

The Rio Tinto logo is displayed in a white, serif font against a dark blue background. The background features a decorative pattern of thin, wavy, light blue lines that resemble topographical contours or a stylized river, flowing from the top right towards the bottom right.

RioTinto

Finding Better Ways to Manage Tailings Risk

Jai Prasad, Chief Advisor – Next Generation Processing

19 September 2024, MIT



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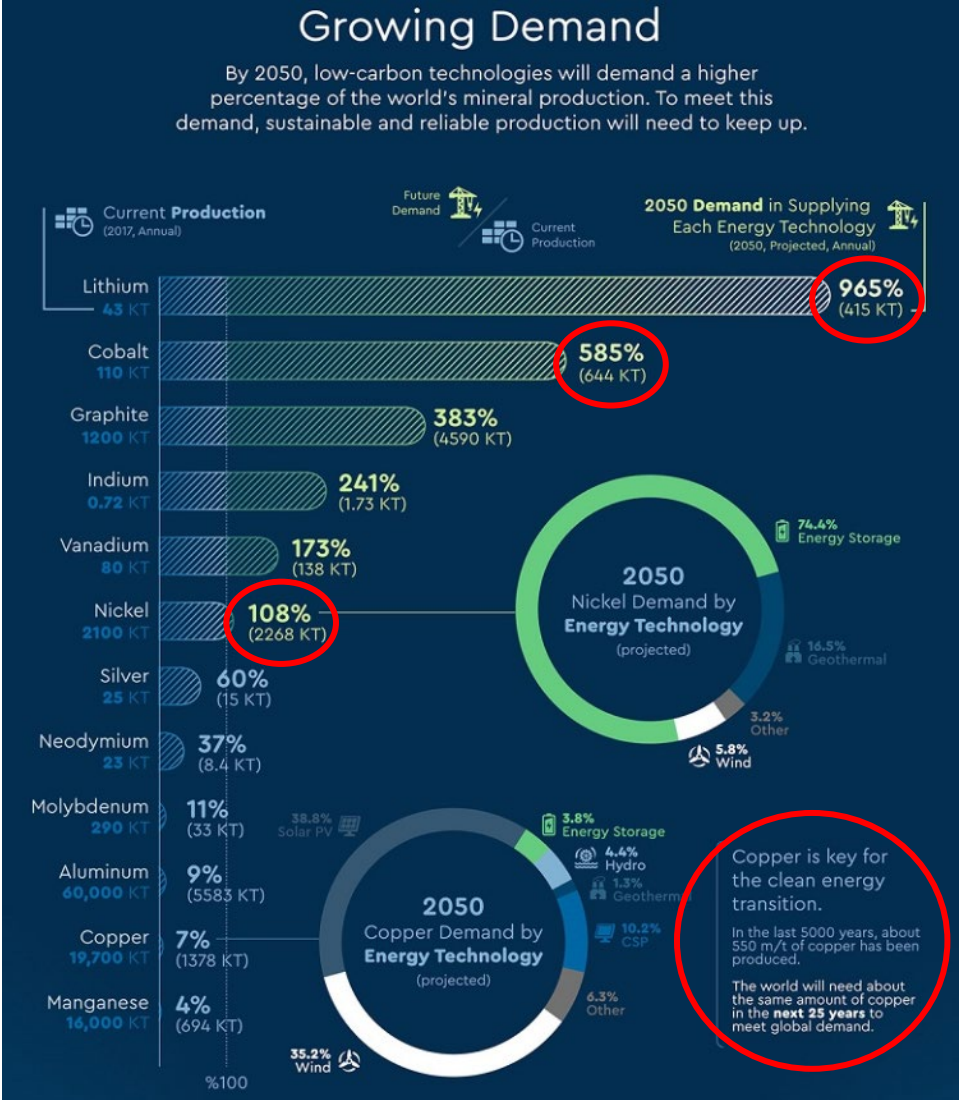
Blueberries, Aerospace & the Art of the Possible

