Technology and the metals industry

World Materials Forum 2023

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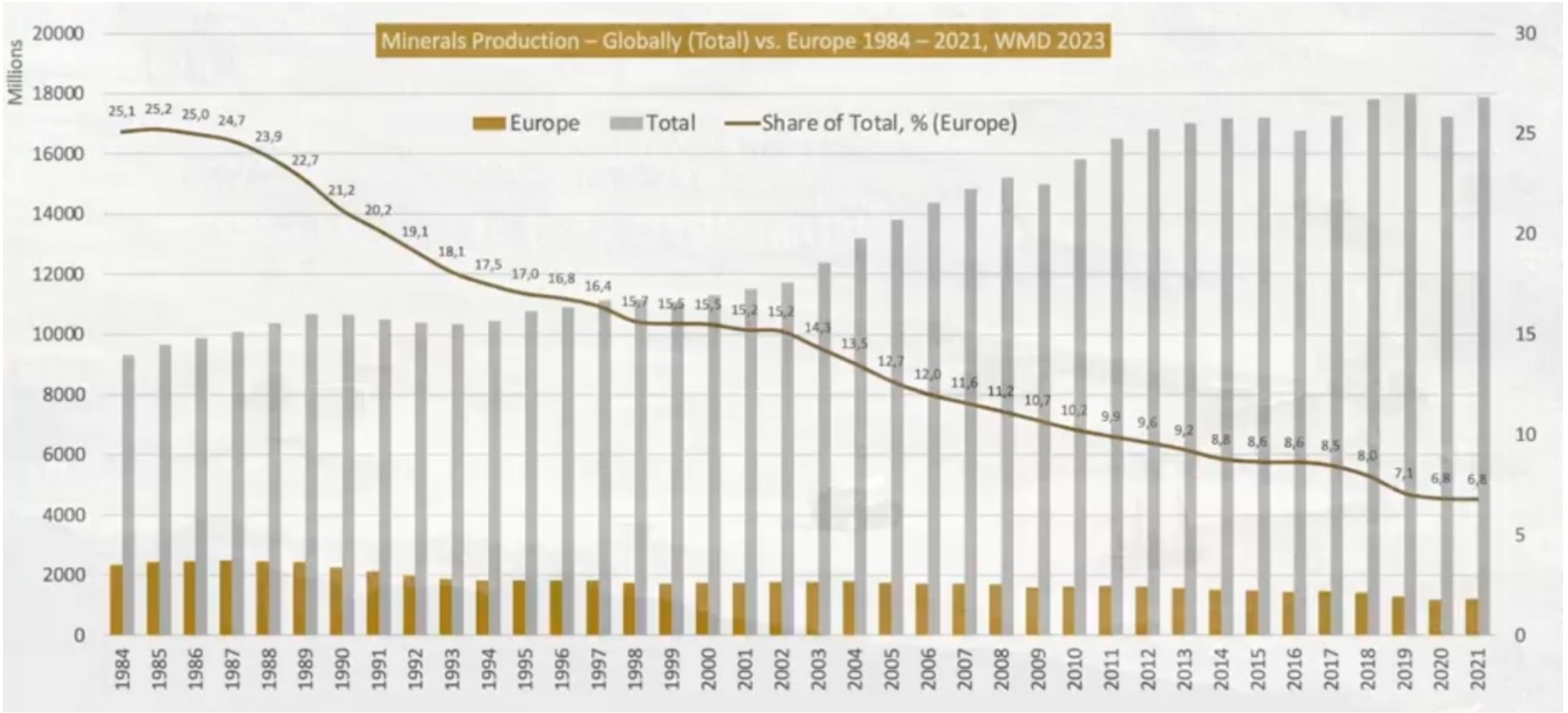
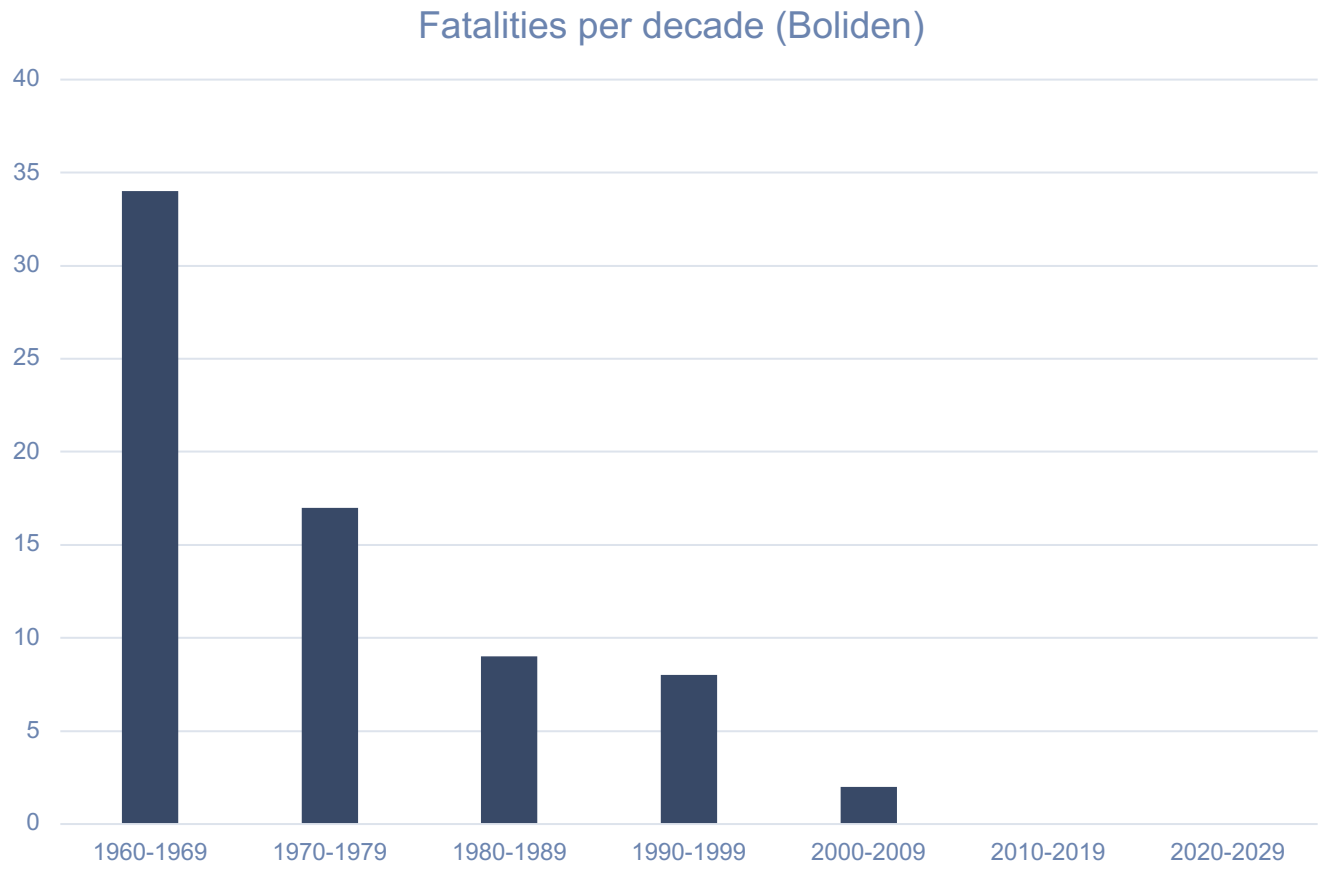
Declining minerals production in Europe



