

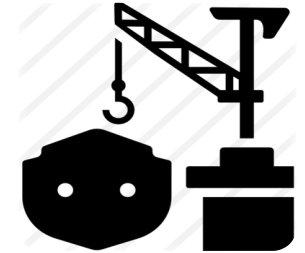
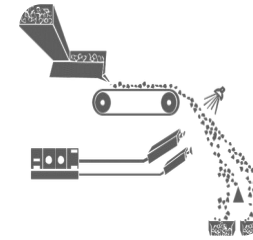
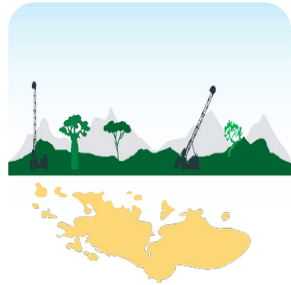
3. How do we mine metals/minerals?

The third part of the presentation is about how we find and exploit (mine) metals and minerals.

- Try putting the parts of a lifecycle of a mine into the correct order and then estimate how long each stage might take:
 - o Idea/geological reconnaissance (~6 months)
 - o Licence acquisition (6 months to 1 year)
 - o Preliminary exploration (1 to 2 years)
 - o Mineral Resource estimate (3 months)
 - o Scoping Study (6 months)
 - o Detailed exploration (2 to 5 years)
 - o Feasibility Study (1 to 2 years)
 - o Financing (1 to 2 years)
 - o Trial processing (1 year)
 - o Mine construction (1 to 2 years)
 - o Production (10 to 100+ years)
 - o Closure and decommissioning (1 to 2 years)
 - o Rehabilitation and on-going monitoring (indefinitely)
 - o What is the shortest, and what is the longest likely total time, not including the last point?



- Case studies of 2 potential mining projects, below:
 - o Assess the positives and negatives of both projects.
 - o If you were an investor, which project would you choose to invest in and why?
 - o What are the main environmental and social concerns in both cases?



Geology
 Porphyry copper
 Orogenic plutonism
 Disseminated copper sulphide
 Huge tonnage, low grade
 Close to surface

Mining
 Huge scale open pit
 Massive movement of rock
 Huge trucks and excavators
 Hard rock - blasting
 Water inflows in pit

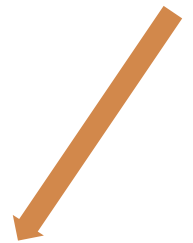
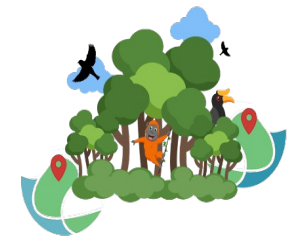
Processing
 Crushing and grinding
 Flotation of sulphides
 Product - copper sulphide concentrate
 Waste - tailings of mainly feldspar, quartz, clays and sulphides

Logistics & Infrastructure
 Mountainous terrain
 Poor local infrastructure
 New railway needs to be built
 300km nearest port
 Hydro-electric power plant

Government
 Licences
 Tax
 Governance

People
 Local communities generally in support
 New jobs and skills
 Change in climate affecting farming
 Opposition from biodiversity NGO

Environment
 Mine inside rainforest
 Fragile ecosystem
 Endangered species
 Villages down-stream of processing plant
 Acidic waste, noise, dust pollution

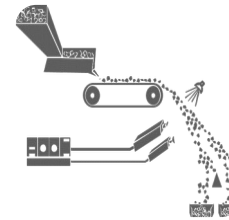




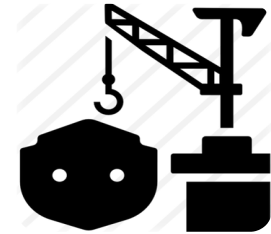
Geology
 Lithium pegmatite -
 spodumene
 Hydrothermal
 Low tonnage, high
 grade
 200m deep



Mining
 Small-scale
 underground
 Minimal waste
 Specialised, electric
 underground loads
 Hard rock - blasting
 Dry area, no water



Processing
 Crushing
 Gravity separation
 Product - spodumene
 concentrate
 Waste - tailings of
 mainly feldspar, and
 quartz



Logistics & Infrastructure
 Flat desert
 Excellent
 infrastructure
 50km nearest port
 Coal power plant

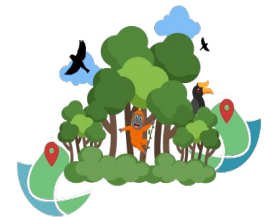
Government
 Licences
 Tax
 Governance



People
 Local communities
 not in support due to
 large tourism industry
 New jobs and skills
 Opposition from local
 government



Environment
 Desert
 Low biodiversity
 Water shortages
 No villages close
 Minor noise, dust
 pollution



- Look at the image below showing the main technical areas required for study prior to opening a mine and needing to be updated/monitored during and after the mine closes. For each of these areas, think about what problems there could be in terms of risk to the project failing or potential impacts to the local environment and community.
 - o Examples could be: exploring and finding no ore! Finding ore but the price of the commodity not high enough to be economic, during operation – pit slope failure or underground rock falls (potentially fatal accident), water flooding mine, processing plant problems – equipment failures or explosions, extreme weather events closing railways or roads, waste rock or tailings dam failures (potentially fatal accident), social issues such as poor working conditions, environmental disasters such as leaching of acidic mine waste into ground or surface water.
- Minecraft! There are two amazing mods (plugins) created by the British Geological Survey (BGS) and EIT Raw Materials.
 - o BGS (<https://www2.bgs.ac.uk/minecraft/#/6232/64/22413/-11/0/0>): this mod imports real 3D geological models of 5 different locations in the UK with real geological units and scale.
 - o EIT (<https://www.bettergeoedu.com/eng>): this mod adds some amazing geological layers to the game with real mineral-lithology associations, many different rock types, fossils, different metals (including critical metals), a museum for rocks, minerals and fossils!