Finding Better Ways to Manage Tailings Risk

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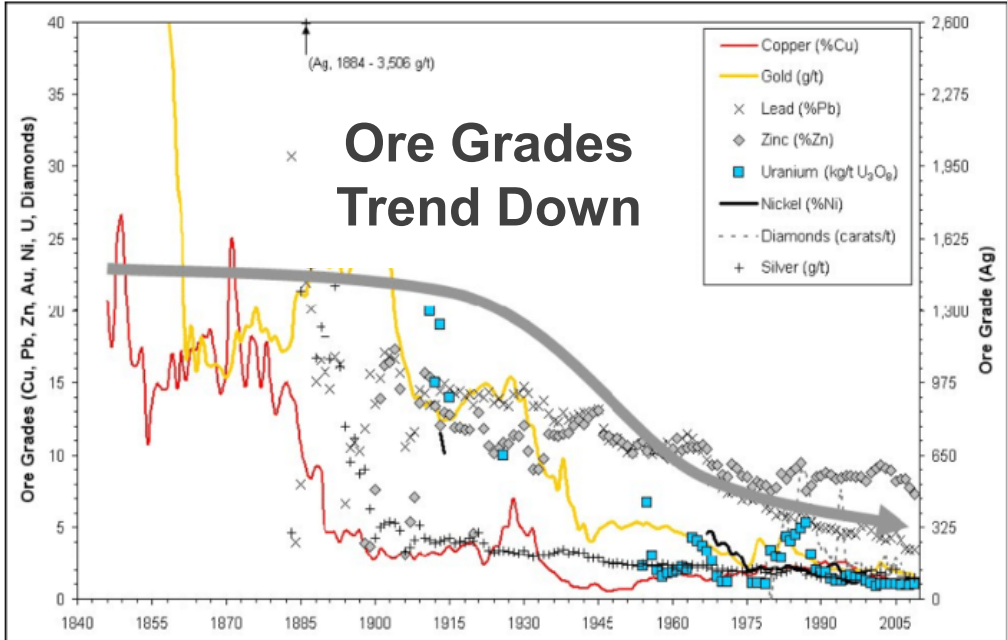
Our challenge...



AND there are headwinds...

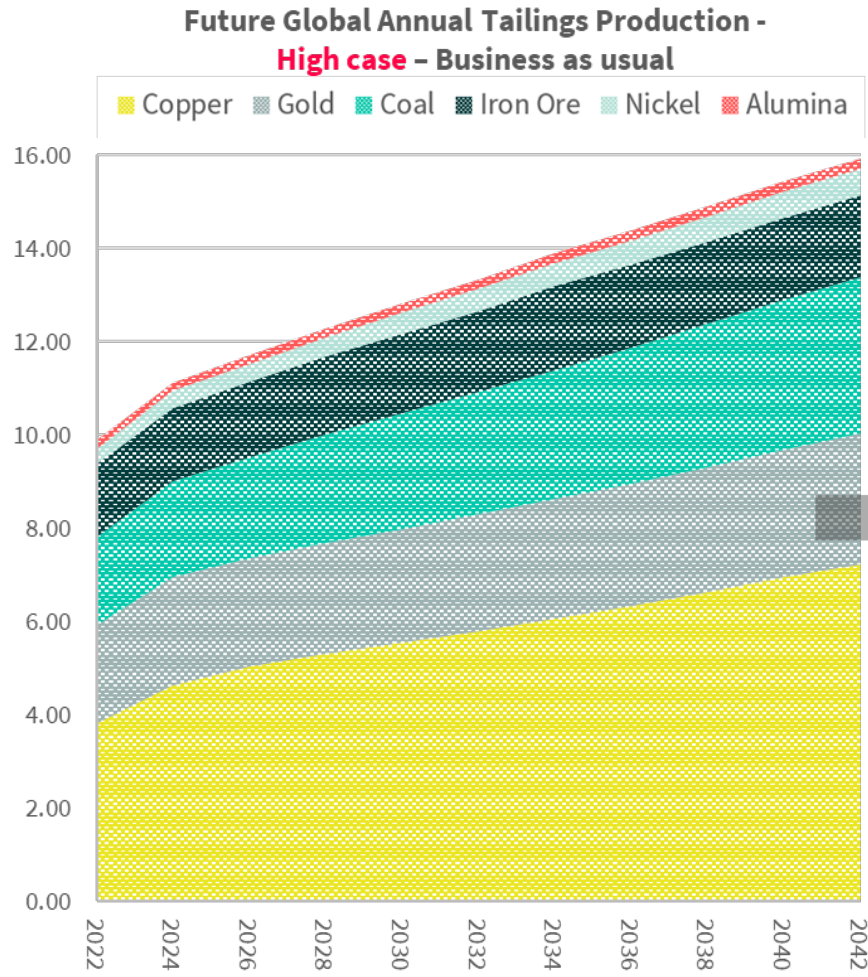
Trends:

