Norge Mineraler AS

ENERGISKIFTET

GRØNNE FORRETNINGSMULIGHETER

CLARION HOTEL AIR - SOLA

Mars 2023

Bilde: Gloppedasura, Vlad Kiselov, unsplash.com


McDonald's
BILLIONS AND BILLIONS SERVED

KRITISKE RÅMATERIALER EU LISTE 2020

Norge Mineraler AS

- Kritiske råmaterialer er materialer som er økonomisk viktige og hvor det er risiko forbundet med tilgangen.
- Det handler om sikkerhet og geopolitikk
- EU`s fagorganer EIT – ERMA;
  - Mineralene i Bjerkreim forekomsten kan også brukes i framstilling av Fosfat og Titanmetall foruten Vanadium og Fosfatstein
  - Dvs. 4 råmaterialer på EU`s liste

2020 critical raw materials (new as compared to 2017 in bold)		
Antimony	Hafnium	Phosphorus
Baryte	Heavy Rare Earth Elements	Scandium
Beryllium	Light Rare Earth Elements	Silicon metal
Bismuth	Indium	Tantalum
Borate	Magnesium	Tungsten
Cobalt	Natural graphite	Vanadium
Coking coal	Natural rubber	**Bauxite**
Fluorspar	Niobium	**Lithium**
Gallium	Platinum Group Metals	**Titanium**
Germanium	Phosphate rock	**Strontium**

Kilde: https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical_en

FOSFOR

- Mineral-apatitt
- Ett av tre makro næringstoff – N ***P*** K
- I kunstgjødsel – plantenæring - i fôrmidler
- I en lang rekke kjemier og kjemiske produkter
- I batterier – ulike teknologier

Kilde; uio.no

Tesla is already using cobalt-free LFP batteries in half of its new cars produced

Fred Lambert - Apr. 22nd 2022 2:57 am PT @FredericLambert

Kilde: Tesla.com

Foto, Bioforsk, Stjørdal

GEOLOGICAL MAP OF THE ROGALAND ANORTHOSITE PROVINCE

Scale 1 : 75 000

Mogens Marker, Henrik Schiellerup, Gurli B. Meyer, Brian Robins and Olivier Bolle

NGU
Norges geologiske undersøkelse

LEGEND

EGERSUND DYKE SWARM

Dolerite

JOTUNITIC TO CHARNOCKITIC INTRUSIONS

Jotunitic to mangeritic dyke with local noritic or quartz-mangeritic facies, or jotunite intrusion (Ela-Reke fjord intrusion)

Charnockite

Quartz mangerite with minor mangerite and charnockite

Mangerite

THE BJERKREIM-SOKNDAL LAYERED INTRUSION - LAYERED SERIES*

Anorthositic and leuconoritic rocks

Leuconorite and troctolite (ipinC). Zone IIb, IIb & IVb.
Leuconorite and anorthosite (pC and piC), norite (phiC), minor ilmenite pyroxenite (hiC) and ilmenite-rich cumulates (ihC). Melanocrite and olivine melanocrite (hpim +/- oCi between Teksevatnet and Blåtjødnet. Zone IIIa and IVa

Leuconorite and anorthosite (pC and piC)
Zone IAa and IBa

Ilmenite-magnetite leuconorite and anorthosite (pimC)

Banded gneiss. Dominant phases of grey granitic gneiss with sporadic amphibolitic (noritic) and metasedimentary (calc-silicate, quartzitel bands, well-developed planar structure (high strain) and variable content of light grey granitic bands

STRUCTURES

Fault

Strike and dip of foliation/modal layering

Strike and dip of mineral lamination

* The Bjerkreim-Sokndal Layered Intrusion has been divided into cyclic units (0, IA, IB, II, III, IV), each consisting of a number of cumulate zones (a-f) defined by index mineralogies (Wilson et al., 1996). The rock terminology follows standard cumulate nomenclature:

