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“Raw materials for the green transition in new geopolitical era

- challenges and opportunities for Europe and Sweden”

Maria Sunér, vd Svemin

SVENSKT NÄRINGSLIV

Svemin

- Business organization for Metal- Mining and Metalproducers in Sweden
- Main task is to create enabling conditions for the mining sector in Sweden
- 60+ members,
- 20 000 direct and indirect employees (100 000 for the extended mining cluster)
- 1 % of Swedish GDP (3 % the extended mining cluster)

Svemins members = the ecosystem of mining

Technology and service providers

Epiroc
SANDVIK
Hitachi Energy
HY-TECH DRILLING
GISAB
STRABAG
ABB
geopool
ZEPPELIN CAT
Schneider Electric
SWEROCK
KATI
DRILLCON GROUP
protekhorr
BRIDGESTONE
BERGTEAMET
Metso:Outotec

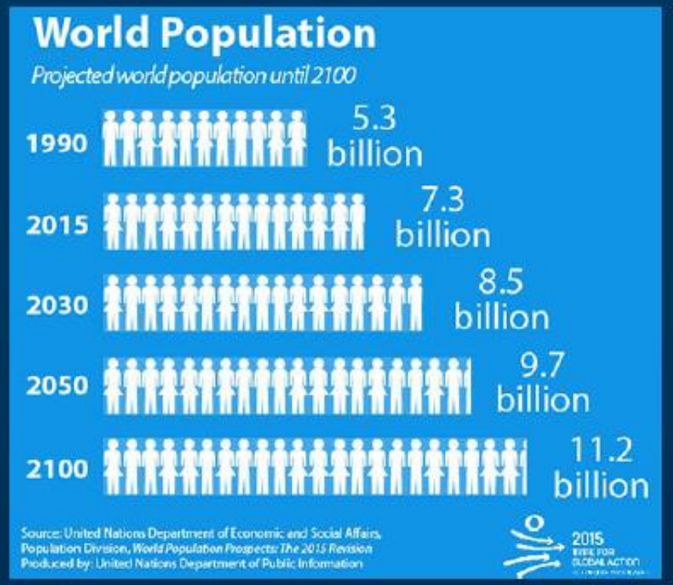
Active mining companies

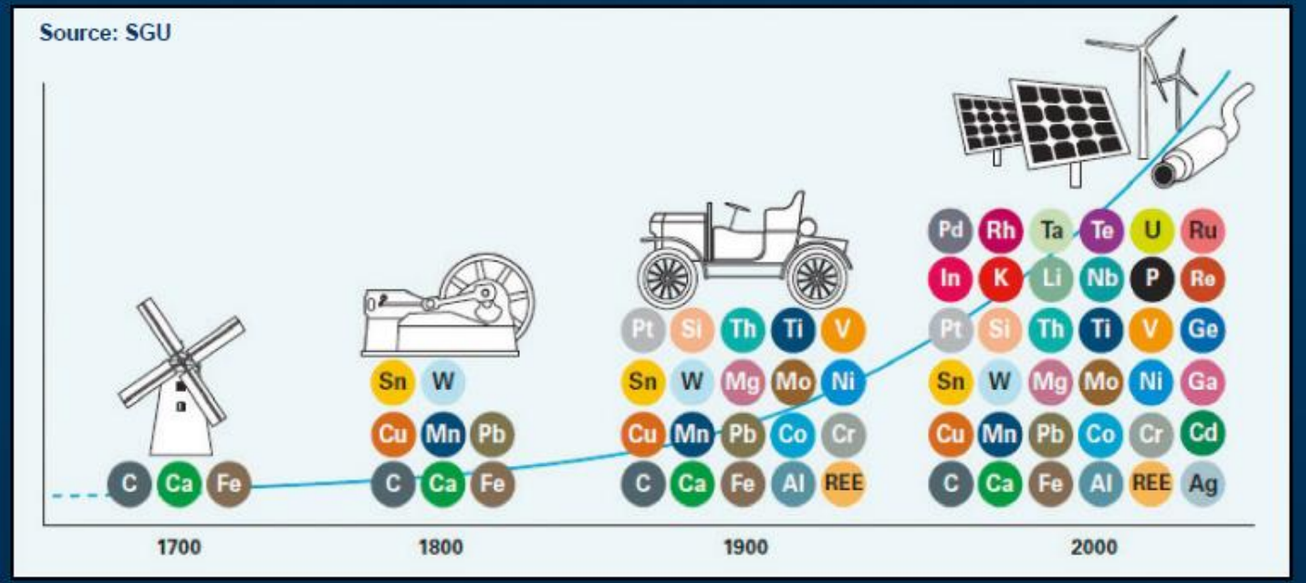
LKAB
LOVISAGRUVAN
Zinkgruvan Mining
a subsidiary of lundin mining
Dragon Mining
Nordkalk
CEMENTA
HEIDELBERGCEMENT Group
NEW BOLIDEN
KPAB
Kalkproduktion Storugns AB
KAUNIS IRON
MANDALAY RESOURCES
BJÖRKDALSGRUVAN AB
sma mineral

Juniors – exploration and development

AGNICO EAGLE
BEOWULF MINING
Nordic Iron Ore
GRANGEX
LEADING EDGE MATERIALS
EMX ROYALTY CORP
THE ROYALTY GENERATOR
Vilhelmina mineral
ROLLING ROAD
EXPLORATION SWEDEN AB
talga
BOTNIA EXPLORATION
GOLD LINE RESOURCES LTD.
SCANDI VANADIUM
ALICANTO MINERALS LIMITED
COPPERSTONE RESOURCES

Demand for minerals and metals





LULEÅ UNIVERSITY OF TECHNOLOGY

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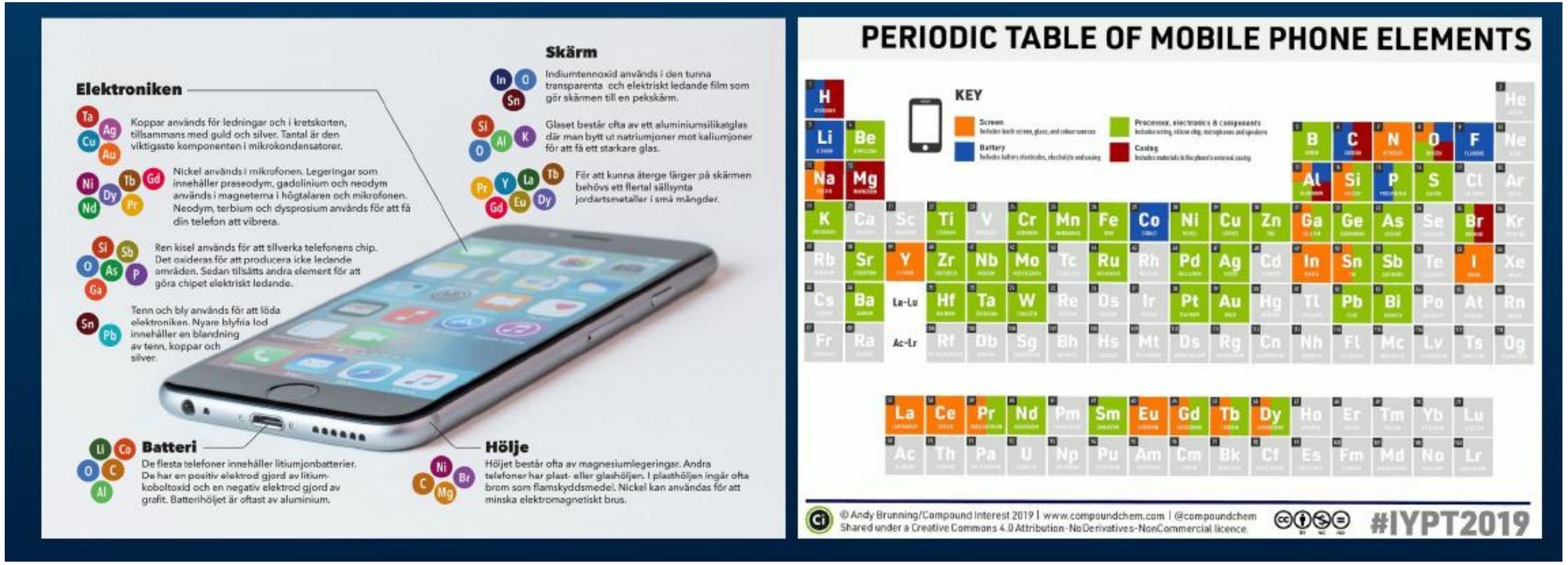
Need for materials in a mobile phone



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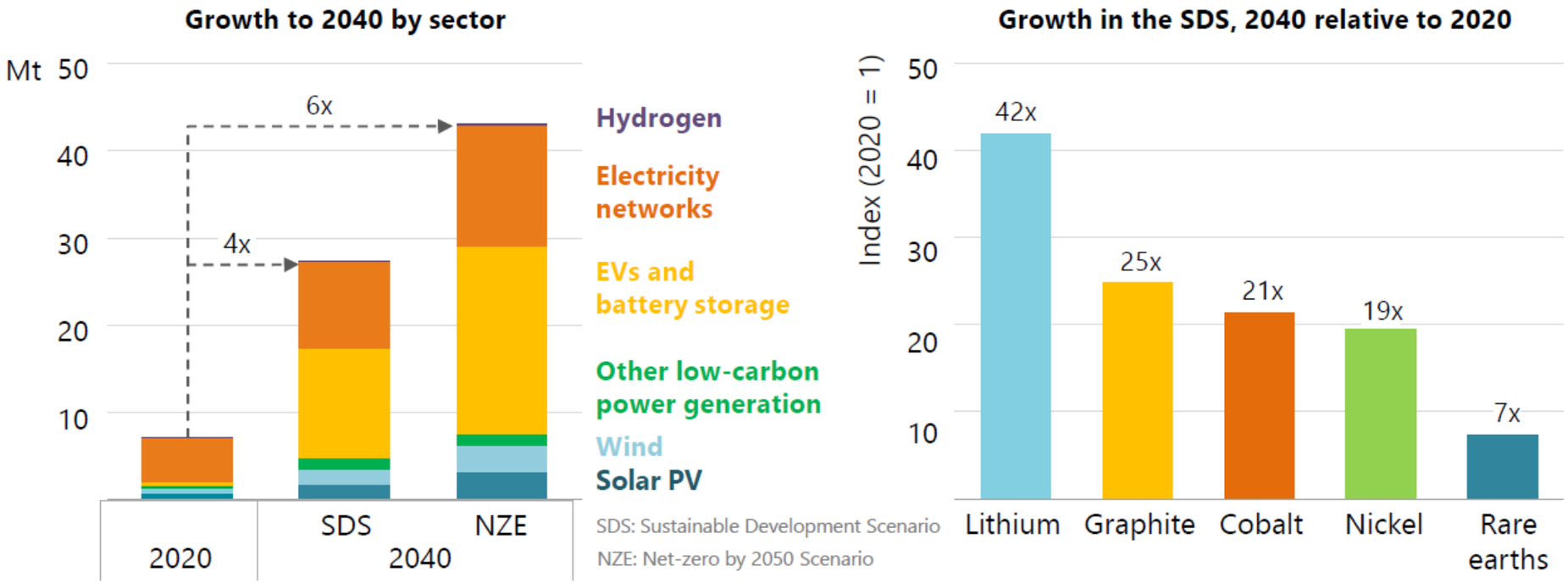
A Net Zero world requiers 6x more minerals by 2040