- Ore grade (metal concentration) is declining
- Ore is at increasing depths
- Mineralogy is increasingly complex

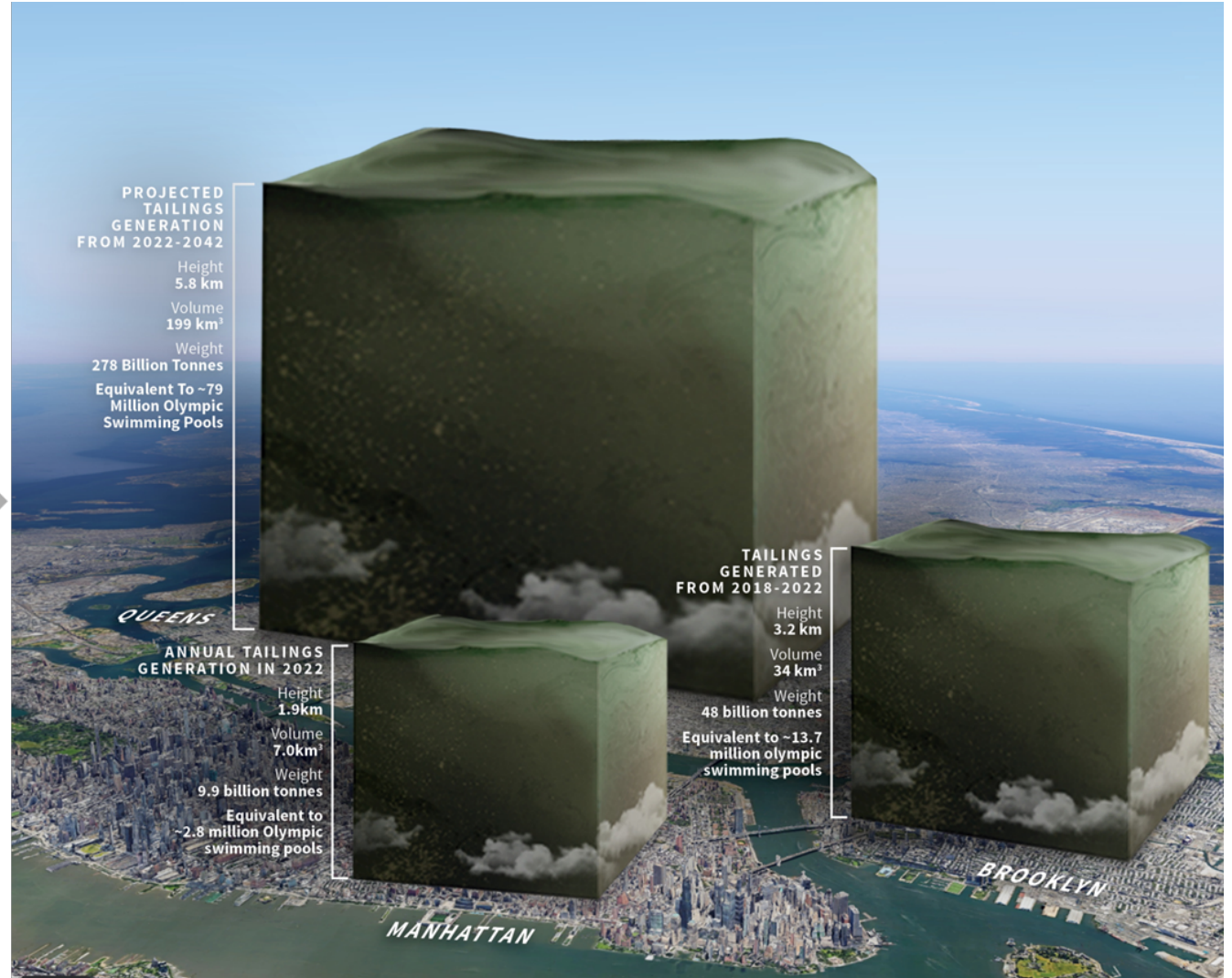


Combined Average Ore Grades Over Time for Base and Precious Metals in Australia. Source: Mudd (2009) 46.

