MINERAL AND METAL DEMAND

The potential of the Swedish bedrock

Professor Christina Wanhainen



MINERAL AND METAL DEMAND

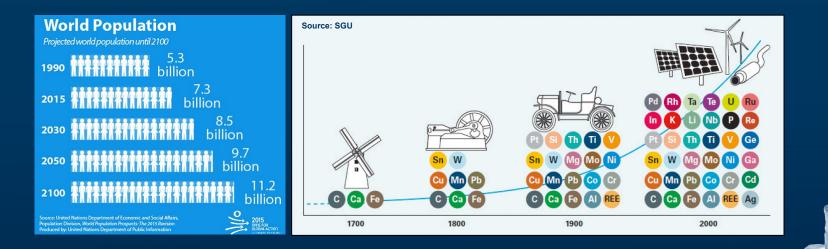
The potential of the Swedish bedrock

Demand for minerals and metals Sweden as mining nation today The potential of the Swedish bedrock

Professor Christina Wanhainen



Demand for minerals and metals





A DE



1		Source: SGU									> 50 %								
	Li																F	Ne	
	Na		1 - 10 %												Cl	Ar			
	К	Ca															Br	Kr	
	Rb																	Xe	
	Cs																At	Rn	
	Fr	Ra		Rf					Mt		Rg		UUt						
	* Lan		ia:															Lu	
	** Aktiniderna:			Ac		Pa		Np			Cm	Bk	Cf	Es	Fm	Md	No	Lr	

Elektroniken









---De flesta telefon

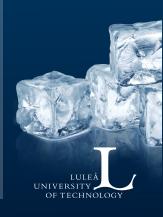
Skärm

- Hölje

PERIODIC TABLE OF MOBILE PHONE ELEMENTS







Recycling – critical metals, how??

Elektroniken

Tb Gd

Ni

Sn

Koppar används för ledningar och i kretskorten,

viktigaste komponenten i mikrokondensatorer.

Nickel används i mikrofonen. Legeringar som

Ren kisel används för att tillverka telefonens chip. Det oxideras för att producera icke ledande områden. Sedan tillsätts andra element för att göra chipet elektriskt ledande.

De flesta telefoner innehåller litiumjonbatterier.

De har en positiv elektrod gjord av litiumkoboltoxid och en negativ elektrod gjord av grafit. Batterihöljet är oftast av aluminium.

innehåller praseodym, gadolinium och neodym

används i magneterna i högtalaren och mikrofonen.

Neodym, terbium och dysprosium används för att få

tillsammans med guld och silver. Tantal är den

din telefon att vibrera.

Tenn och bly används för att löda

elektroniken. Nyare blyfria lod innehåller en blandning

av tenn, koppar och

🕕 🙆 Batteri

Skärm

Sn

Y La

Gd

Hölje

minska elektromagnetiskt brus.

Ni

Br

Indiumtennoxid används i den tunna

gör skärmen till en pekskärm.

för att få ett starkare glas.

transparenta och elektriskt ledande film som

Glaset består ofta av ett aluminiumsilikatglas

där man bytt ut natriumjoner mot kaliumjoner

jordartsmetaller i små mängder.

behövs ett flertal sällsynta

Höljet består ofta av magnesiumlegeringar. Andra telefoner har plast- eller glashöljen. I plasthöljen ingår ofta brom som flamskyddsmedel. Nickel kan användas för att

G

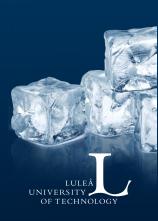
För att kunna återge färger på skärmen

-7	V 307	di la																
1	н	Sou	irce:	SGU						> 50 %								
	- Li	Be									10 - 25	%		с	N	0	F	Ne
										1.	10 %							
	Na	Mg									1%		Al	Si	Ρ	S	CI	Ar
	к	Ca	Sc				Mn	Fe	Со	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
	Rb				Nb	Мо	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Те	T	Xe
	Cs	Ba	٠	Hf		w	Re	Os	Ir	Pt	Au	Hg		Pb		Ро	At	Rn
	Fr	Ra	**	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	UUB	UUt	UUq	UUp	UUh	UUs	UUo
	* Lantaniderna:				Ce	Pr	Nd	Pm	Sm	Eu	Gd	ть	Dy	Но		Tm	Yb	Lu
	** Aktiniderna:			Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

PERIODIC TABLE OF MOBILE PHONE ELEMENTS





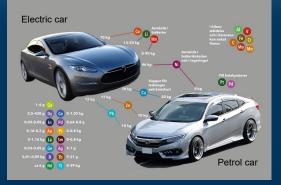


CODE=



Recycling – base metals in infrastructure, when??