Mining industry has always pushed technical development



Zinc mining: 1936 vs today

Climate performance need to improve

- Mining and smelting still relies on fossil fuels such as diesel and coal
- Alternatives are sometimes available, but access and competitiveness is still challenging
- Technical advancements within a variety of areas within the value chain still needed
  - Energy
  - Emission
  - Water Waste

We have selected 10 breakthrough technologies for Ultra Low Mining Footprint

				Energy	Emission	Water	Waste				
Transverse		1	AI Resource imaging	-15%	-15%	0%	-50%	8	Marginal	Savings on a case-by-case basis	GOLDSPOT DISCOVERIES CORP. SENSORE Computational GEOSCIENCES
		2	Dry stack tailings	+10%	0%	-75%	-10%	9	Comparable to incumbent	200-600	MP MATERIALS Metso FLSmidth TAKRAF DELKOR
		3	Efficient rock crushing	-50%	-50%	0%	0%	4	Comparable to incumbent	-25% of incumbent	pulse
Specific to elements	Ni	4	Nickel sulfide pressure oxidation	-10%	-50%	+100%	-15%	8	60k	11k	VALE
		5	Nickel rock bioleaching	-50%	-65%	+350%	-15%	8	21k	10k	FINNISH MINERALS GROUP SUOMEN MALMIJALOSTUS
	Cu	6	Cooper in-situ leaching	-50%	-50%	-70%	-95%	8	4k	4k	Taseko Excelsior MINING CORP ENVIRO COPPER
		7	Copper tailing bioleaching	-50%	-50%	-50%	-95%	8	40	3k	JETTI nuton
	REE *(Pr, Nd)*	8	REE Efficient Separation	-15%	-10%	-5%	0%	8	5k	8-16k	USA Rare Earth REEtec ucore 中国五矿集团公司 CHINA MINMETALS CORPORATION
	Li	9	Direct Lithium extraction	-25%	-10%	+200%	-90%	8	32k†	3k†	Liblac solutions Standard LITHIUM SUMMIT NANOTECH
		10	Lithium un-calcinated rock leaching	-60%	-60%	-85%	-85%	6	21k††	2-4k††	CYCLADEX Lithium Australia

- Note: (*) Sum of CAPEX divided by tonnes of metal per year. Figures show typical values but highly depend on deposit quality; (**) USD per ton of metal; Transverse: indicates additional OPEX by deploying technology; Specific to element: OPEX of whole process by replacing existing technology. Figures show typical values but highly depend on deposits quality; (†) USD/ton $LiOH \cdot H_2O$; (††) USD/ton Lithium Carbonate (LCE),
- Sources: Arthur D. Little Analysis

Strong positive impact — Strong negative impact

Thank you!

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