p: plagioclase
c: olivine
m: magnetite

h: Cpx or pyroxene
i: inverted pigeonite
a: apatite

o: Cpx-rich cumulate
i: ilmenite
C: cumulate

0 5 10
Kilometres

NGU Special Publication 9 - Marker et al. - Plate 1

Layout responsibility: Torbjørn Sørdal

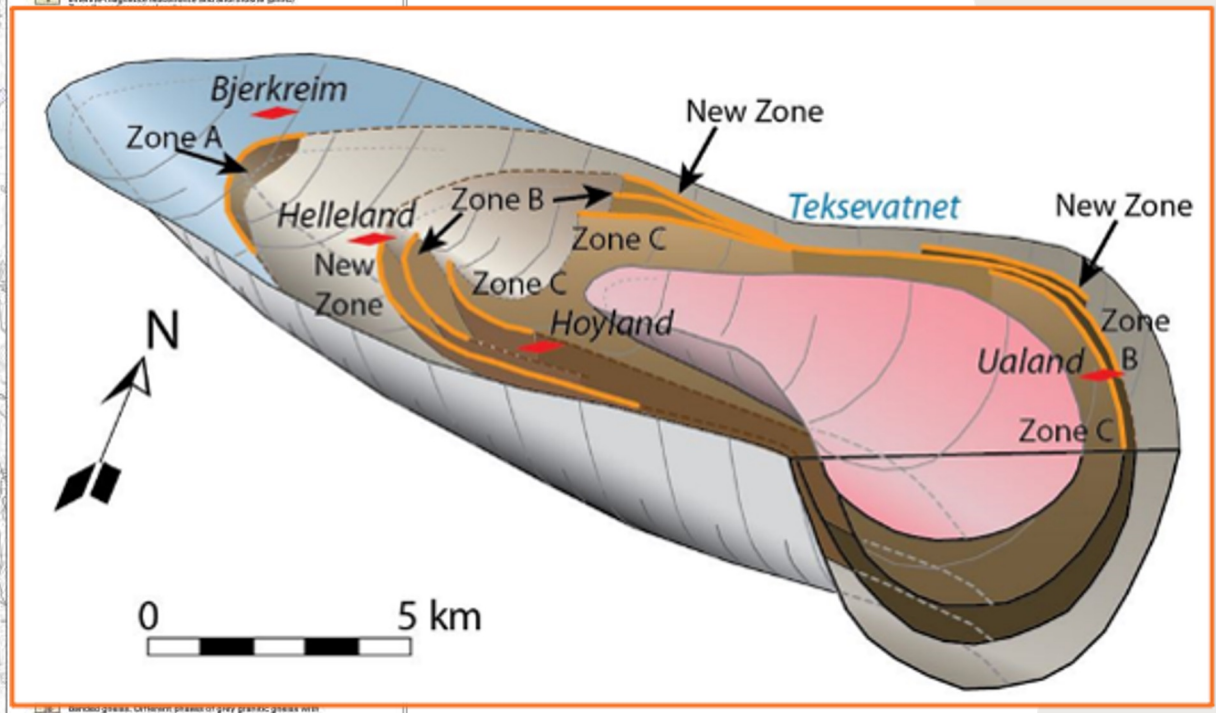
Kartgrunnlag: Statens Kartverk Database N250