Mineral demand for clean energy technologies by scenario



Källa: IEA 2021.The Role of Critical Minerals in Clean Energy Transitions

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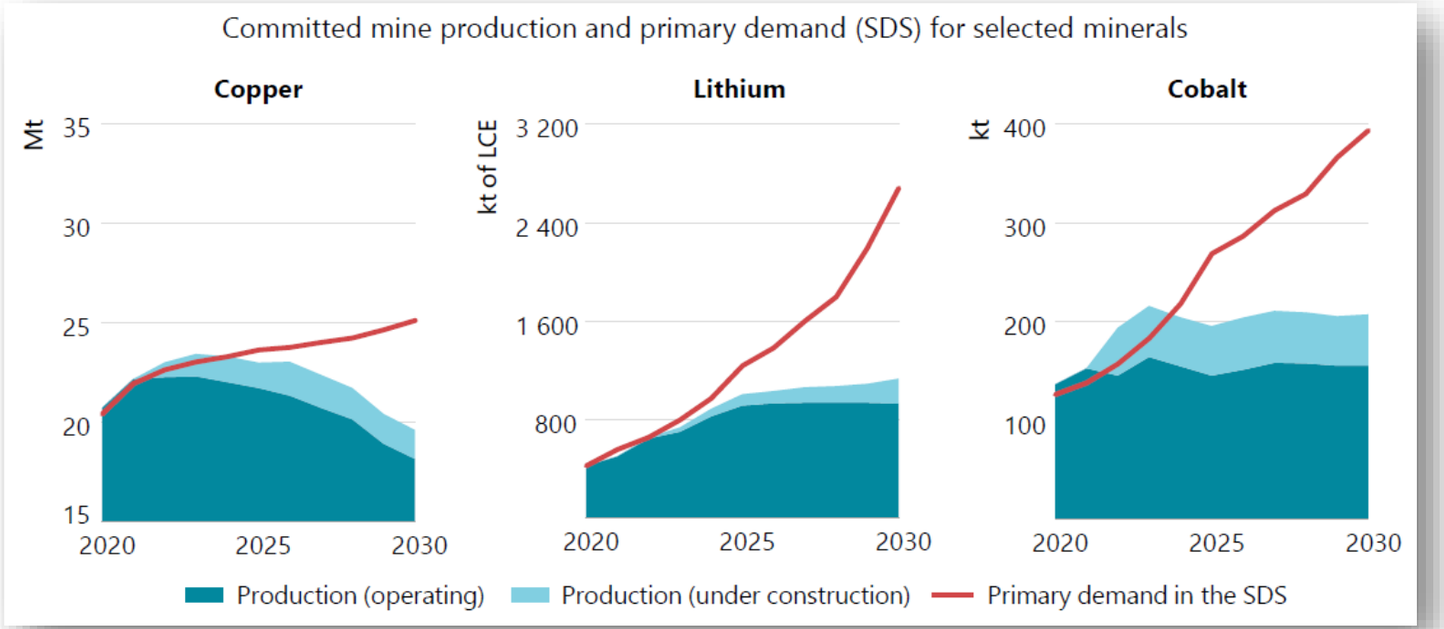
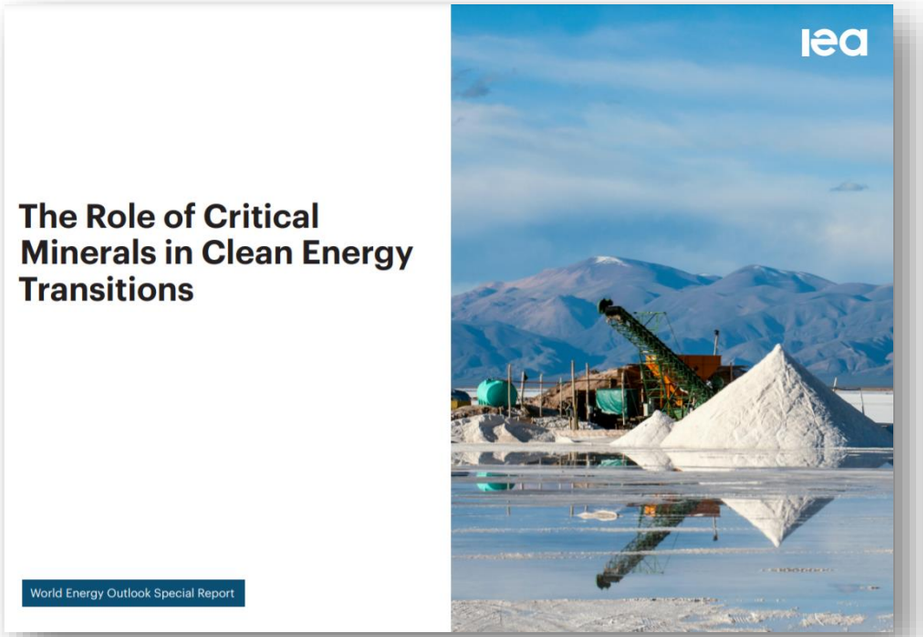
Materials a bottle-neck in the green transtion?





”Today, the data shows a looming mismatch between the world’s strengthened climate ambitions and the availability of critical minerals that are essential to realising those ambitions."

Dr Fatih Birol
IEA Executive Director

Källa: IEA 2021.The Role of Critical Minerals in Clean Energy Transitions; Världsbanken 2020. Minerals for Climate Action - The Mineral Intensity of the Clean Energy Transitionn

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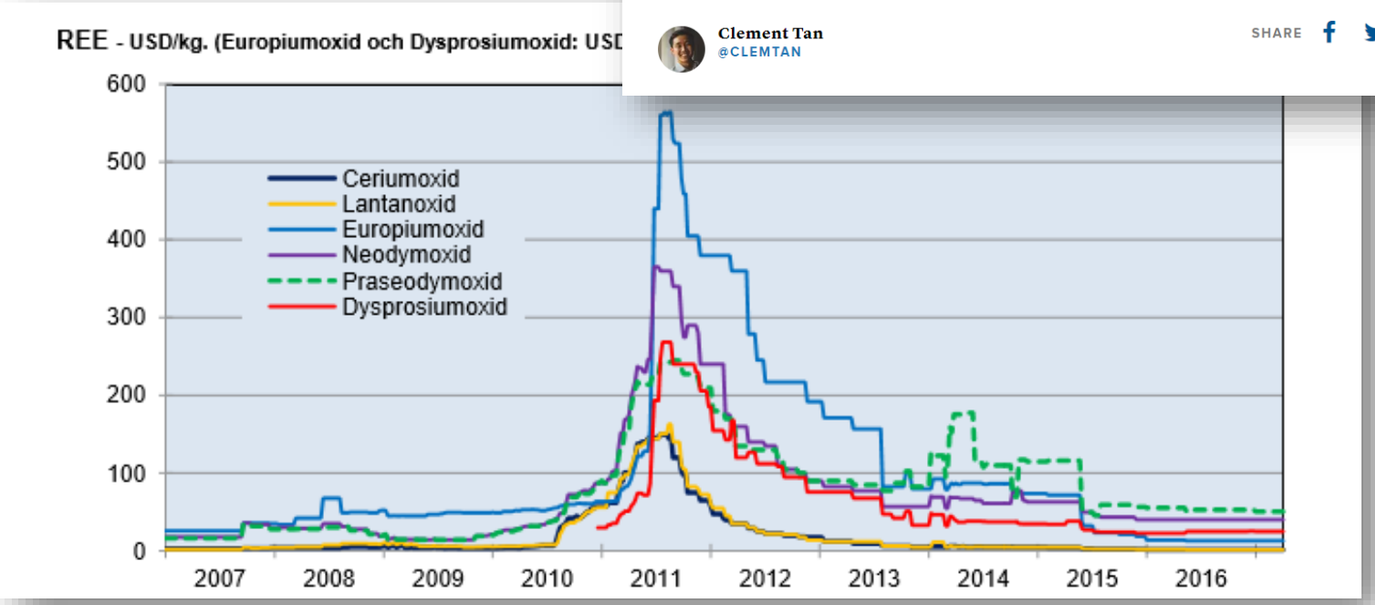
Raw materials in the geopolitiks



CHINA ECONOMY

China exports zero germanium and gallium in August as national security curbs bite

PUBLISHED WED, SEP 20 2023•1:06 AM EDT

Clement Tan
@CLEMTAN

SHARE

2010 Senkaku boat collision incident

Sällsynta metaller och stormaktsrivalitet

En översikt om nya strategiska resurser och risken för råvarukonflikter

Niklas H. Rossbach

FOI-R--5478--SE

Juni 2023

FOI

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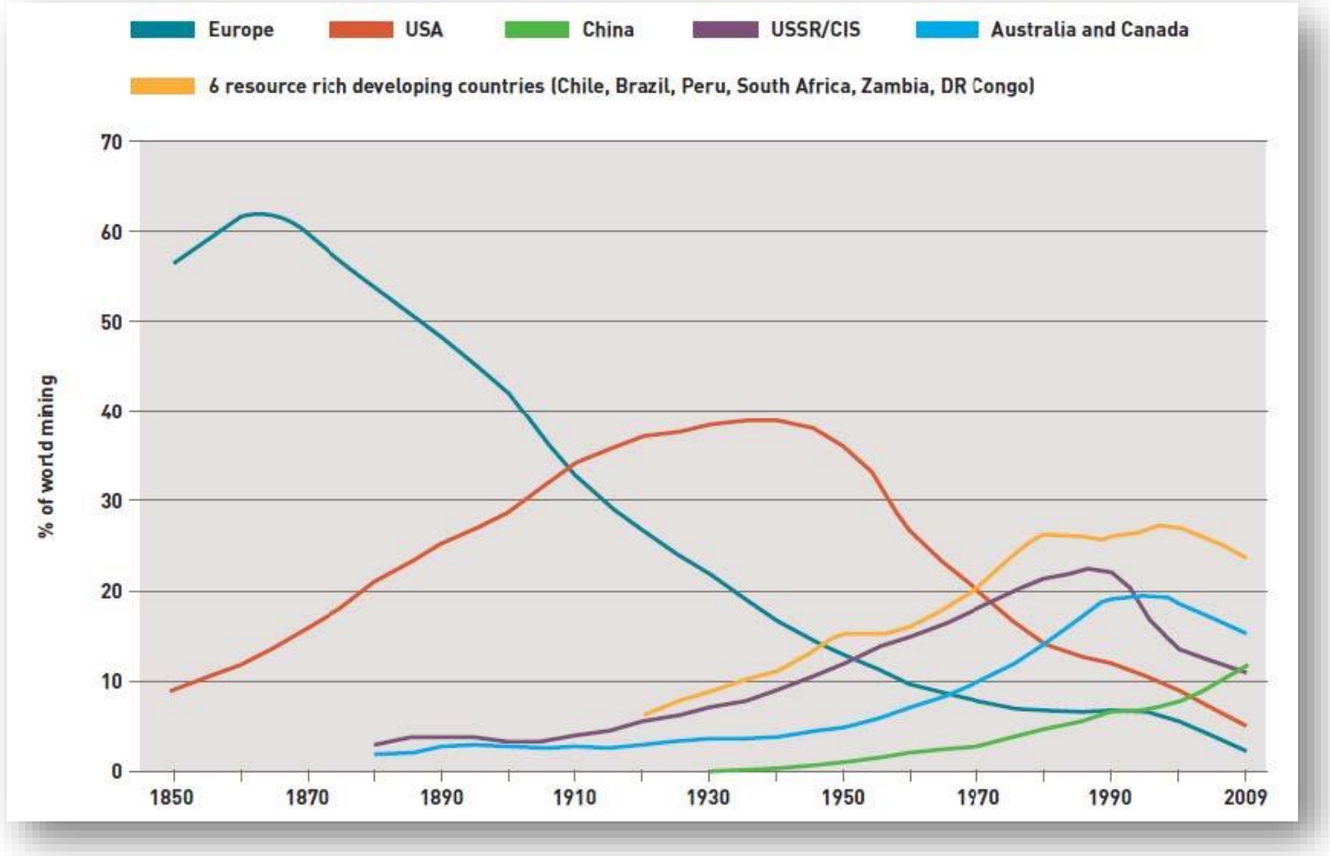
Share of mining in the world (1850 - 2009)



Källa: EU-Commission 2016. Raw Materials Scoreboard, based on ICMM 2012.Trends in the mining and metals industry – Mining's contribution to sustainable development.

Materials for the defence sector in EU

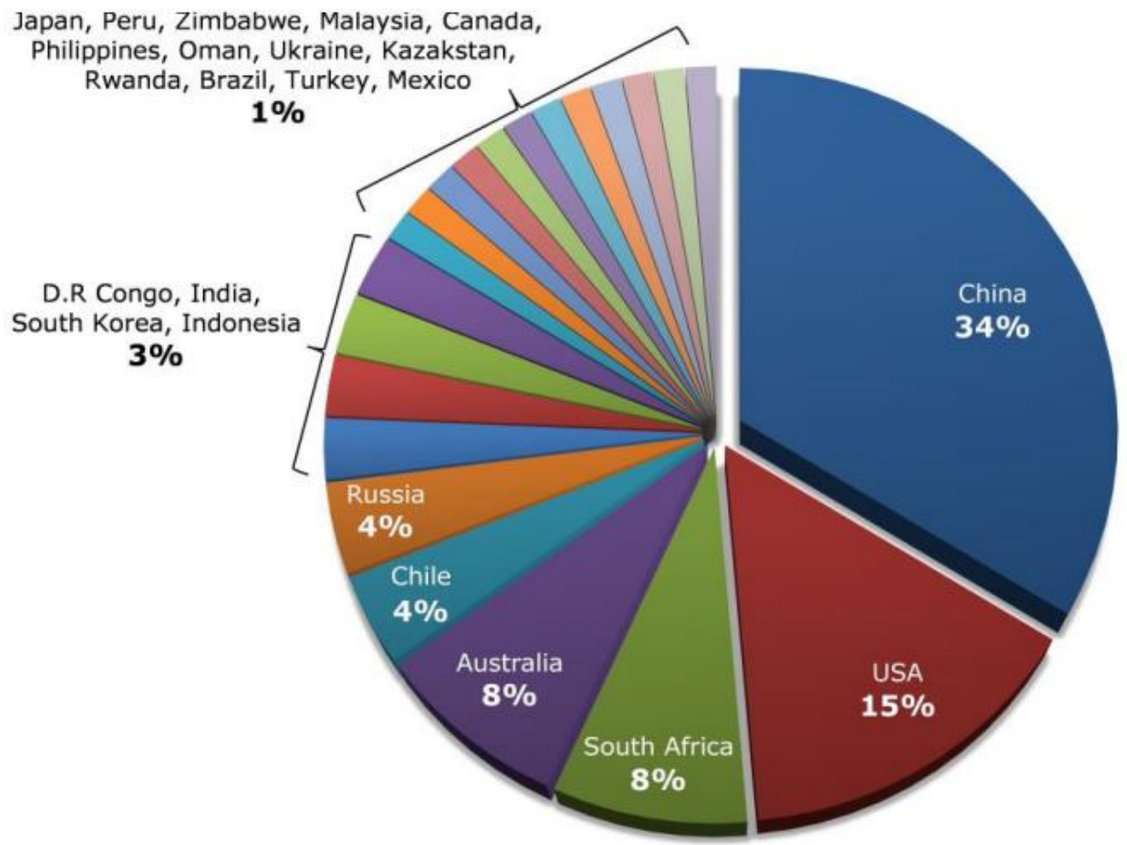
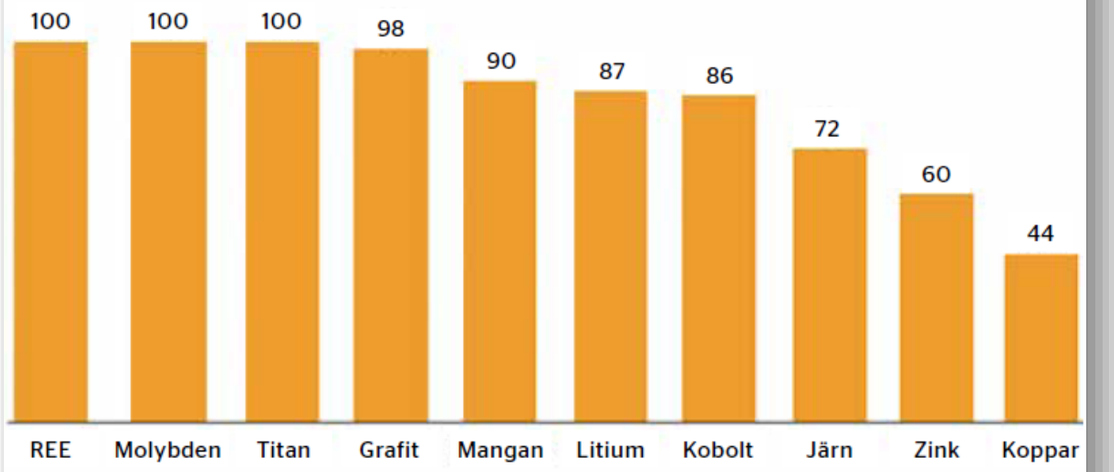


