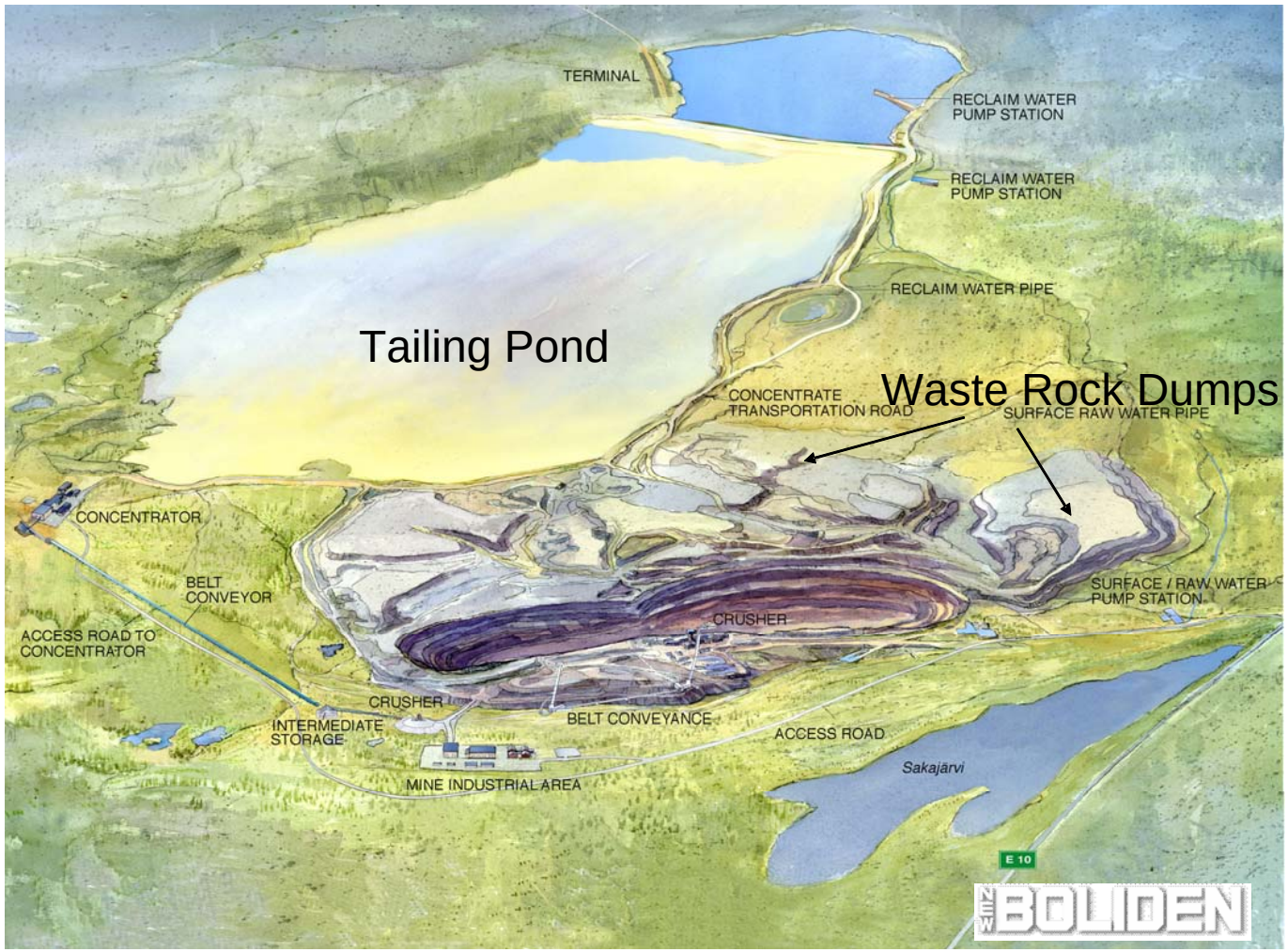
Dewatering of Concentrates – pressure filter