Needed for modern solar panels: Al, C, Cu, Ga, In, Fe, Pb, Te, Ti..... World production of dysprosium is 1350 tonnes/year



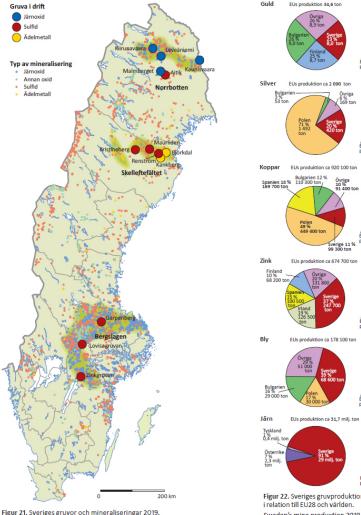
Needed to get 1 megawatt from a windmill: 132 t of steel 370 kg Al 10 t Cu 111 kg Ni 6,7 t Pb 124 kg Nd (neodymium) 22 kg Dy (dysprosium) Metals and minerals are natural resources that are indispensable for the sustainable development of our society.

Fossil-free energy requires more metals than fossil-produced energy

So, demand increases and while recycling will play an important role in meeting demand, primary production will still be needed. A sustainable development requires *a combination of*:

Less consumption Improved recycling (by improved product design) Improved extraction techniques Exploration for new resourcesand more





Source: SGU

Sweden's mines and mineralizations 2019.

produktionen: 1.4 % Figur 22. Sveriges gruvproduktion år 2019 i relation till EU28 och världen. Sweden's mine production 2019 in relation to EU28 and the world.

Världsproduktion

EUs andel av världs-produktionen: 1 %

Världsproduktion

25 500 ton

EUs andel av världs produktionen: 8.2 %

Världsproduktion ca 20.4 mili, ton

Us andel av värld

Världsproduktion ca 12,9 milj. ton

EUs andel av världs produktionen: 5.2 %

> Världsproduktion ca 4,7 milj. ton

Us andel av världs produktionen: 3.8 %

Världsproduktion ca 2 325 mili, ton

EUs andel av värld

Igarien 12 %

449 400 ton

Övriga

Sverige 11 % 99 300 ton

3 186 ton

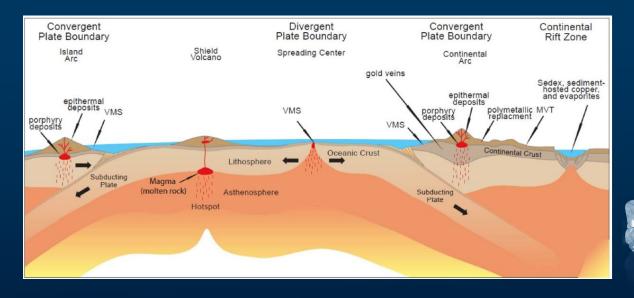
Mine production in Sweden

- EU produces c. 3% and consumes more than 20% of the yearly, global metal production
- A continous addition of metals is required, but few giant deposits discovered lately, and no new mines have opened in Sweden in 12 years
- Good potential to find more metals in Sweden, how can we claim that?



In ore geology we study the processes that concentrate metals and minerals in the crust.

Most ore deposits are related to specific geological environments, where the most productive are mantle plumes, continental rift zones and continental arcs.



Source: SGU

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C Debies

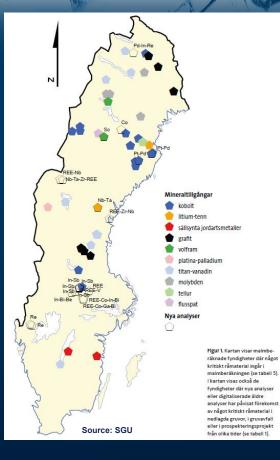
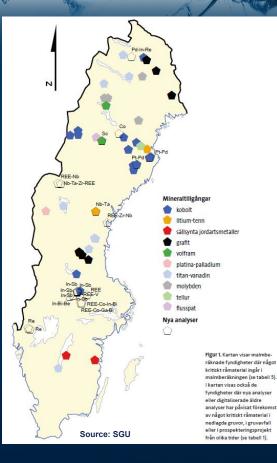


CHART A

What do we know?