Figure 5.2: Major supplier countries of raw materials in the European defence sector[10]

EU has a strong import dependency for Raw Materials

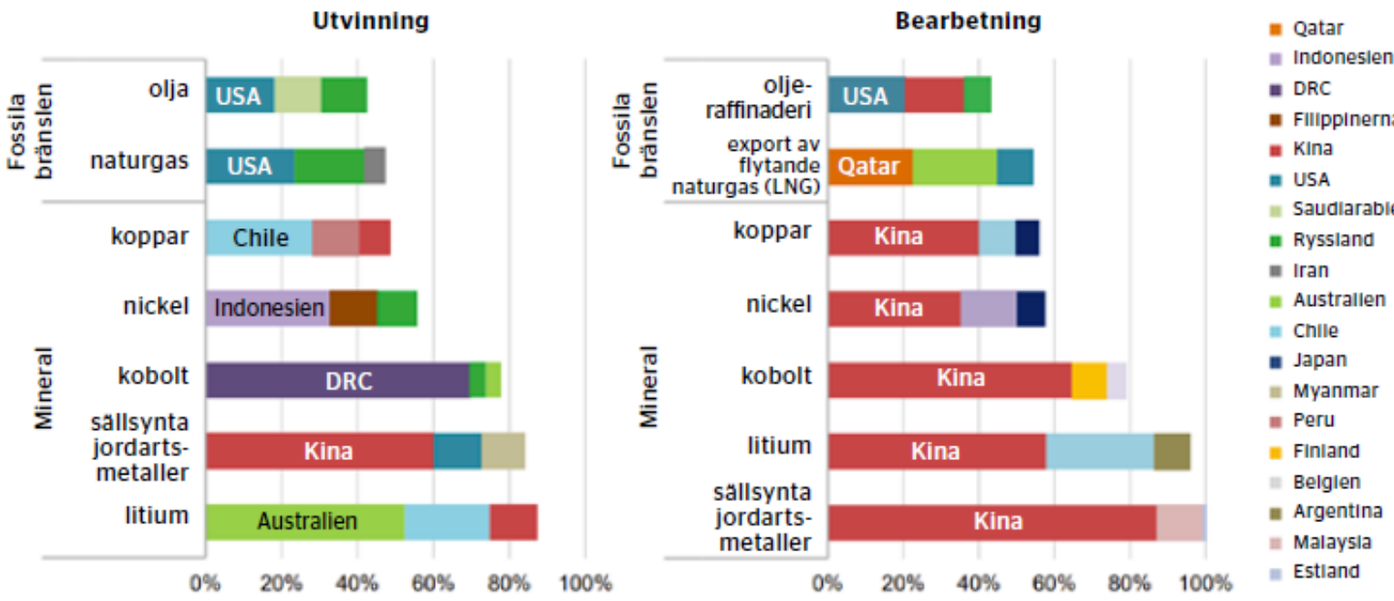
Importberoende för utvalda metaller och mineral
Europa importerar en majoritet av sitt metallbehov, för några metaller är EU helt importberoende.

Importberoende till EU per metall
Procent



Not: Importberoende av utvinning (ej bearbetning)
Källa: Study on the EU's list of Critical Raw Materials (2020)

Produktionen av många energikritiska mineral som behövs i omställningen till ett klimatneutralt samhälle är idag mer geografiskt koncentrerat än olja och gas.
Bilden visar andelen produktion av vissa mineral och fossila bränslen i topp tre producerade länder.



Bildkälla: IEA (2021) The Role of Critical World Energy Outlook Special Report Minerals in Clean Energy Transitions.

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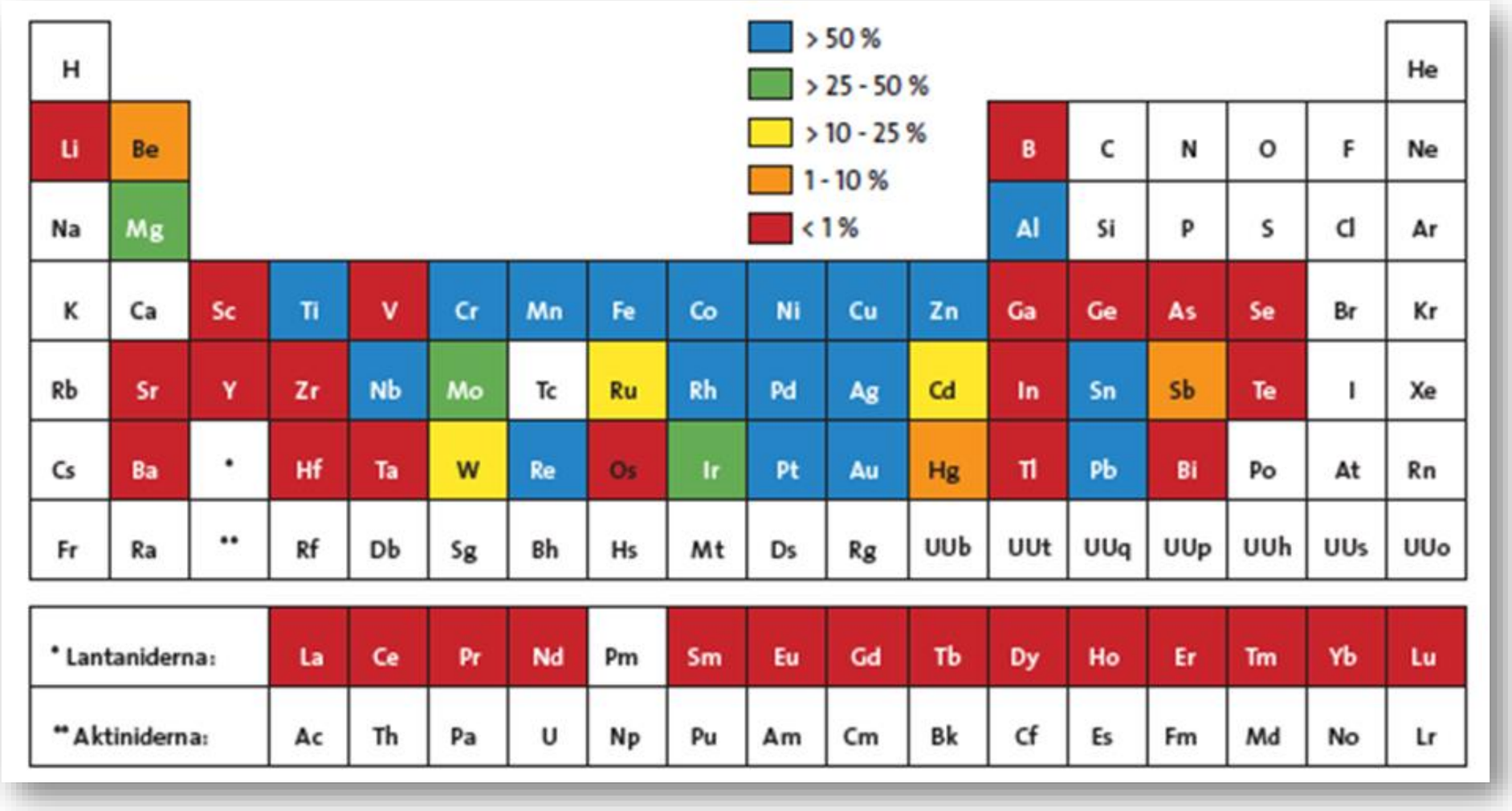
Low rate of recovery for many materials



Källa: SGU 2017. MineFacts: Material Economics 2021.

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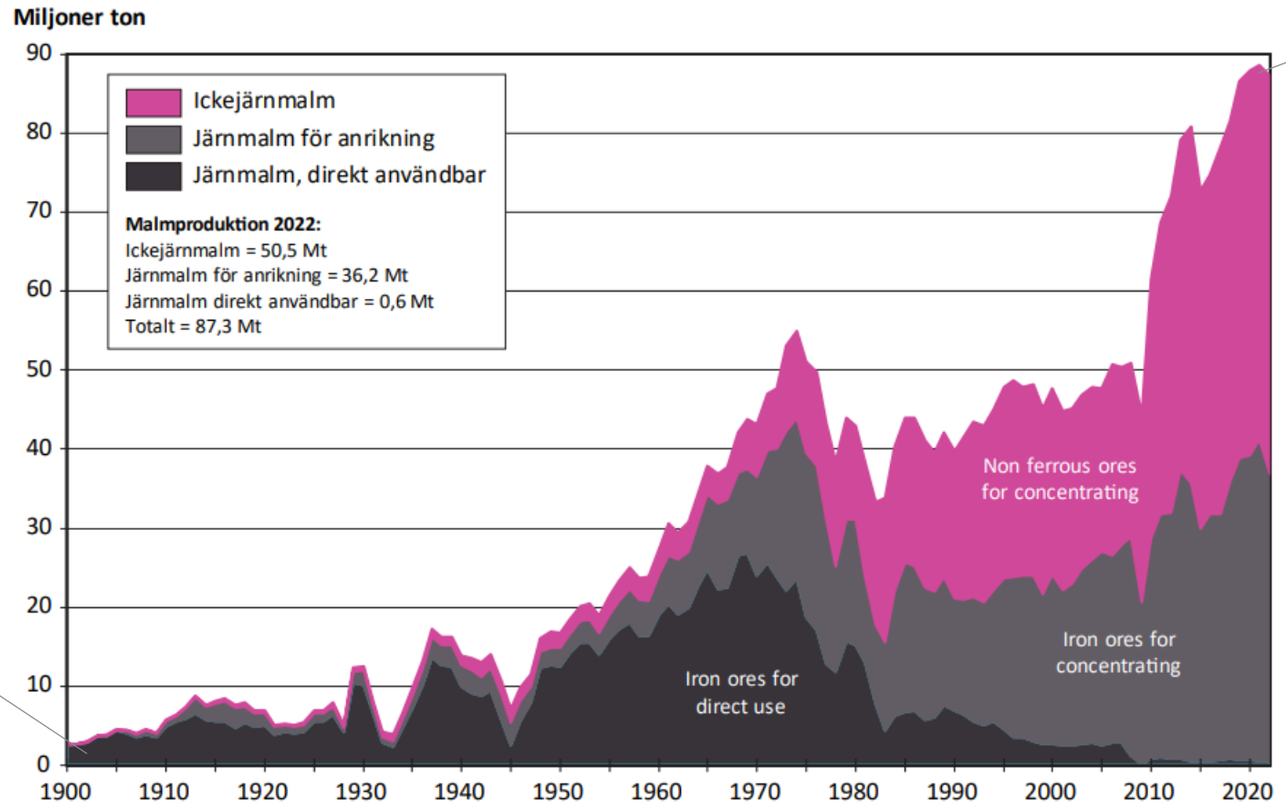
Sweden has a long history of mining

12 mines

250 mines



Figur 23. Malmproduktionen i Sverige, år 1900–2022.
Production of ores in Sweden 1900–2022.