- Fully automatic
- Capacity up to 250 t/h

Mill and leaching plant at Boliden Area Operations

Tailings and waste rock disposal



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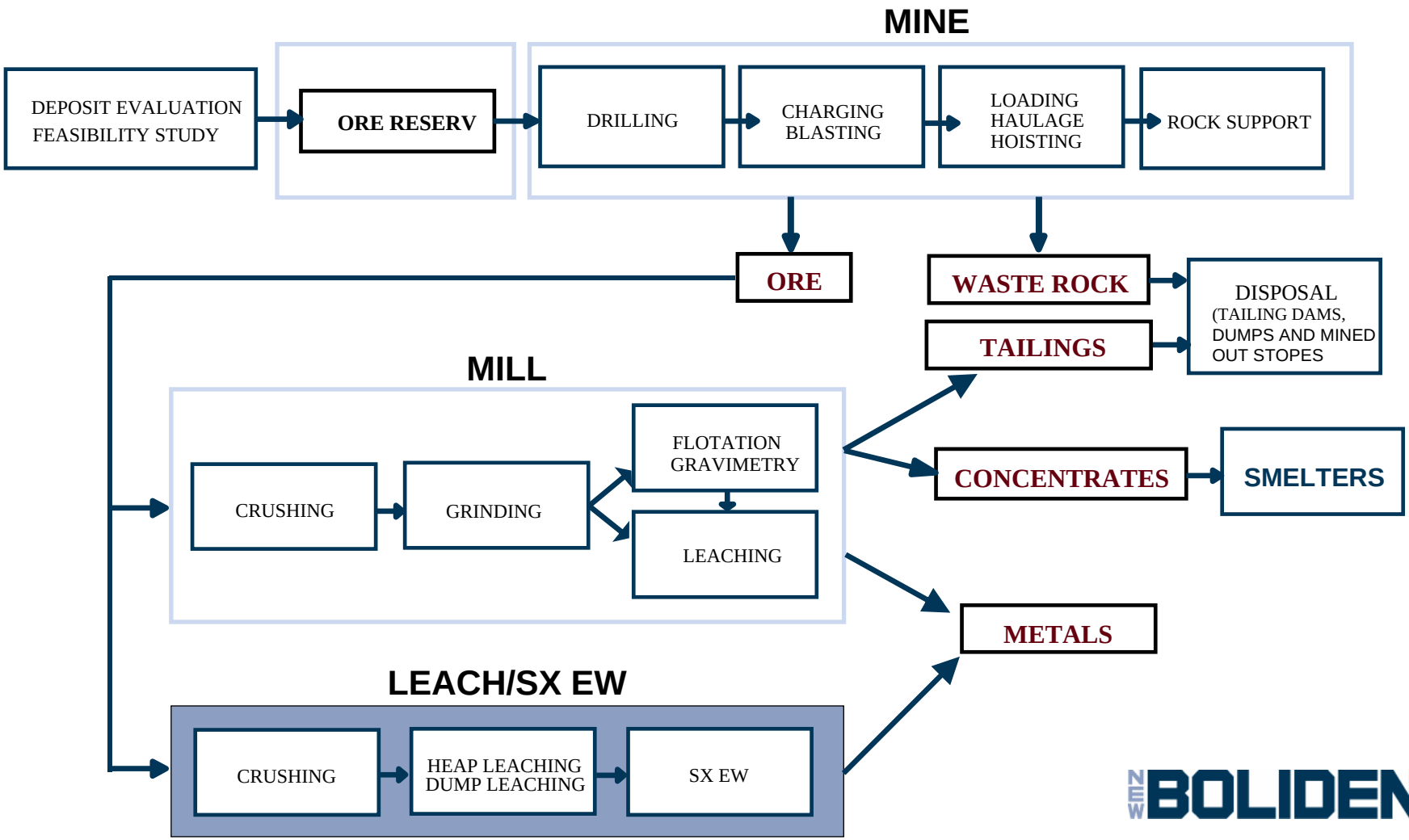
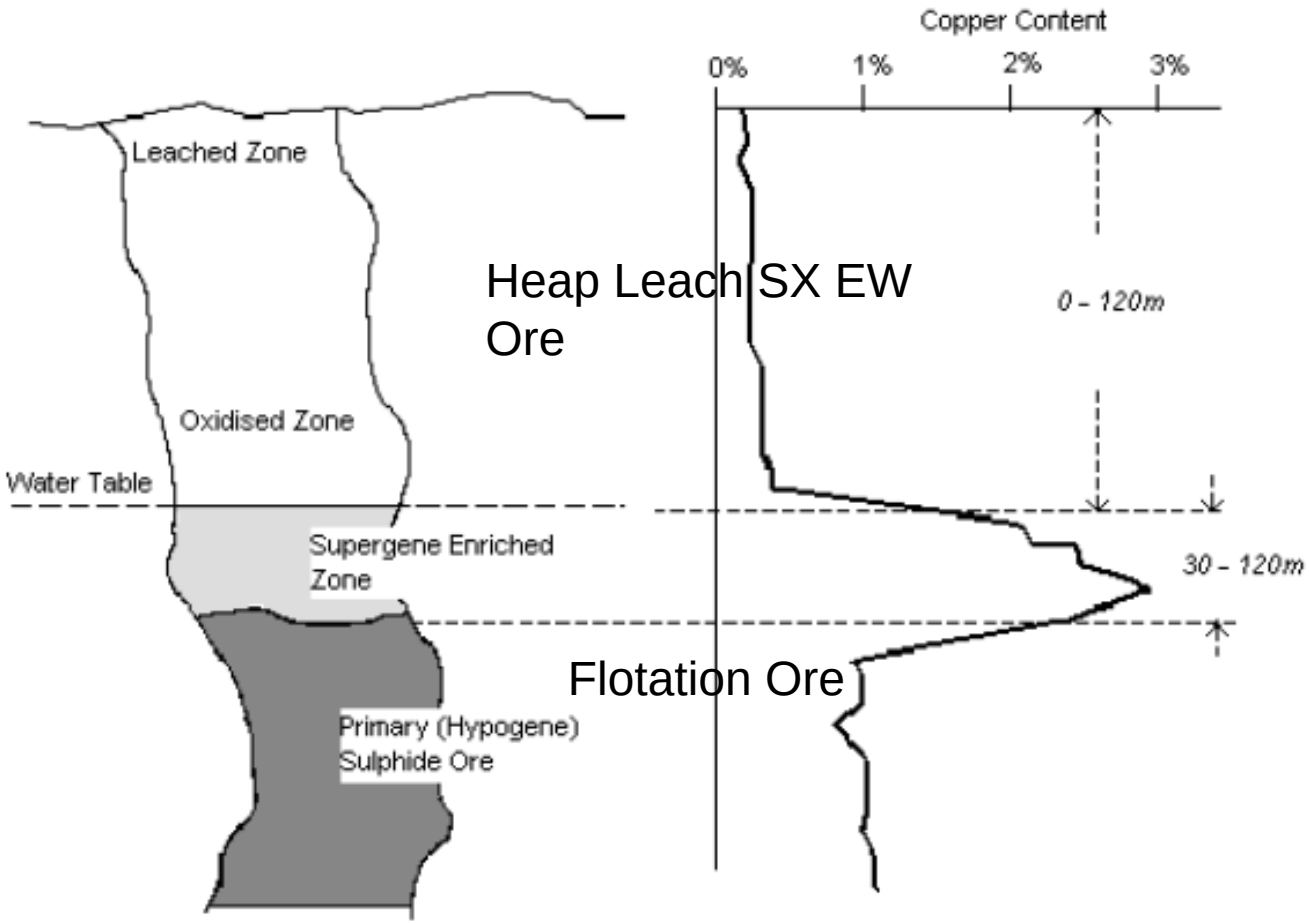
Stekenjokk – reclaimed minesite