The size of our challenge, if we do nothing



ICMM, Hatch, IEA, S&P Global



What do we mean by 'risk'?

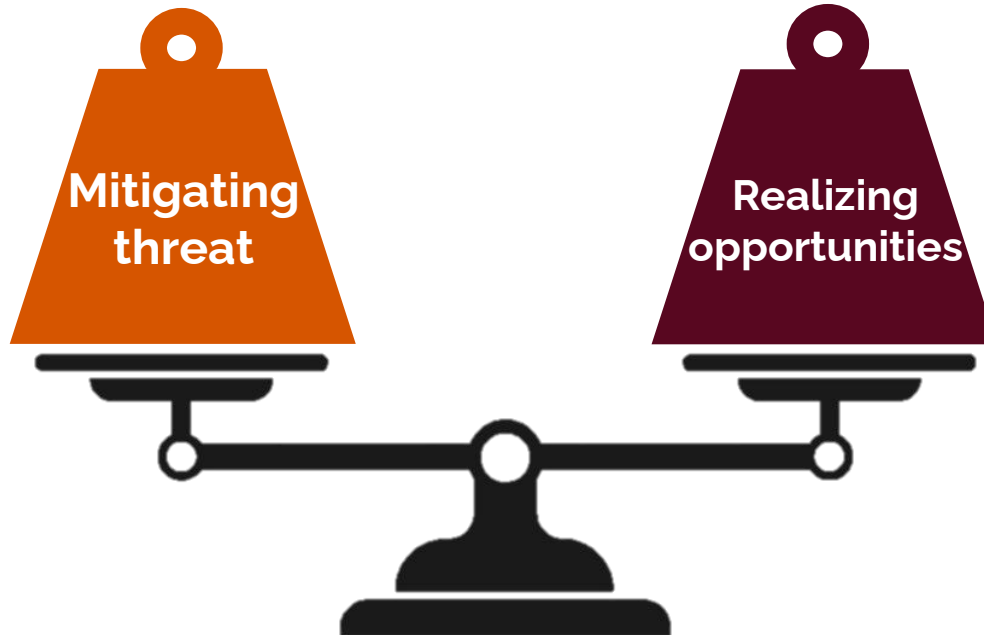


risk *noun*

1. :possibility of loss or injury: peril
2. :someone or something that creates or suggests a hazard

Tailings Risk: Losses from NOT

Engineering / administrative controls



Technical study to create opportunity



Reuse

Some challenges



The high failure rate for re-use technologies



Market alignment and physical distance



Processing can be very complex



Risk aversion, maybe for good reason!

Even superfoods need their minerals!

Anhydrite (calcium sulfate) is a by-product of the aluminium refining process. We make 85 ktpa from our operations in the Saguenay, Lac-Saint-Jean region, Quebec.



Blueberry growers in the region need anhydrite to make their plants more productive.



Our proximity allows farmers reliable, low-cost access to our by-product.



Other uses for anhydrite include construction materials.



Scandium: Making aerospace even cooler...

Rio Tinto Iron and Titanium (RTIT) at Sorel-Tracy, Quebec now make scandium oxide from titanium dioxide production 'waste'



99.99%

Product Purity



~50 Mpa*

Higher Strength



600°C

Thermal Resistance



CO₂

Energy Savings

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<https://www.elementnorth21.com/>

Scandium is a critical metal in the USA, Canada and Australia

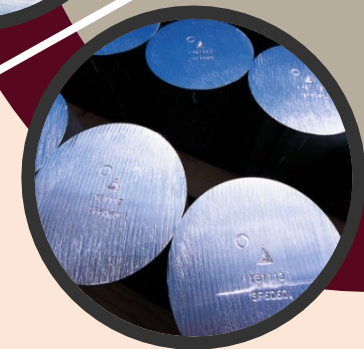


Uses of Scandium alloys:

- Aerospace, defence
- 3D-printing, sporting goods
- Fuel cells, for back-up power