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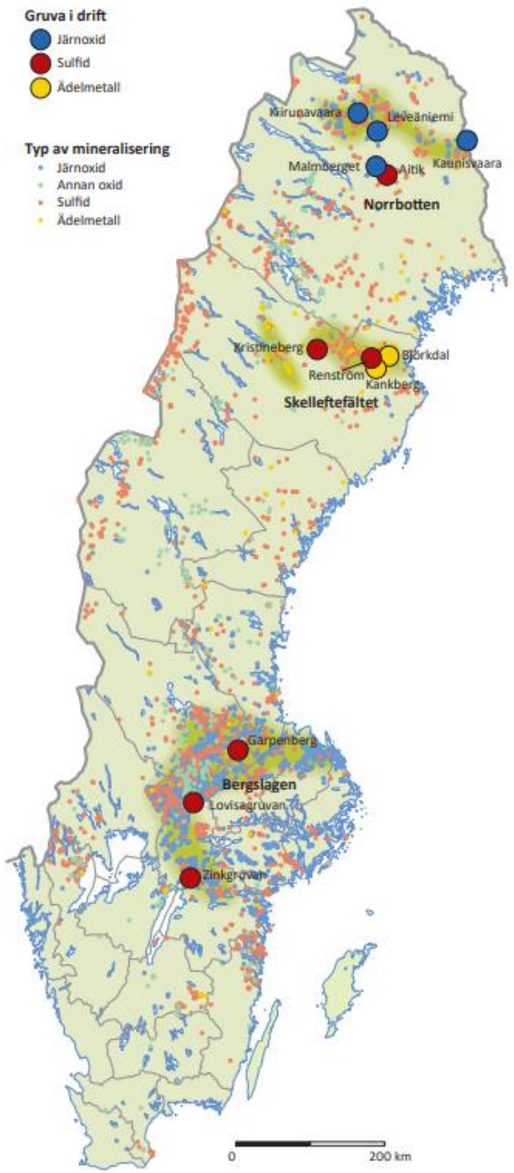
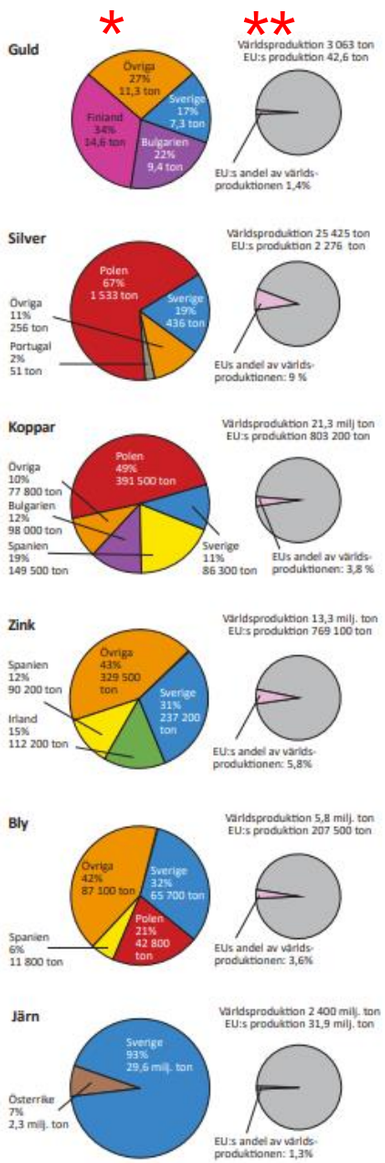


Figur 20. Sveriges gruvor och mineraliseringar, år 2021.
Sweden's mines and mineralisations, in 2021.



Figur 21. Sveriges gruvproduktion år 2021 i relation till EU och världen.
Sweden's mine production 2021 in relation to the EU and the world.

Bergverksstatistik 2021

Sweden = EUs mining nation no #1

* SE share of EU production (in blue)

** EU share of global production (in pink)

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Significant potential for critical Raw Material in the Nordics

- “In mineral-richness, **the Nordic bedrock** can be compared with the most mineral-rich areas of the world, such as Canada, the USA, Brazil and Australia, and **can supply almost all of the critical raw materials defined by the EU**.”

- “In addition to creating **sustainable economic growth and employment**, the **Nordics can ensure Europe and the rest of the world access to critical raw materials produced with high sustainability, ethic and environmental standards**.”

https://www.nordicinnovation.org/2021/nordic-supply-potential-critical-metals-and-minerals-green-energy-transition-0

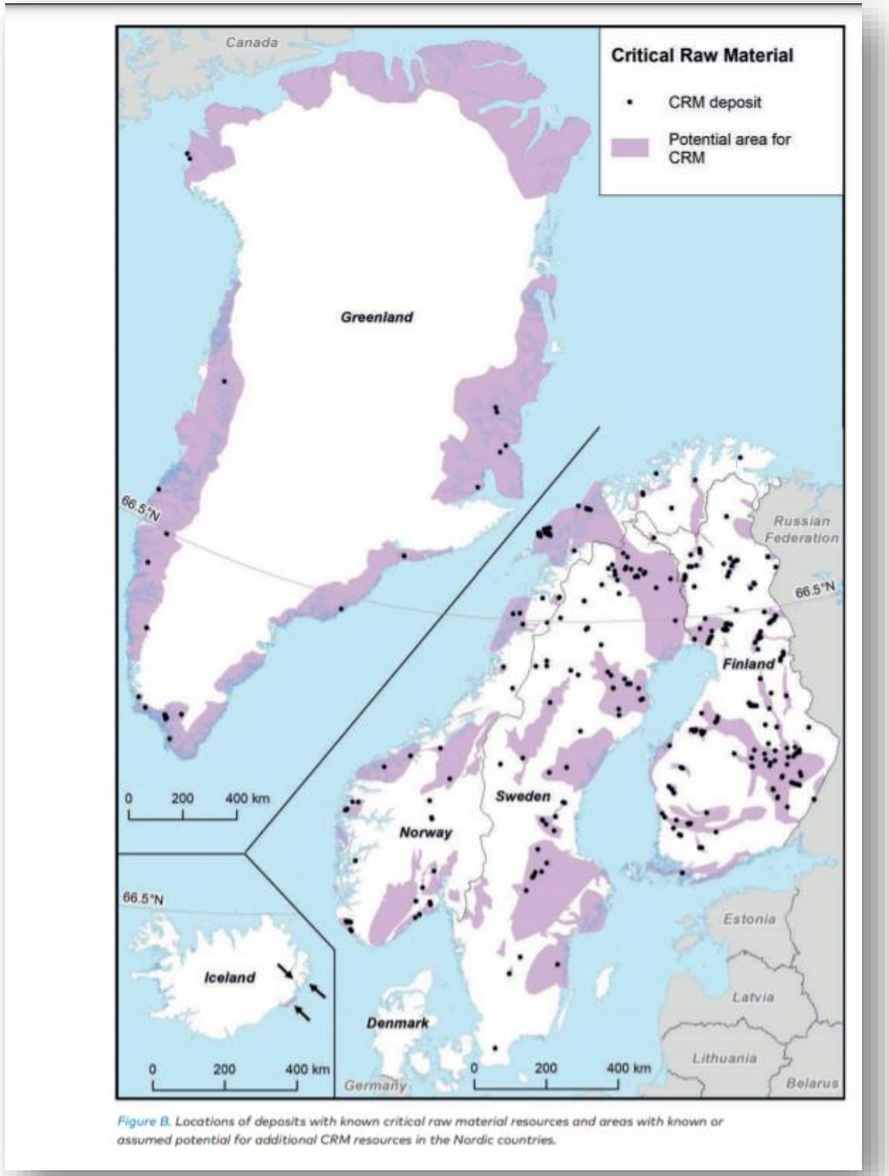

Figure B. Locations of deposits with known critical raw material resources and areas with known or assumed potential for additional CRM resources in the Nordic countries.

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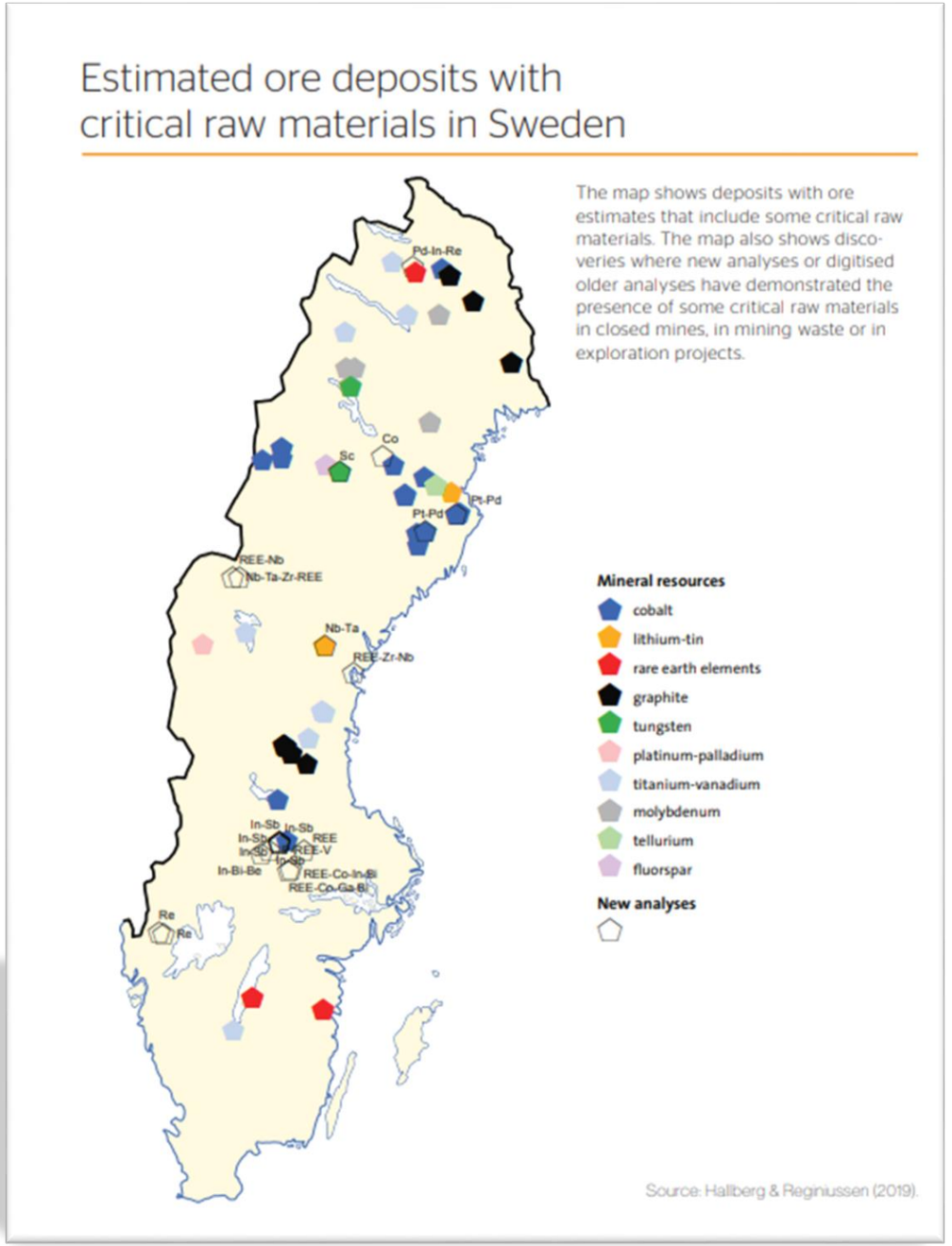
Potential for Critical Raw Materials



Källa: Swedish Geological Survey 2019.