NORTH SEA

ROGALAND
VEST-AGDER
AUST-AGDER

U-Pb isotopic ages

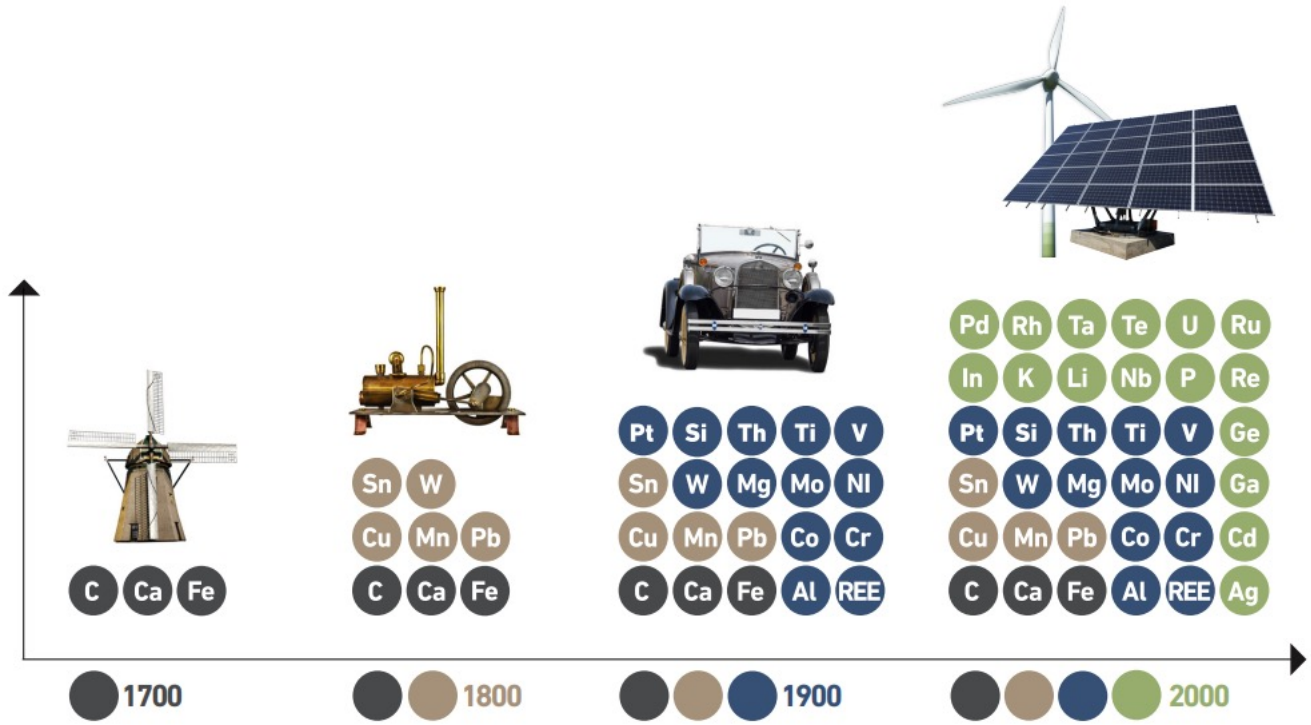
Norge Mineraler AS



DET MESTE KOMMER FRA EN GRUVE

Norge Mineraler AS

Sirkulær økonomi utvikling– 100 % gjennvinning
- Ikke realistisk på mange tiår for viktige materialer



Kilde: NGU brosjyre, Mineraler for det grønne skifte, tema 1 2019

Global industrialisering har i alle år blitt fulgt av økende behov for både mengder og typer av råvarer. Den høyteknologiske revolusjonen og det grønne skiftet har medført et behov for å bruke en stadig større del av det periodiske systemet – her eksemplifisert ved behovet for grunnstoffer i kjerneteknologier gjennom de siste tre hundre år. Figur basert på [1]. Figuren modifisert etter Volker, Z.,Simons, J., Reiler., Ashfield, M., Rennie, C. (BP), 2014, "Materials critical to the energy industry - An introduction".

Metaller och mineral i en elbil*

Metall/mineral	Antal kg
Järn	934
Koppar	53
Magnesium	24
Zink	0,1
Grafit	66
Kobolt	13
Sällsynta jordartsmetaller	0,5
Nickel	40
Litium	9
Annat	0,3
Aluminium	404

* Källa IEA förutom järn som kommer från Volvo Car Group, Annual Report 2020

Kilde; Svemin.se

Norge Mineraler AS

VANADIUM

- Mineral - vanadiumbærende magnetitt
- Egenskaper og styrke i stål legeringer
- Økte krav til styrke i armeringslegeringer, bl.a. i Kina
- Stasjonære strømningsbatterier- energilagringsanlegg med «hurtig avtapping og påfylling». Lokal kraftutjevning/balansering
- F.eks. Trondheimsbaserte Bryte batteries. Pilot hos R. Kjeldsberg

Flow Batteries

Vanadium Redox Flow Batteries(VRFB) are one of the most sustainable solutions for stationary energy storage. They provide a long operational lifetime, negligible degradation and self-discharge, and low levelized cost of storage(LCOS).