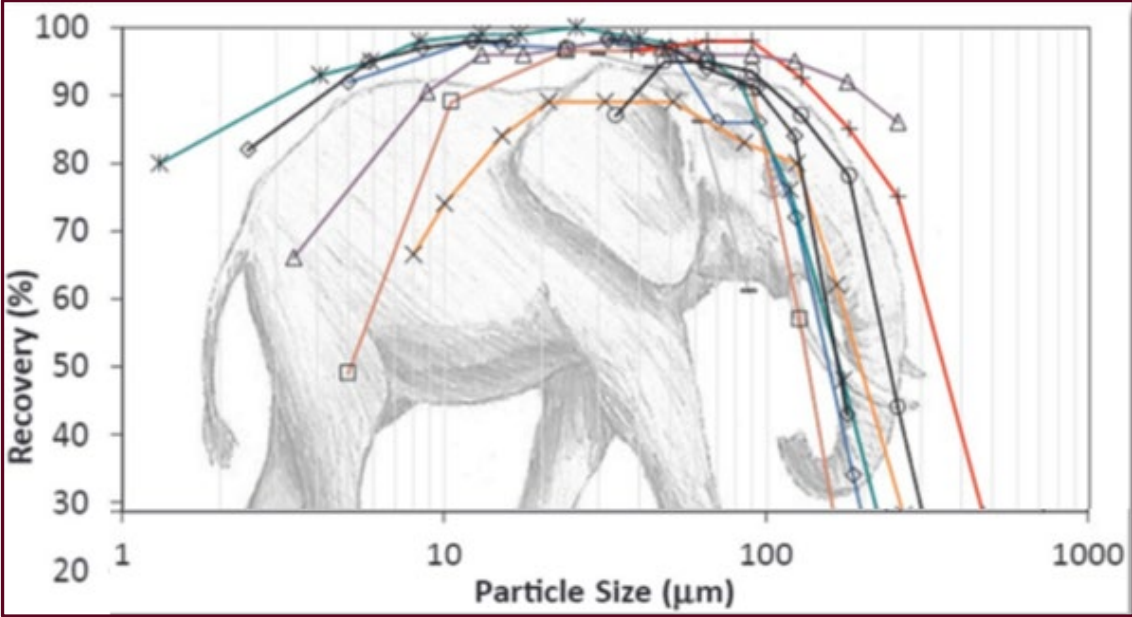
We now produce scandium oxide with no additional mining, from 'waste'



Reduce:



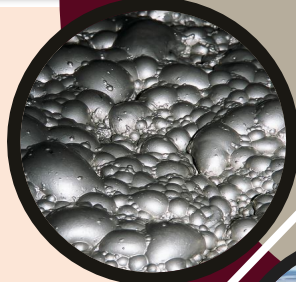
Coarse Particle Flotation: A host of benefits *and* reduced tailings volume