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A world leader in sustainable mining – sustainability targets

Climate

Fossil free mining operations by 2035 and fossil free processing by 2045

Reindeer herding

Fact-based and respectful dialogue for long-term co-existence between reindeer herding and mining

Biodiversity

Net-gain of biodiversity by 2030 in all regions where mining and exploration takes place

Health and safety

Safe and attractive workplaces without accidents or work-related illness

Innovation

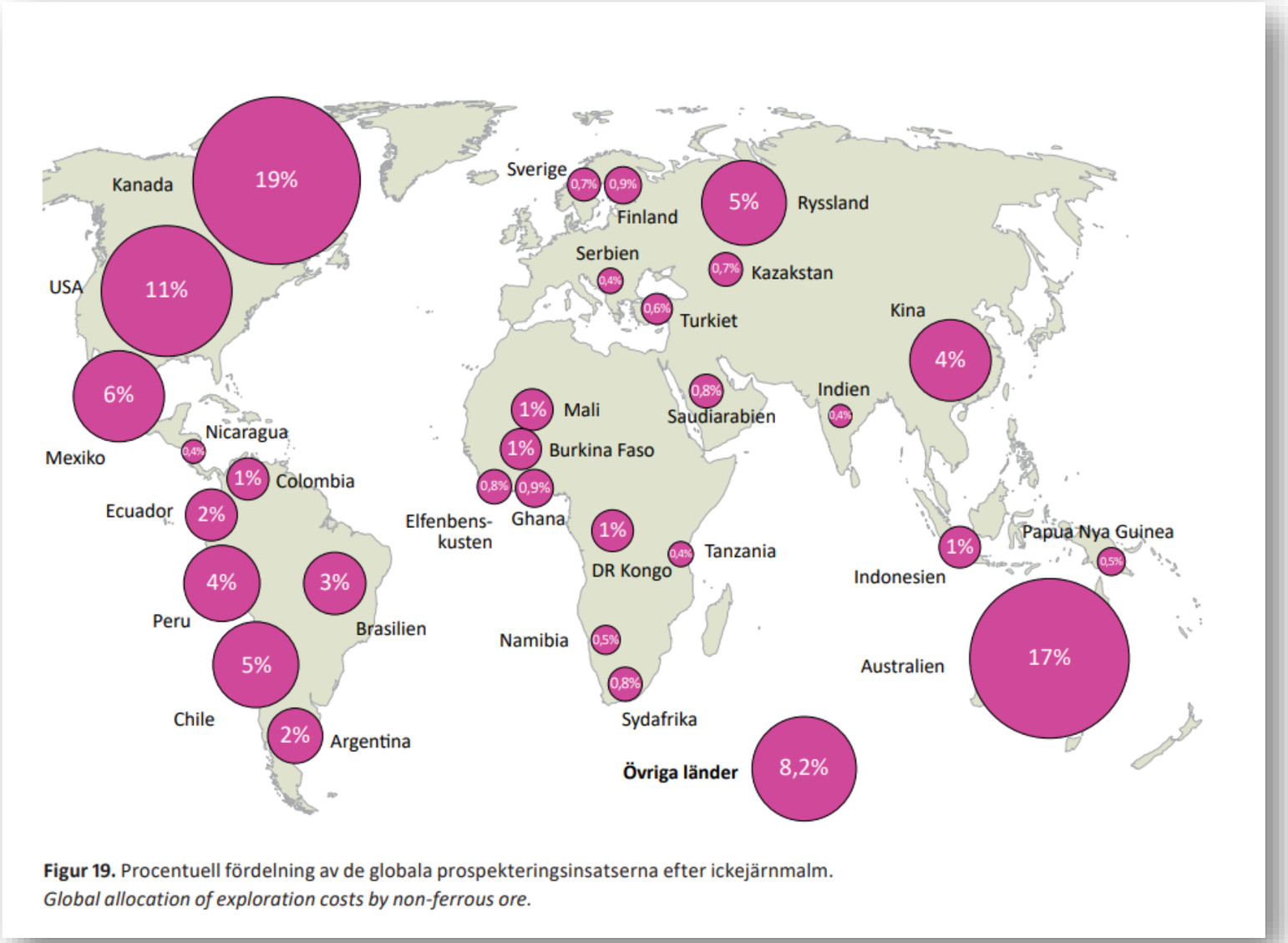
A global innovation leader in mining technology and mineral related research

Circular Economy

Recovery of more minerals from waste streams and synergies between primary and secondary raw materials

Global investments into exploration (non- ferrous ore)

! *only 3 % goes to Europe*



Figur 19. Procentuell fördelning av de globala prospekteringsinsatserna efter ickejärnmalm.
Global allocation of exploration costs by non-ferrous ore.

Source: Geological Survey of Sweden. Statistics of the Swedish Mining Industry 2021.

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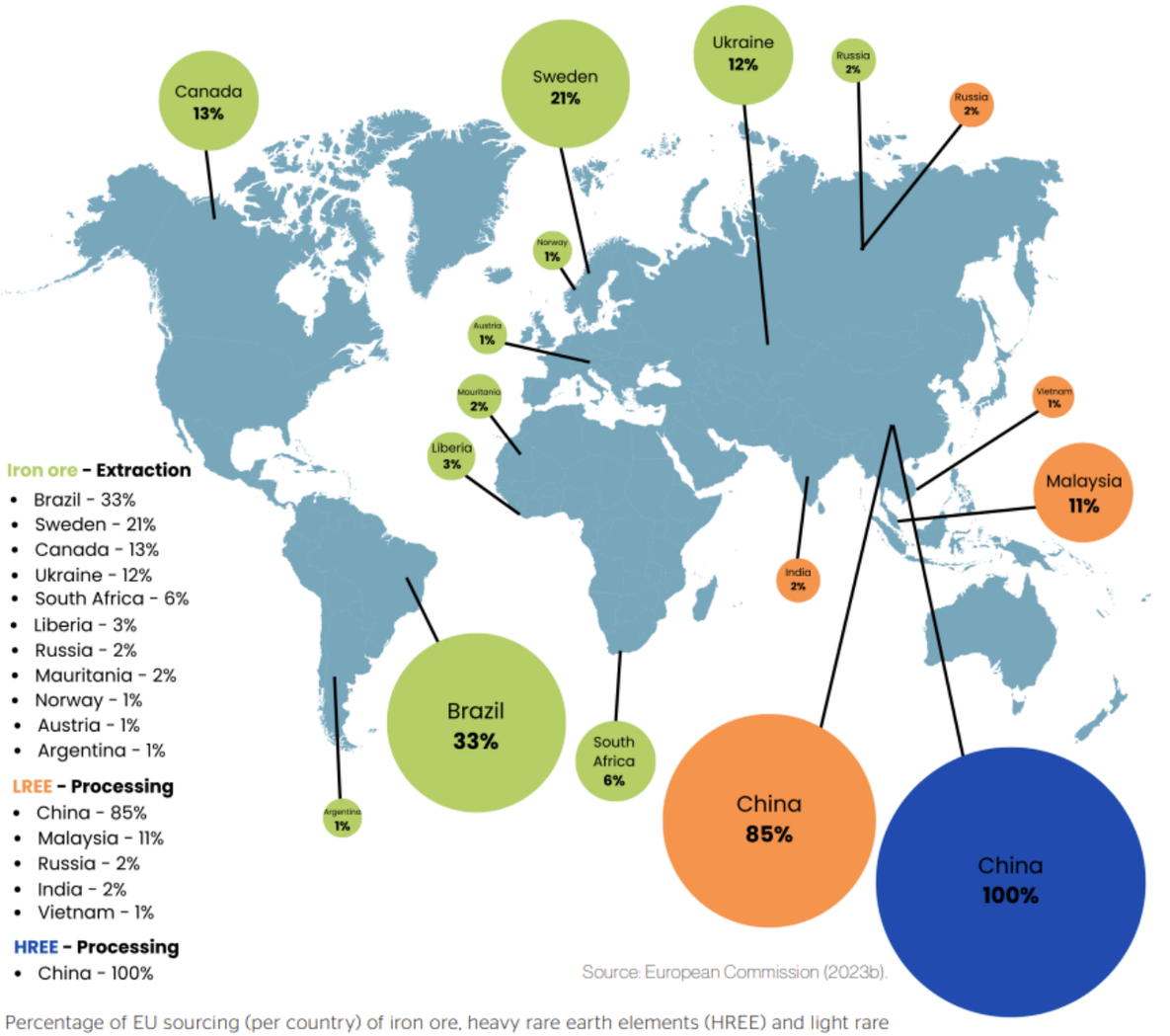
Major EU sourcing countries of – Iron ore, HREE, LREE



Iron ore – Extraction

- Brazil – 33%
- Sweden – 21%
- Canada – 13%
- Ukraine – 12%
- South Africa – 6%
- Liberia – 3%
- Russia – 2%
- Mauritania – 2%
- Norway – 1%
- Austria – 1%
- Argentina – 1%

LREE – Processing

- China – 85%
- Malaysia – 11%
- Russia – 2%
- India – 2%
- Vietnam – 1%

HREE – Processing

- China – 100%

Source: European Commission (2023b).

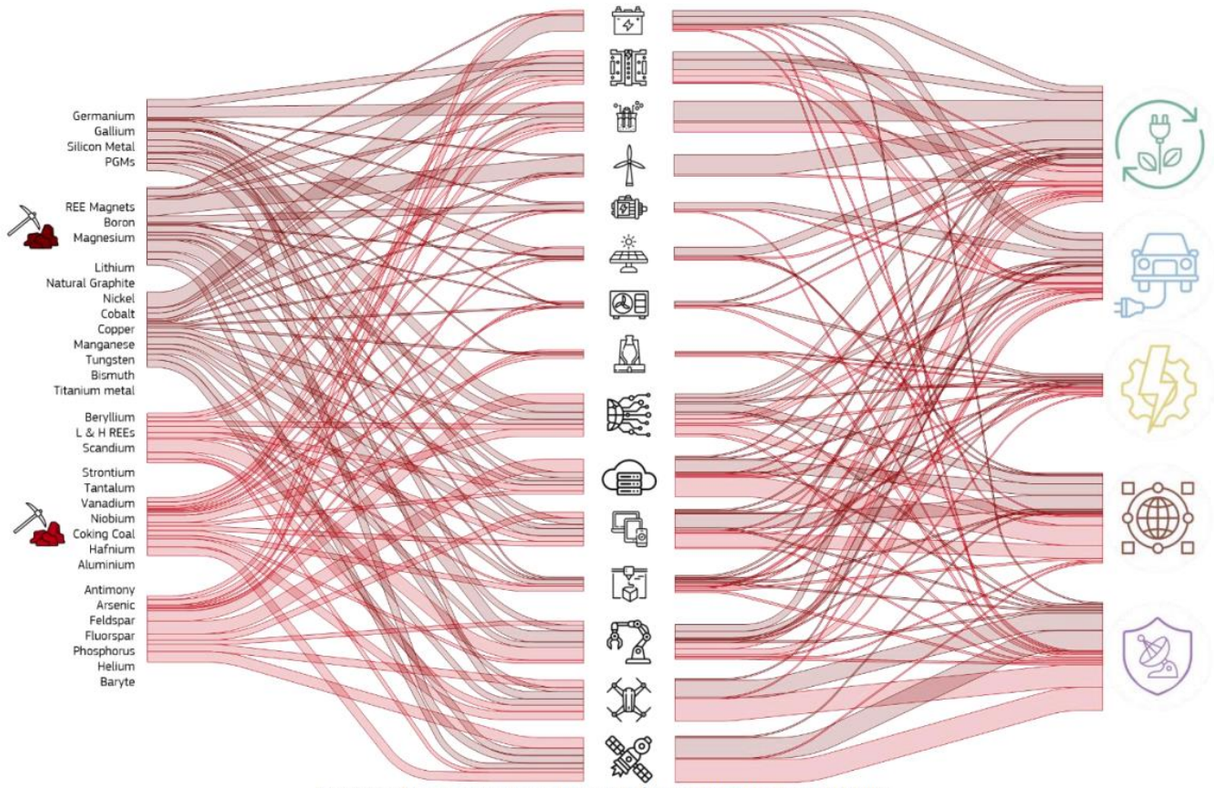
Percentage of EU sourcing (per country) of iron ore, heavy rare earth elements (HREE) and light rare earth elements (LREE). Even for important metals like iron, the EU is dependent on a few high-producing countries. Disruptions in the production chain in individual countries can therefore have a major impact on supply. Maintaining and strengthening competitive iron ore production in the EU is therefore crucial. The iron ore in Kiruna also contains REE and is planned to be extracted as a by-product of the iron ore, which in turn can reduce dependency on China if the processing stage can be located in the EU.

Critical Raw Material Act (CRMA)

- Strong political signal with benchmark targets
- 34 critical and strategic raw materials
- Positive elements:
  - Focus on strengthened trade relations as well as increased domestic extraction
  - More efficient permitting processes
  - Increased exploration in Europe

Critical Raw Material Regulation

Figure 2. Semi-quantitative representation of flows of raw materials to the fifteen technologies and five sectors



Source: JRC analysis (see Annex 3 for methodological details).

EUROPEAN COMMISSION

Brussels, 16.3.2023
COM(2023) 160 final

2023/0079 (COD)

Proposal for a

REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

establishing a framework for ensuring a secure and sustainable supply of critical raw materials and amending Regulations (EU) 168/2013, (EU) 2018/858, 2018/1724 and (EU) 2019/1020

(Text with EEA relevance)

{SEC(2023) 360 final} - {SWD(2023) 160 final} - {SWD(2023) 161 final} - {SWD(2023) 162 final}

EN **EN**

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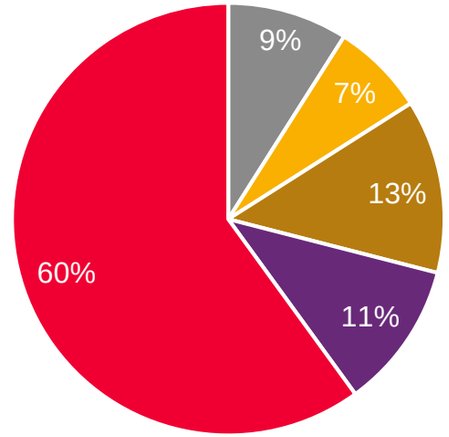
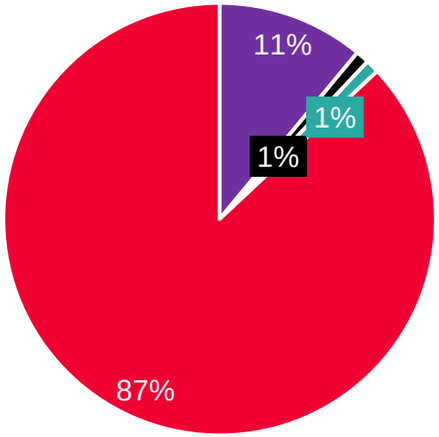
Europe needs Rare Earth Elements (REEs)
Mining and processing is lacking