Kilde; www.brytebatteries.com

TITAN

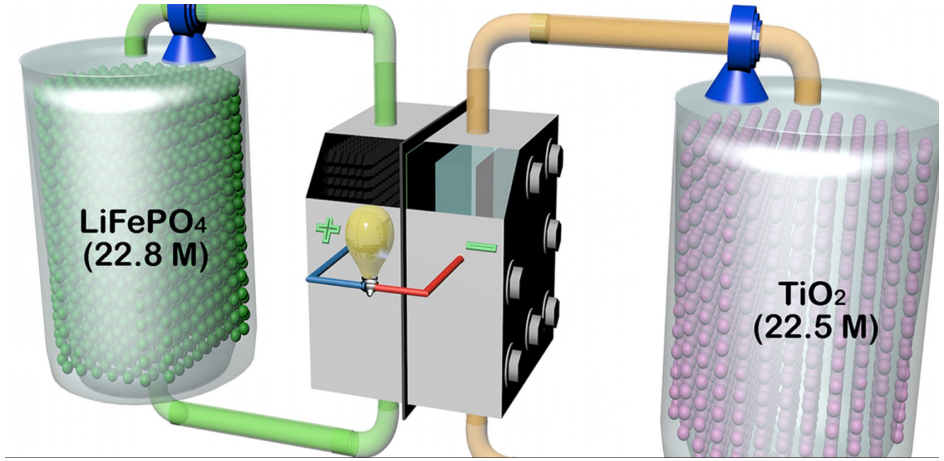
Norge Mineraler AS

- Mineral, Ilmenitt-FeTiO3
- Videreforedles/konsentreres ofte til TiO2 titaniumdioksid , pigment
- Maling, tannkrem + komponent i mange andre produkter/formål
- Kan være aktuell i batteriteknologier for kjøretøy, maskiner og for stasjonære strømningsbatterier

Foto; Jotun

Foto; Colgate

Kilde: Titoech.no



Kilde: Science.org

Norge Mineraler AS

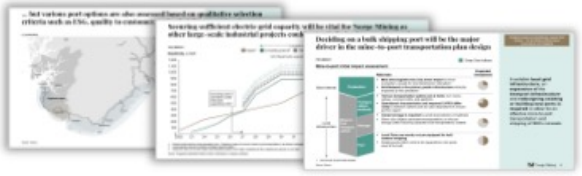
Norge Mining could contribute ~185 mn EUR per annum to Norwegian GDP and support ~1,200 jobs each year

10 Mtpa scenario

		Direct impacts	Supply chain impacts	Multiplier impacts
		I Direct	II Indirect	III Induced
Description		**Direct contribution** of the mining project to GDP and jobs (i.e., from Norge Mining and direct subcontractors)	Indirect **contribution** to GDP and jobs **from suppliers to traditional mining providers** as well as suppliers of suppliers, etc. Tier 1 suppliers include fuel companies and machine manufacturers, accounting firms, etc.	Contribution of **spending of direct and indirect employees** on food, beverages, recreation, clothing, housing and other consumer goods and services
Long-term impact[1]:				
Local	 Rogaland	GDP **40mn** EUR **350** jobs	GDP **65mn** EUR **330** jobs	GDP **17.5mn** EUR **130** jobs
National	 Norway	GDP **50mn** EUR **430** jobs	GDP **100mn** EUR **500** jobs	GDP **35mn** EUR **250** jobs
Trans-national	 Europe	GDP **33bn** EUR and **80k** jobs that are threatened by supply chain disruptions are potentially supported through Norge Mining		no impact assessment available

Norge Mineraler AS

A 10Mtpa scenario could create ~185mn EUR GDP p.a., across Norway while strengthening local communities and Norway's international significance

	Scale			
Dimension	**Regional/ Local**	**National**	**Transnational**	**Content**
Socio-economic development	~125mn EUR GDP impact for Rogaland, ~800 jobs supported[1]	~185mn EUR GDP impact, ~1.2k jobs supported[1]	Up to 33bn EUR revenues and 80k jobs at risk of supply disruption protected[2]	
Net-zero transition	Potential CO_2 emission reduction of up to 0.9Mt p.a. through green mining and processing, and of up to 0.5Mt p.a. through shorter downstream delivery[2]			
Demographic renewal	Eigersund population to grow by 7%, workforce by 4%, and share of retirees in population reaches 20%			
Infrastructure improvement	Significant investments required to develop transportation and expand port capacity			

1. Annual run-rate impact (excluding initial capex impact) for 10Mtpa scenario
2. For full extraction (150Mtpa) scenario

Bjerkreim fossen, Callum Stewart, unsplash.com