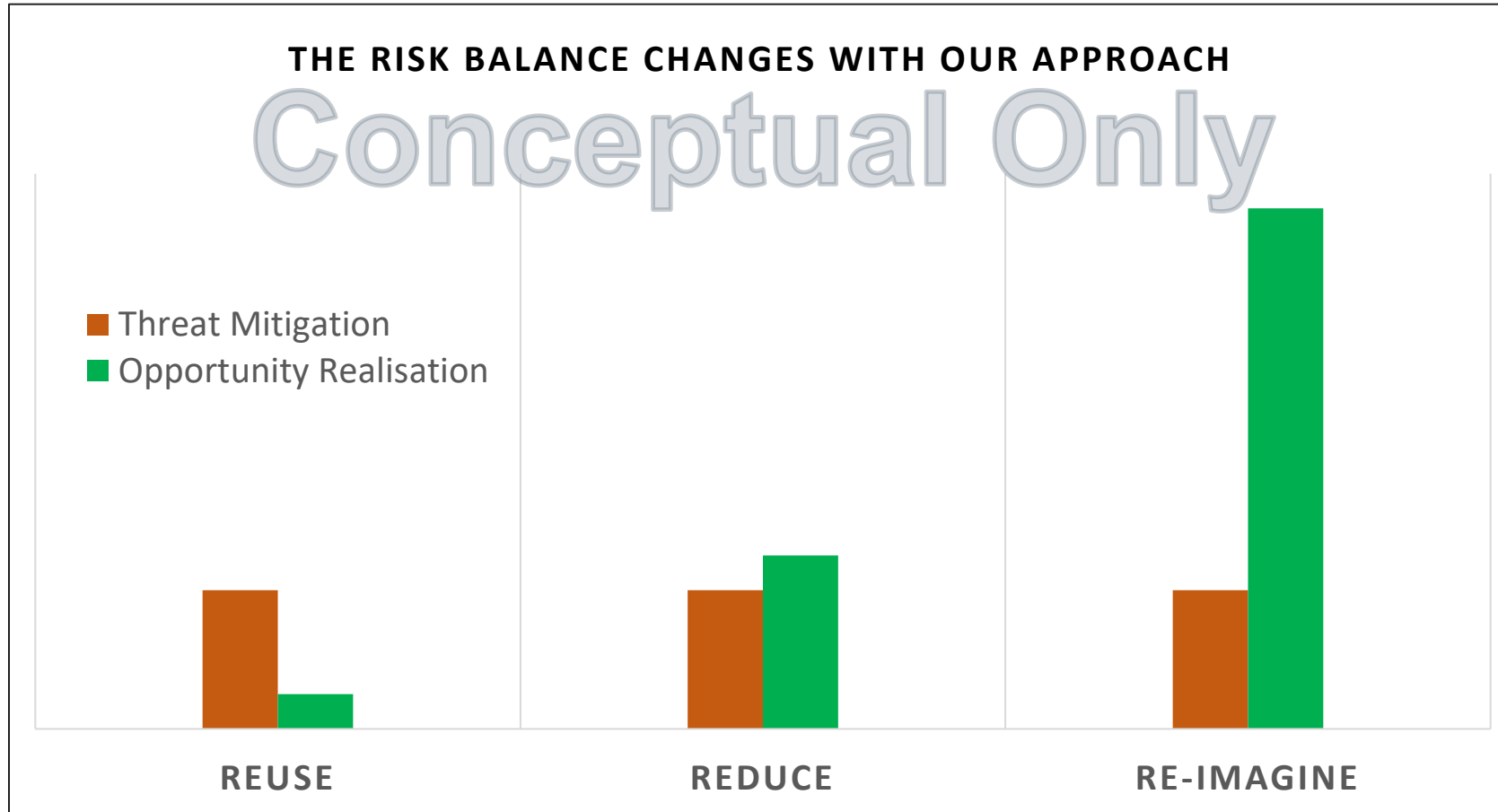
Lynch, A.J., Johnson, N., Manlapig, E., Thorne, C. 1981. Mineral and coal flotation circuits: Their simulation and control.

Benefits of Coarse Particle Flotation

- A coarse grind size means less energy
- Fewer fines. We regrind only what we must
- An increase in mill and overall plant throughput
- Improved mineral recovery
- Coarser tailings means improved settling, water recovery & tailings management



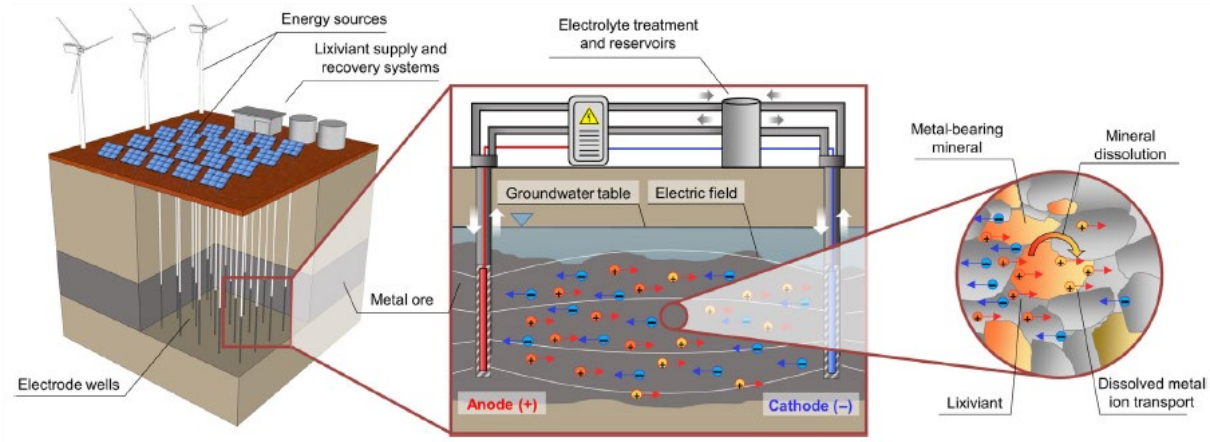
Re-imagine



There are several reasons for re-imagine technologies not to work. Thinking of those is easy. Instead let's be driven by the opportunities and focus on a few key challenges at a time.