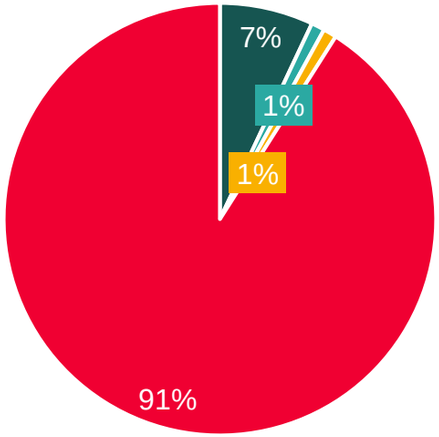
REE oxides Mining



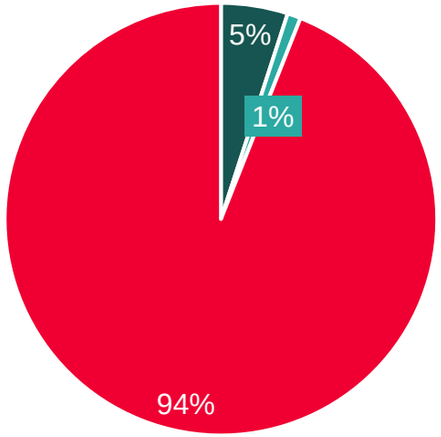
REE oxides Enrichment



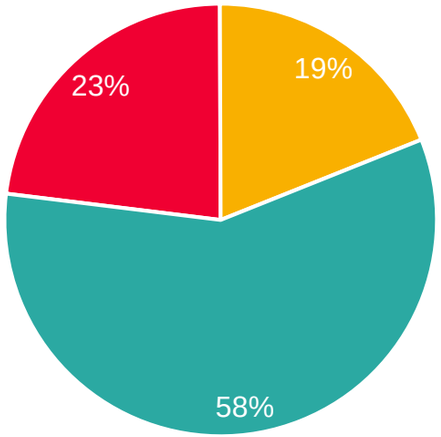
REE oxides Metals



Permanent magnets



Example: wind turbines



Source: European Raw Materials Alliance, combined data from Roskill 2018; Adamas Intelligence 2019; Peteves 2017; Carrara et at 2020; IEA 2021; USGS 2021

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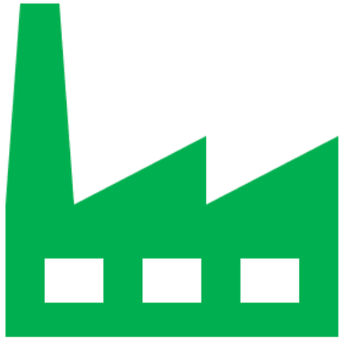
EU Benchmarks by 2030 for domestic capacities

The Act sets these benchmarks along the strategic raw materials value chain and for the diversification of the EU supplies

At least 10% of the EU's annual consumption for **extraction**

At least 40% of the EU's annual consumption for **processing,**



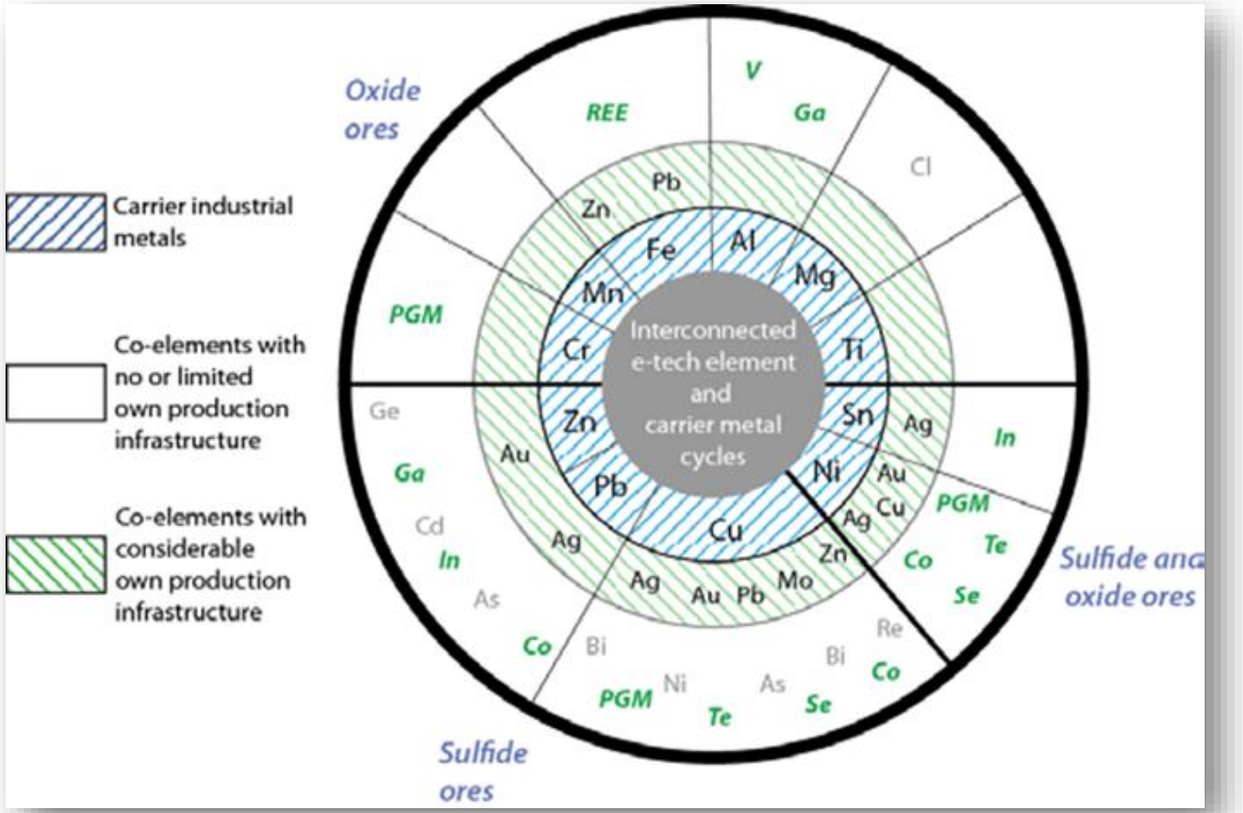
At least 15% of the EU's annual consumption for **recycling,**

Not more than 65% of the Union's annual consumption of each strategic raw material at any relevant stage of processing **from a single third country.**

Updated Critical raw materials list 2023 (34 substances) (red = strategic)

(a) Antimony
(b) Arsenic
(c) Bauxite
(d) Baryte
(e) Beryllium
(f) Bismuth
(g) Boron
(h) Cobalt
(i) Coking Coal
(j) Copper
(k) Feldspar
(l) Fluorspar
(m) Gallium
(n) Germanium
(o) Hafnium
(p) Helium
(q) Heavy Rare Earth Elements
(r) Light Rare Earth Elements
(s) Lithium
(t) Magnesium
(u) Manganese
(v) Natural Graphite
(w) Nickel – battery grade
(x) Niobium
(y) Phosphate rock
(z) Phosphorus
(aa) Platinum Group Metals
(bb) Scandium
(cc) Silicon metal
(dd) Strontium
(ee) Tantalum
(ff) Titanium metal
(gg) Tungsten
(hh) Vanadium

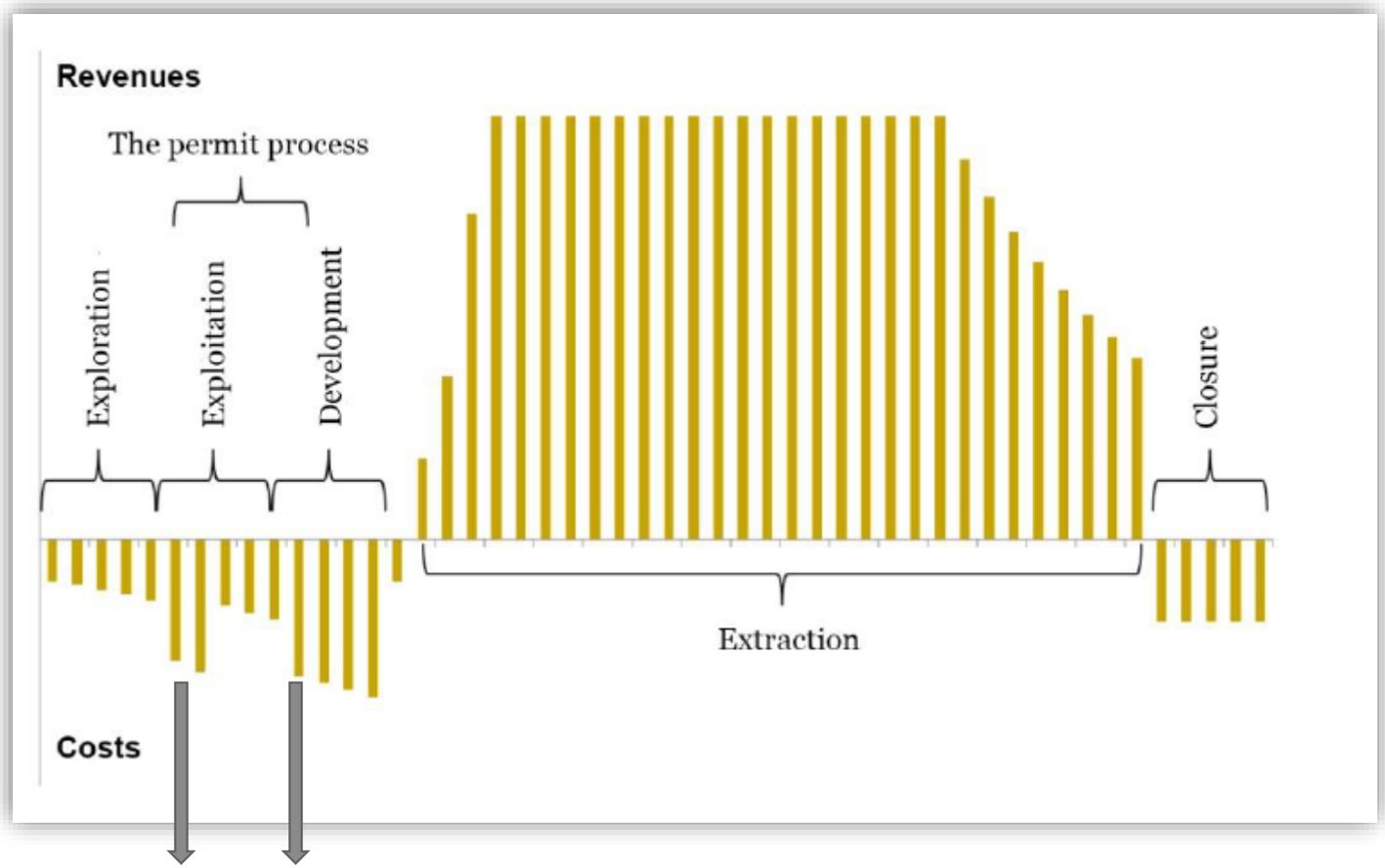
Critical Raw Materials are often by-products from mining of other materials – and not the economic driver



- CRMs are usually not the economic driver for mining and thus not the primary targets for exploration
- CRMs are often derived as by-products from ores of major or “carrier” metals in which the CRMs are present in low concentrations.

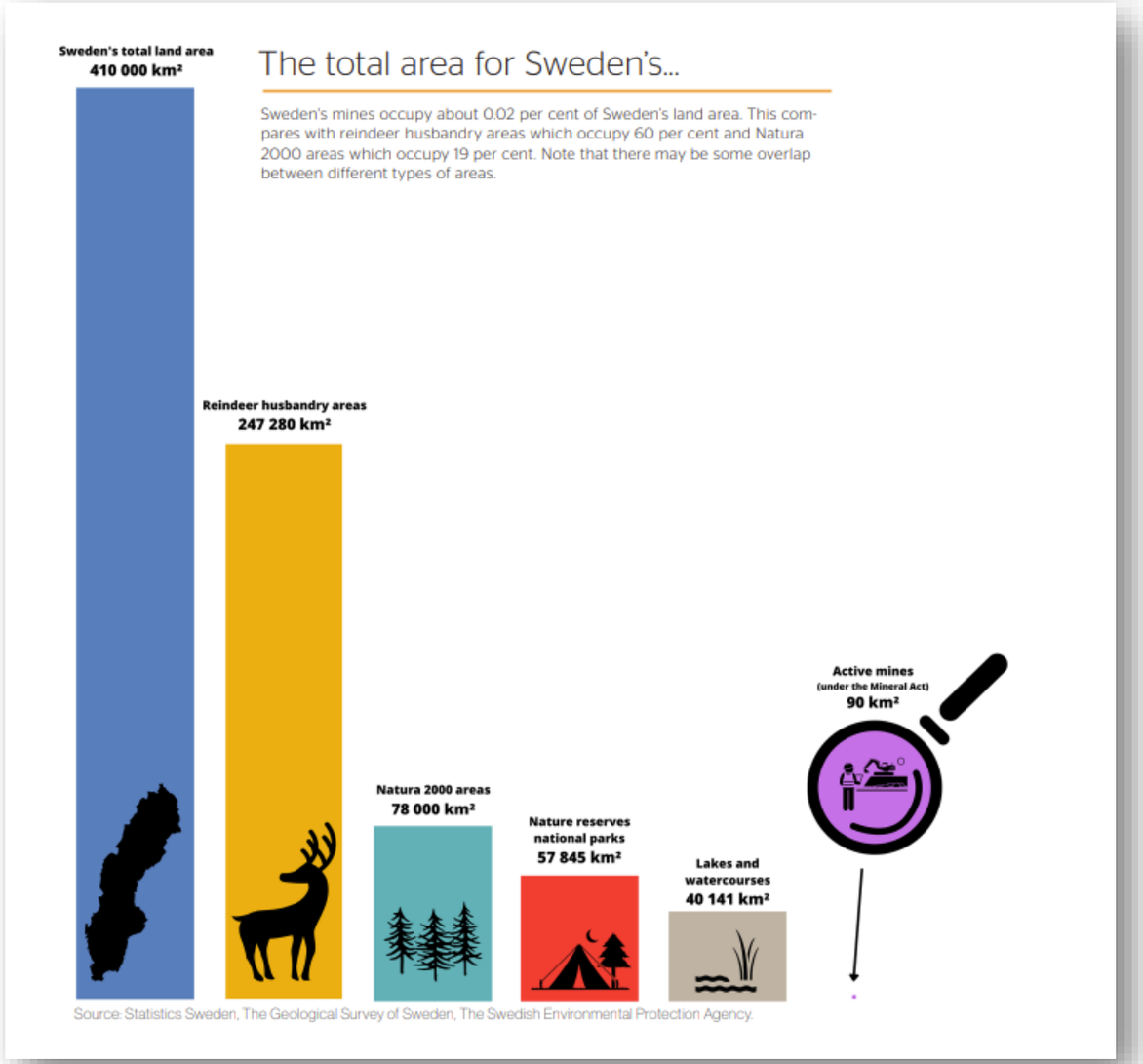
Reuter, MA et al., 2005.