Heap Leaching SX EW



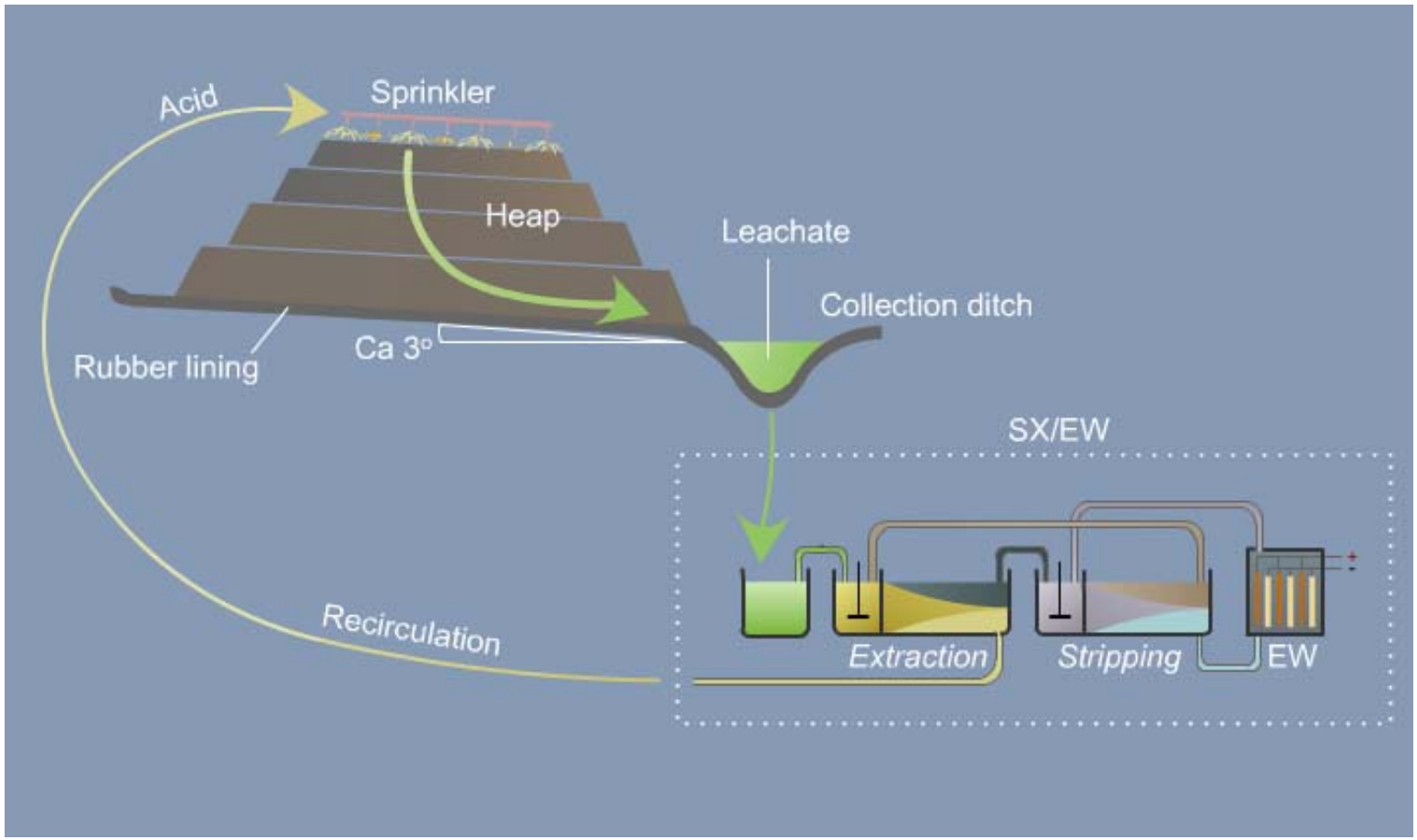
Typical porphyry copper ore



Heap leaching SX EW

- The process is normally applicable to oxide minerals (the upper weathered zone of the ore bodies)
- Some 20% of copper production is coming from HL operations
- Some applications on zinc and nickel have recently started
- The heap leach process is now in many cases enhanced by use of bioleaching in order to recover primary minerals

Heap leach process – copper



Heap leach operation