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Connecting matters

A brief Introduction to Mining Industry Side Streams

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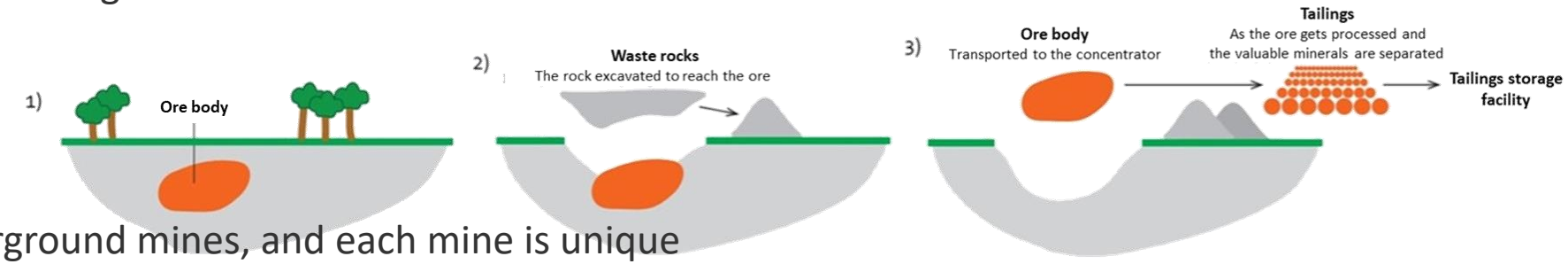
MINE SIDE STREAMS

During ore extraction and processing occurs two waste and tailings types

1. Waste rock
2. Tailings



Source: http://projects.gtk.fi/export/sites/projects/MineFacts/materiaalit/MineFacts_fin.pdf

There are open pits and underground mines, and each mine is unique

- The amount of side streams is increasing as the ore grades are decreasing

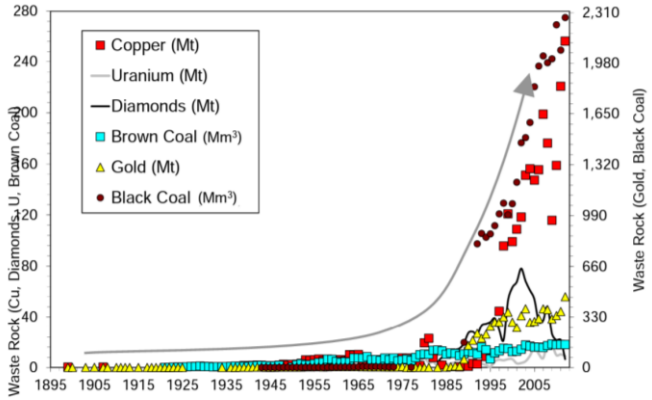
Demand for metals of all kinds have been increasing

Decreasing of ore grade – As demand has increased, all the easy to extract deposits have been mined out

Concentrator grind size is decreasing – Ores with a more challenging rock structure are processed

Global demand for copper in 2019 was 24.5 Mt, which was extracted, producing 4.9 Bt of waste rock

Global estimate for unprocessed ore capacity is 60,000 Mt/a which produce tailings >20,000 Mt/a



Source: Michaux, S. P., 2021, The Mining of Minerals and the Limits to Growth, GTK

MAIN ORE TYPES – DIFFERENCES IN COMPOSITION AND ENVIRONMENTAL IMPACT

1. Sulphide ores
    - Sulphide minerals are sulfur compounds and several base metals such as zinc, lead, copper and nickel are mined from sulfide ores
    - Major environmental risks are associated with the decomposition of sulphide minerals
        - Stable but become rapidly unstable and oxidize in contact with oxygen – The bond between sulfur and iron breaks and the iron ends up in an aqueous acid solution – The reaction also releases hydrogen ions which lowers the pH and acidifies the water ➔ Acid Mine Drainage (AMD) can contaminate the water ecosystem for hundreds of years

Source: The U.S. Geological Survey

2. Oxide ores
    - Contain metals in oxidized forms and the most important is iron ore (Magnetite and Hematite)
    - Have a low sulfide mineral content and are therefore generally less harmful to the environment
3. Silicate ores
    - Rocks and tailings consist mainly of silica-rich (Si) and feldspar group minerals
    - Refers to minerals which are enriched in the lighter elements such as silicon, aluminum, potassium
    - Inert tailings are commonly utilized as road construction, dam support material etc.

WASTE ROCK

- Waste rocks are excavated to reach the ore and are not financially viable in a mine
- The volume that needs to be removed depends on the geometry and the shape of the ore body, along with the mining method used (open pit/underground mine) and the composition and stability of the rocks
- The chemical composition differs from the ore, and it is very common that there are several different types of waste rocks in the same ore deposit
- Waste rock must be characterized to find out what it contains. In some cases, it may contain minerals that are harmful to the environment, such as sulphide minerals. In such case, waste rock needs to be handled properly and mine site remediation needs to occur immediately after mining
- Are often stockpiled close to the mine in piles to minimize transports or redeposited in open pits and then covered by soil layers

Source: The Geological Survey of Sweden – SGU

MINE TAILINGS

- As the ore gets processed and the valuable minerals gets separated, a fine-grained mineral sand remains as waste, called tailings (ca. -200 μm, roughly the same as ore mineralogy)
  - Due to its low value, and the remote location, over 95 % of the tailings end up being disposed in landfills
- After separating the valuable minerals, the tailings are mostly pumped as slurry through pipes to be deposited in a Tailings Storage Facility (TSF)
  - The tailings are segregated in the facility pond according to their particle sizes and specific gravities
- Possibilities to utilize tailings
  - In dry stacking, the tailings are thickened and filtered, so that these filtered tailings are transported by truck or conveyor
  - In paste backfill, the tailings are mixed with a binder, usually cement, and then pumped underground to fill voids and help support an underground mine
  - Further information: www.researchgate.net/publication/277387306_Recycling_Reuse_and_Rehabilitation_of_Mine_Wastes

Source: https://www.sgu.se/en/geointro/lecture-4-mining-waste/

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