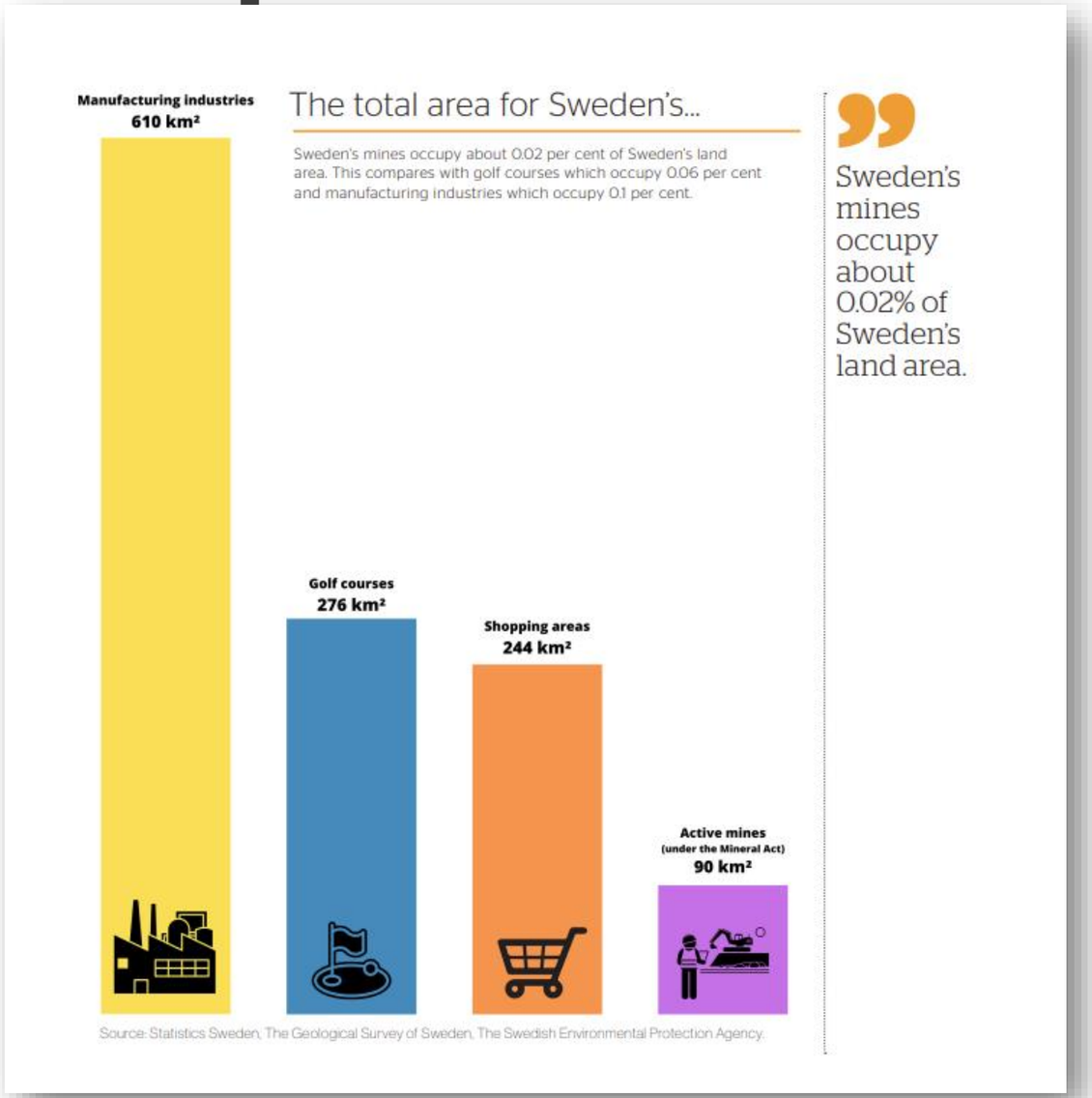
Exploration and early stage financing is key to secure raw material supply in Europe



- A lot of investments are needed for a long period of time before investments can start generating income
- Risk capital is mainly available outside EU
- De-risking early phases of the mining life cycle is key
- **Most important to attract investments: EU needs to showcase that it is possible to take projects all the way from exploration to active mine**

Surface needs for mining in comparison





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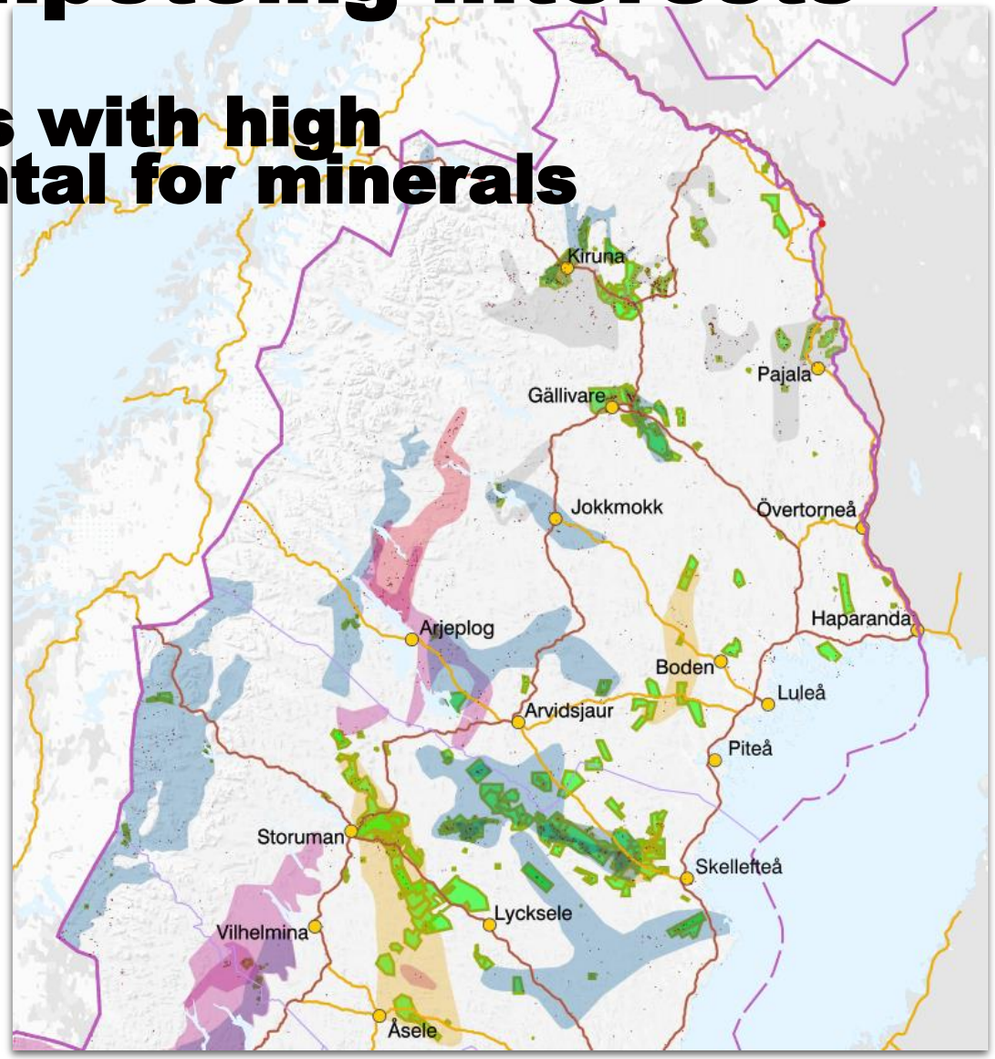
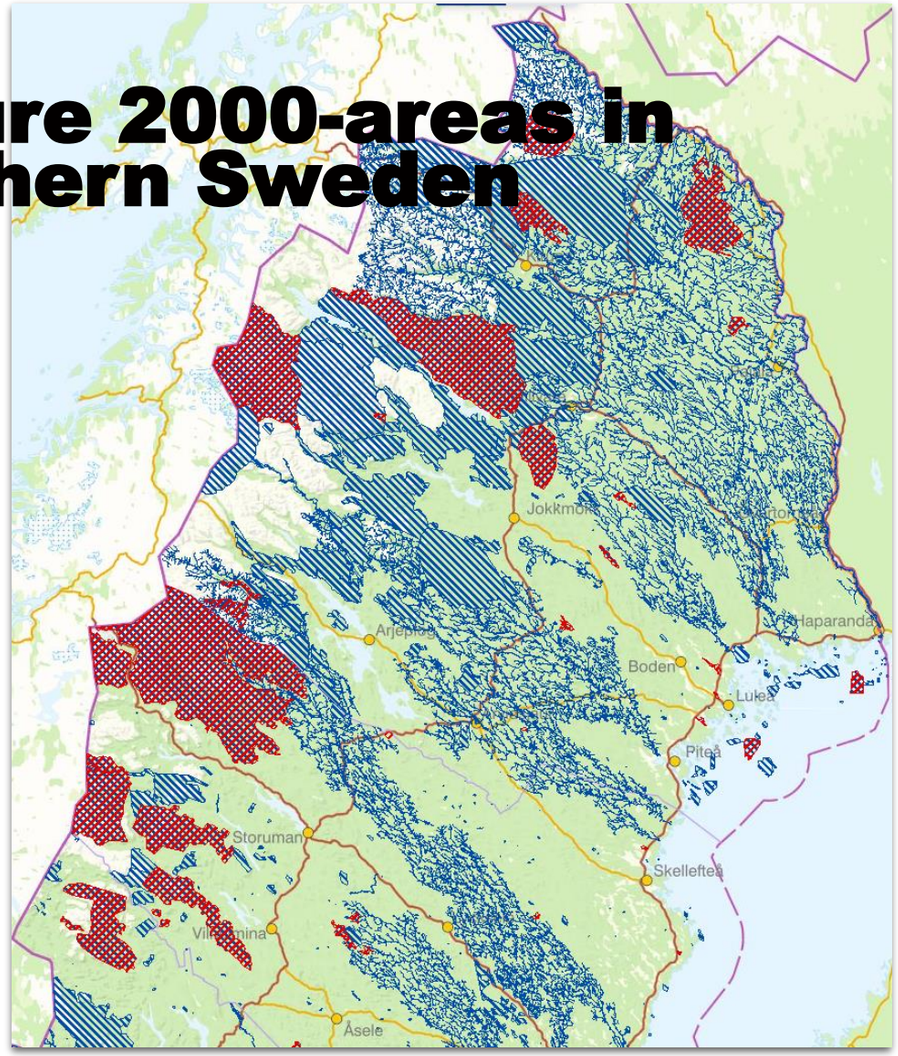
Competeing interests

Areas with high potental for minerals



Metallogenitisk karta över norra Sverige. **Huvudbälten med hög potential för mineraliseringar i grått** (järn, legeringar, REE, fosfor), blå/lila (basmetaller), **rosa (energimetaller och special metaller** inkl vanadin, REE, Molybden, fosfor) och **gult (ädelsmetaller).** Nuvarande prospekteringstillstånd och gruvkoncessioner i grönt.