CONDES.





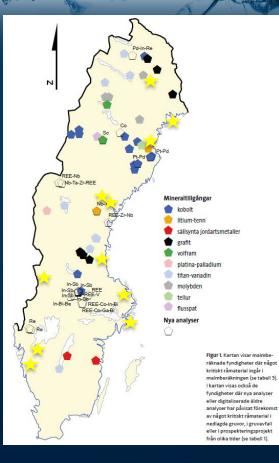
Supply of lithium comes from two main sources: brines and pegmatites

Lithium-rich pegmatites are quite rare and make up only about 0.1% of all known pegmatite occurrences.

Formed from S-type magmas generated by melting of metasedimentary rocks in the crust.

Occur in crustal domains including significant amounts of metasedimentary rocks affected by metamorphism



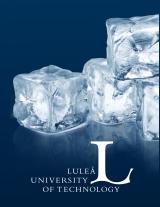


What else do we know?

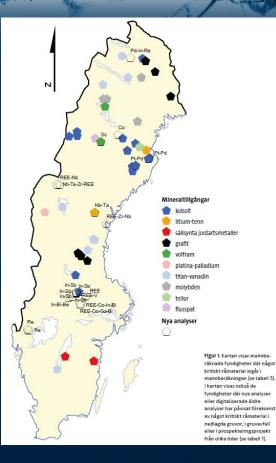
Many lithium-pegmatites have been documented in Sweden, mostly due to coincidences during early mapping and exploration activities.

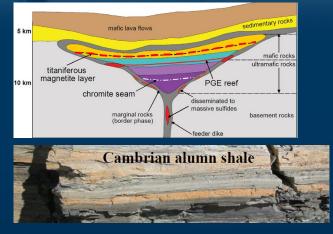
 \star Li occurrences in Sweden compiled by O. Martinsson, LTU

The unknown/undiscovered (4% exposure!)



Vanadium



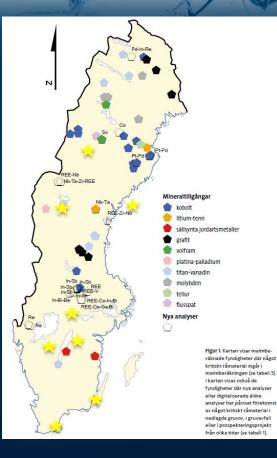


Supply of vanadium comes from four main sources, two relevant for the Swedish bedrock:

Vanadiferous titanomagnetite (Fe-Ti-V) in layered intrusions (e.g. Smålands Taberg)

Shale-hosted vanadium deposits (Deposited in anoxic basins with accumulation of organic matter and absorbing metals from the sea water) e.g. Viken





What else do we know?

Again, most occurrences documented due to coincidences during early mapping and exploration activities.

★ V occurrences in Sweden compiled by O. Martinsson, LTU

There is a clear need to develop capacity in geological mapping!



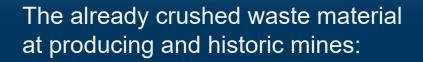




Aitik mine

Historic mines



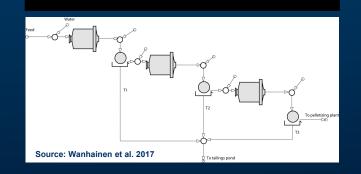


REE Vanadium Cobalt Antimony Baryte Bismuth Germanium Indium Phosphorous Tungsten Rhenium Titanium and more



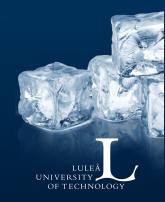
NUD -

Kilometer- to nano-scale studies



To see if a metal is recoverable To optimize the metal extraction process To better utilize ores and tailings

C Seller



To understand how and where ores are formed To minimize environmental impact in exploration To find new (and deep) ores

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