EK-ISL: Changing the paradigm

Electro-kinetic In-Situ Leaching (EK-ISL): Mining Re-imagined?



Martens *et al.*, *Sci. Adv.* 2021; **7** : eabf9971 30 April 2021

Challenges with conventional ISL:

- Containment
- Productivity
- Ore permeability

EK-ISL uses electrical potential to influence the lixiviant flow path

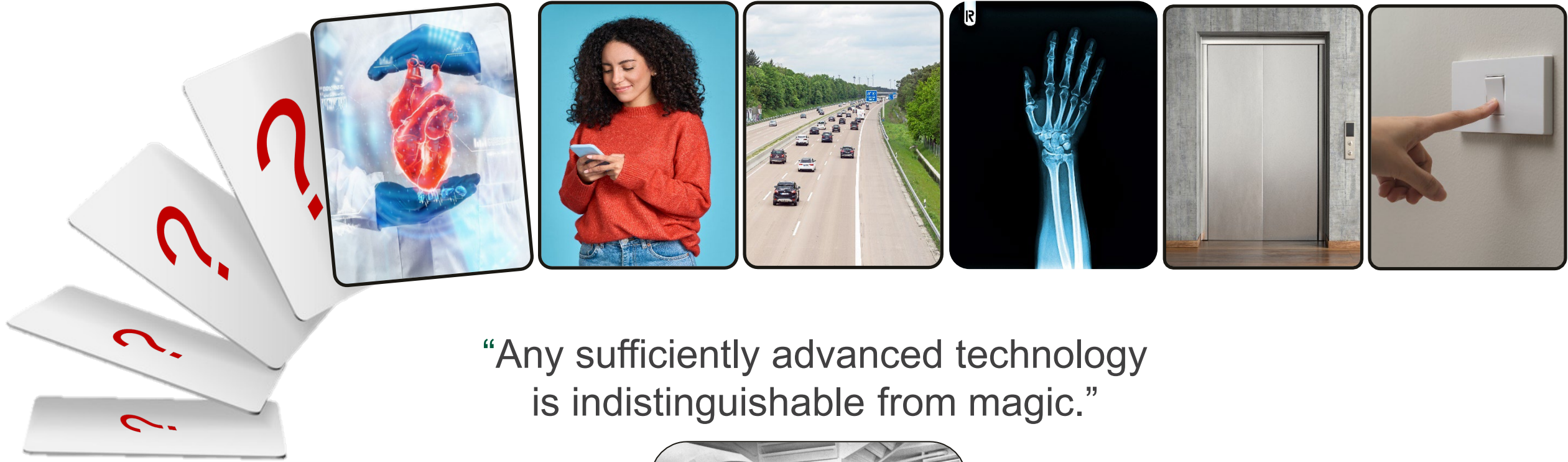
Some benefits at full potential:

- No/low earthmoving
- No comminution
- Much lower closure costs
- Reputation and brand

Problems to solve:

- Power
- Lixiviant science
- Passivation reactions
- Knowledge of orebody layout and structure

We've achieved so much together...



“Any sufficiently advanced technology is indistinguishable from magic.”



Sir Arthur C. Clarke
(1917-2008)

The Art of the Possible...



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References

1. <https://www.worldbank.org/en/news/infographic/2019/02/26/climate-smart-mining>
2. G.M. Mudd; 2009, Resources Policy; 'The Environmental sustainability of mining in Australia: key mega-trends and looming constraints'.
3. ICMM: 'Strategy to reduce tailings risk through innovation: An industry led innovation strategy to accelerate tailings reduction'.
4. A.J. Lynch; N. Johnson; E. Manlapig; C. Thorne; 1981, 'Mineral and coal flotation circuits: Their simulation and control'.
5. E. Martens; H. Prommer; R. Sprocati; J. Sun; X. Dai; R. Crane; J. Jamieson; P.O. Tong; M. Rolle; A. Fourie; Science Advances; 'Toward a more sustainable mining future with electrokinetic in situ leaching'.