Nature 2000-areas in northern Sweden



Natura 2000-områden (Fågeldirektivet i rött, art- och habitatsdirektivet I blått)

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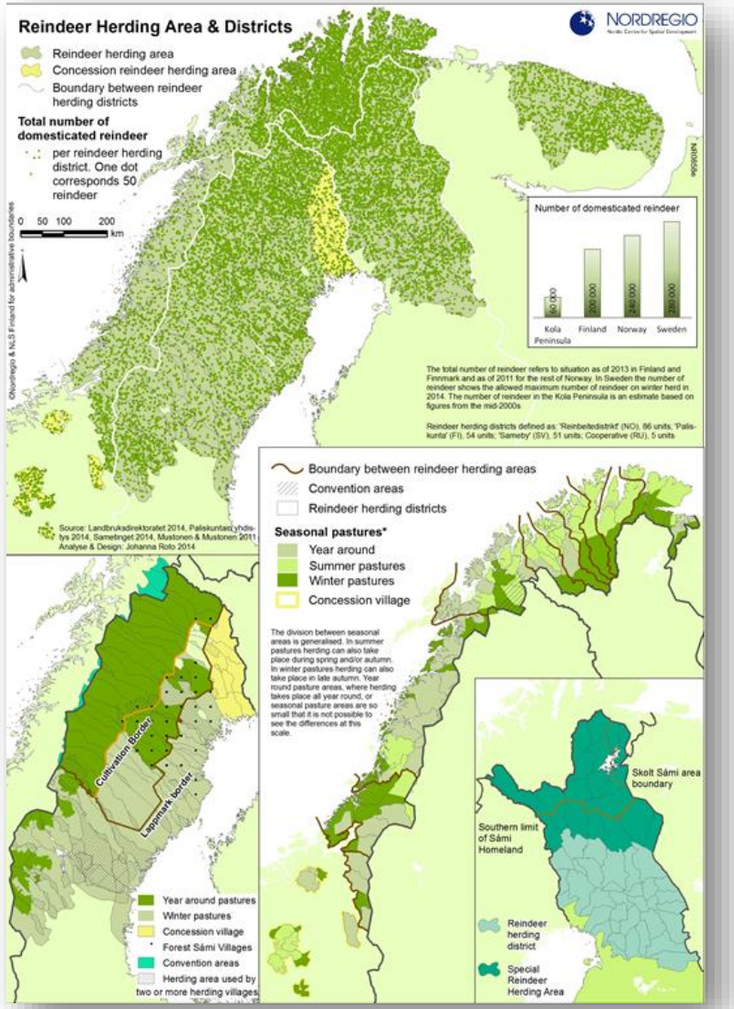
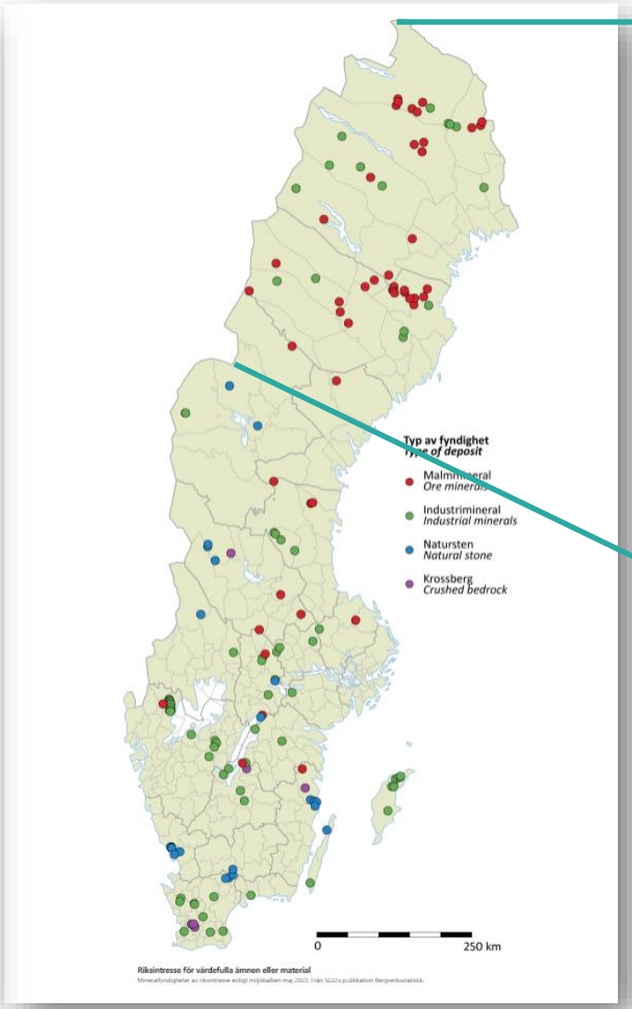
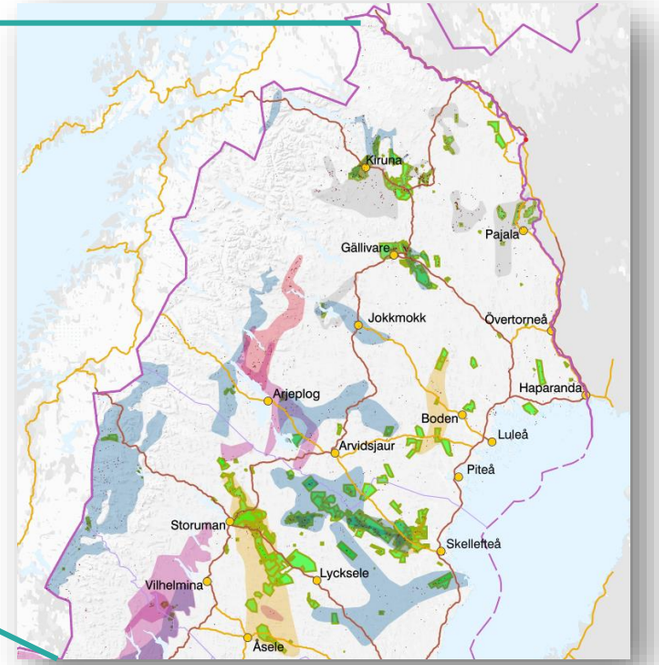
Reindeer herding area vs Mineral deposits of national interest







Source: https://nordregio.org/maps/reindeer-herding-area-in-the-nordic-countries/
https://www.sgu.se/en/mineral-resources/legislation/mineral-deposits-of-national-interest/

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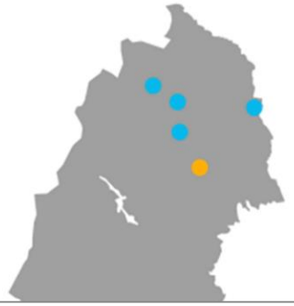
Why is Sweden a sustainable leader in mining?

Active mines in Sweden 2022



Sweden currently has twelve active mines – half of them are more than 50 years old. At the beginning of the 20th century, Sweden had around 250 active mines, yet despite the decrease in the number of mines, total production has more than doubled.

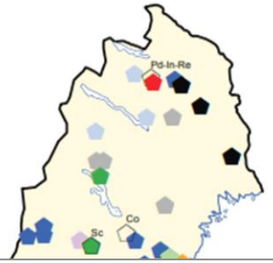
Higly productive modern and sustainable mines, with high degree of automation

Sweden's mining production 2021 in relation to the EU

Gold:	**17%**
Silver:	**19%**
Copper:	**11%**
Zinc:	**31%**
Lead:	**32%**
Iron:	**93%**
Tellurium:	**100%**

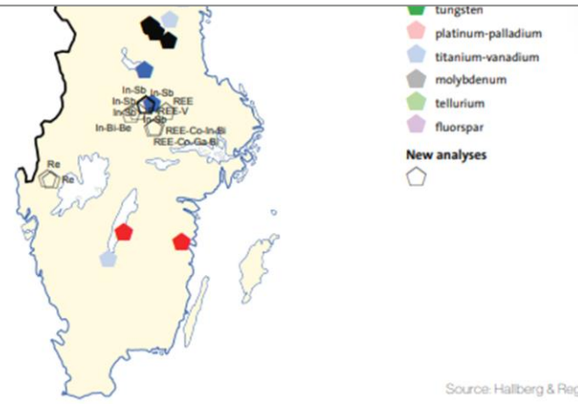
Source: SGU (2022b)

Estimated ore deposits with critical raw materials in Sweden



The map shows deposits with ore estimates that include some critical raw materials. The map also shows discoveries where new analyses or digitised older analyses have demonstrated the presence of some critical raw materials in closed mines, in mining waste or in exploration projects.

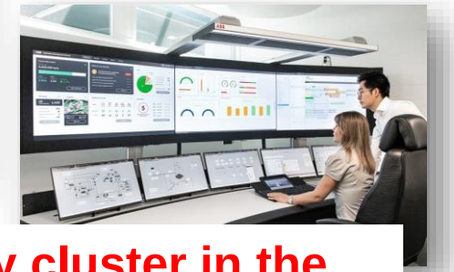
Substantial potential in the bedrock – for both basic materials and CRMs



- tungsten
- platinum-palladium
- titanium-vanadium
- molybdenum
- tellurium
- fluorspar

New analyses

Source: Hallberg & Reginiussen (2019)



Strong technology cluster in the mining sector

- **world leading in technology innovation for the mining sector**
- **partnership with the Swedish mines and academia**

Epiroc · northvolt · SANDVIK · ERICSSON · ABB · VOLVO

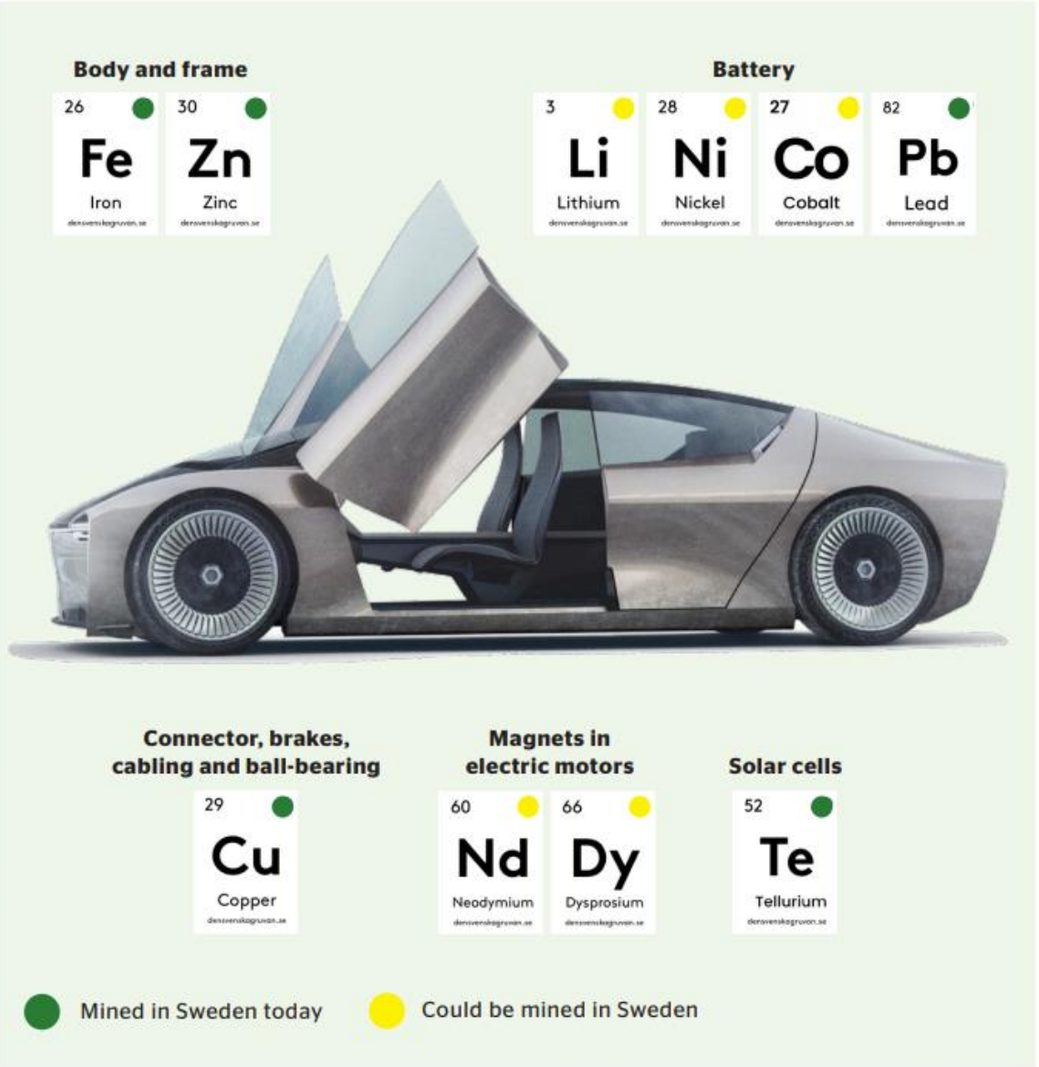
Källa: Swedish Geological Survey 2019.

SveMin

No mines
No electric cars

Most of the metals an electric car needs are found in Sweden's bedrock.

Swedish potential for metals needed in electric car



Metals and minerals in an electric car that are extracted in Sweden today or that could potentially be extracted, i.e. that deposits have been identified. Most of the metals an electric car needs are found in Sweden's bedrock. Aluminium is also crucial, but there are no known deposits in Sweden.

Source: Den Svenska Gruvan

Final words

- We are entering the *era of raw materials*
- Good mineralization's are rare and hard to find – to control the resources gives power
- Balancing of interests is key in permitting processes – do we need to put more weight on raw materials?
- Europe is underexplored and needs to attract more investments into exploration - to strengthen self sufficiency
- The best security of supply is active mines and connected value chains