



# Water supply, reuse and recycling - how geology and geography affect choices

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Large Left Lateral Leaps for Environmental Professionals: Sustainable Water Stewardship

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# Water is Life, Water is Essential for Mining

- El agua es vida, el agua es esencial para la minería
- Água é vida, água é essencial para a mineração
- L'eau c'est la vie, l'eau est essentielle à l'exploitation minière

Shared Water, Shared Responsibility, Shared Approach:  
**Water in the Mining Sector**

ICMM and IFC, 2017

[https://www.commddev.org/wp-content/uploads/pdf/publications/P\\_ICMM-IFC-Water-and-Mining-FINAL.pdf](https://www.commddev.org/wp-content/uploads/pdf/publications/P_ICMM-IFC-Water-and-Mining-FINAL.pdf)





# Geology

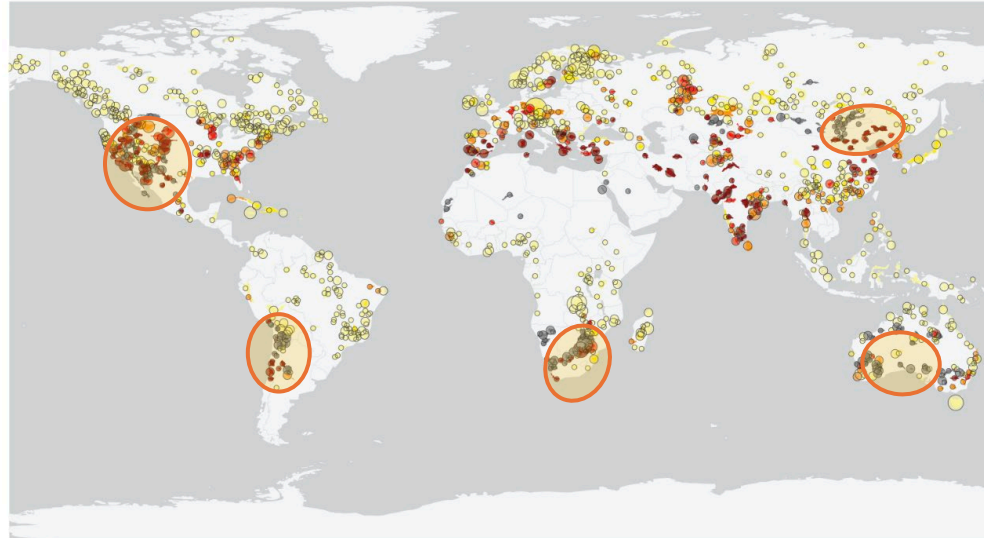
- Structures controlling deposits
- Orientation of deposit, spatial extent influence mining method
- Mineralogy
  - Valuable minerals (abundance, grain size, textures) impact process flowsheet, form of products
  - Gangue minerals in conjunction with processing requirements affect waste management
- Hydrogeology, e.g. aquifers

# Geography

- Topography influences waste management capacity and site selection
- Climate, including precipitation and evaporation, affecting water flows and overall water balance
- Proximity to water sources and transport infrastructure
- Proximity to communities
- Jurisdiction and associated regulatory considerations



# Mining and Water Stress Globally



## Baseline water stress label

- Arid and Low Water Use
- Extremely High (>80%)
- High (40-80%)
- Low (<10%)
- Low - Medium (10-20%)
- Medium - High (20-40%)

## Number of mines, deposits, and districts

- 1
- 1 - 5
- 5 - 10
- 10 - 15
- 15 - 20



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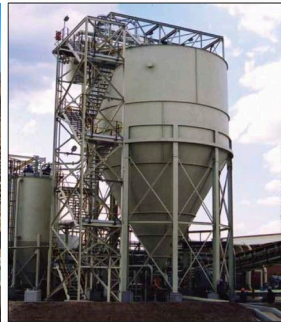
<https://www.wri.org/insights/critical-minerals-mining-water-impacts>

- Most Cu mining where low water availability
  - Northern Chile
  - SW USA, Northern Mexico
  - Mongolia
  - South Australia
- Much Au mining also in arid regions
- How can we use less high-quality water?



# Tailings linked to water balance

- Water makeup linked to water lost to tailings
- Reduce makeup water through tailings dewatering - reuse and recycling
  - Thickening, paste thickening, filtration, hydraulic dewatered stacking
- How can we make less tailings? More drainable?





# Water quality concerns

- Acid rock drainage – water +  $O_2$  + pyrite in waste rock/tailings release acid, metals. Worse in wet areas
- Cyanide contamination can kill fish and birds
- Liner systems limit groundwater contamination



Gravin Mudd, Author provided

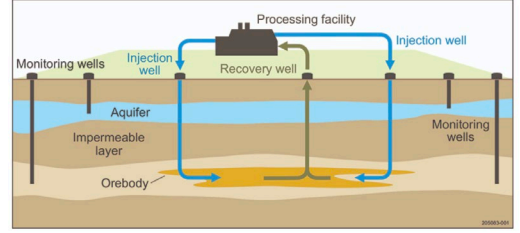
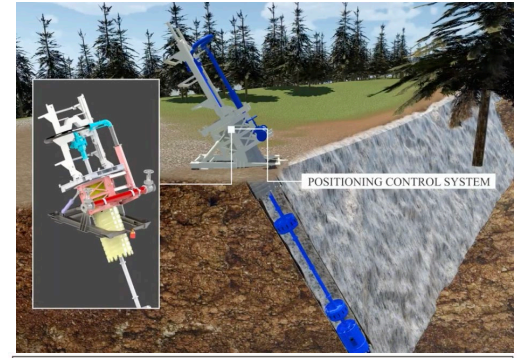




# Large Lateral Leaps?

- Find, mine higher grade deposits
  - Advanced deep exploration
  - Advanced autonomous haulage
  - Unconstrained haulage
- Process technologies
  - Extended life of mine
  - Tailings management
    - Tailings filtration
    - Tailings dewatering
    - Tailings storage
    - Tailings reprocessing
  - Tailings dewatering
  - Tailings reprocessing
- Innovation techniques, prevent air/water ingress

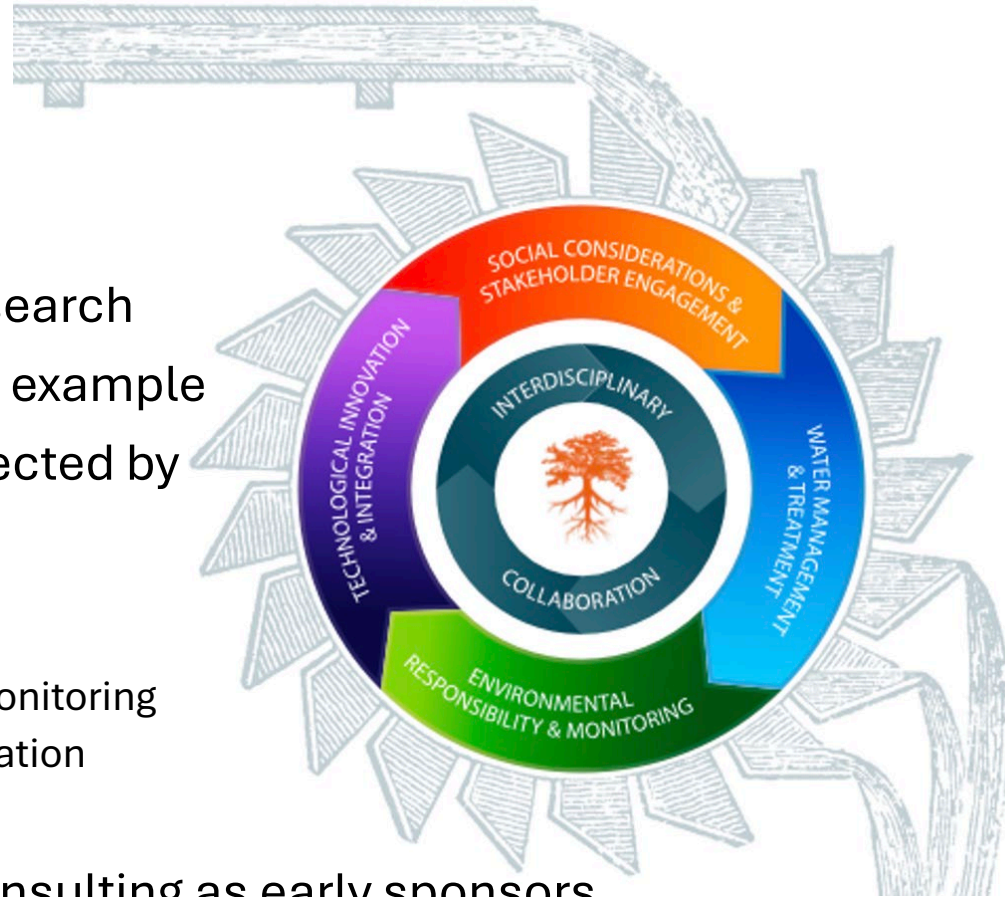
Consider combinations of technologies to form systems that lead to both lower water consumption and lower environmental risk from water contacting mining wastes





# Collaboration is key

- Water issues are complex and interdisciplinary, leaps need research
- CEEC Global Water Initiative for example
- “Water Wheel”; 4 themes connected by interdisciplinary collaboration:
  - Stakeholder engagement, social
  - Water management and treatment
  - Environmental responsibility and monitoring
  - Technological innovation and integration
- Agnico Eagle, Weir, Whittle Consulting as early sponsors, Grantham Foundation grant, looking for collaborators







# Questions?

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