Minerals for a sustainable future

NORDIC MINING

OAX: NOM

How Scandinavian topography offers an innovative approach to mining and tailings disposal

Mines and Technology, London, November 2018

Ivar S. Fossum, CEO

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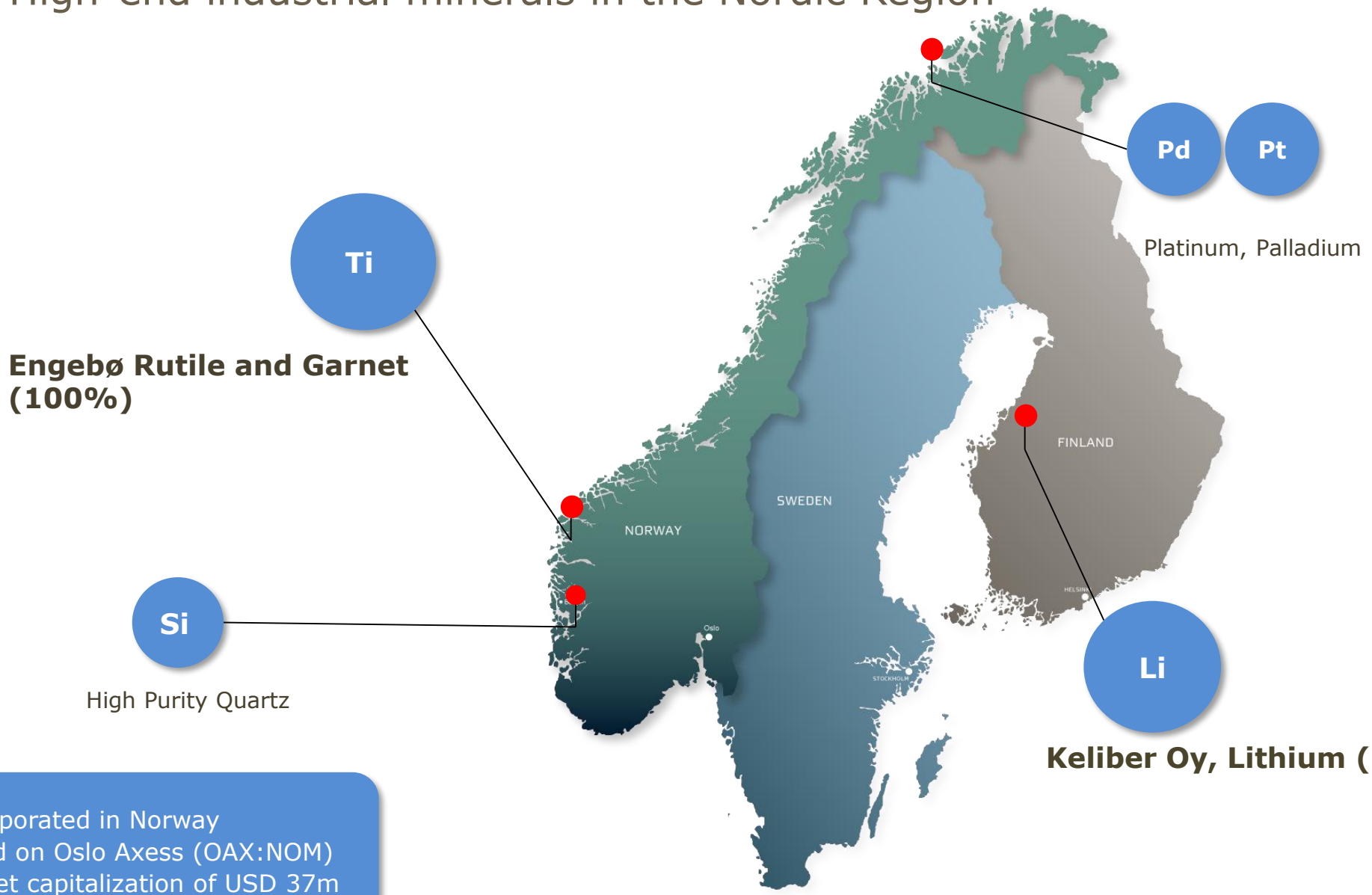
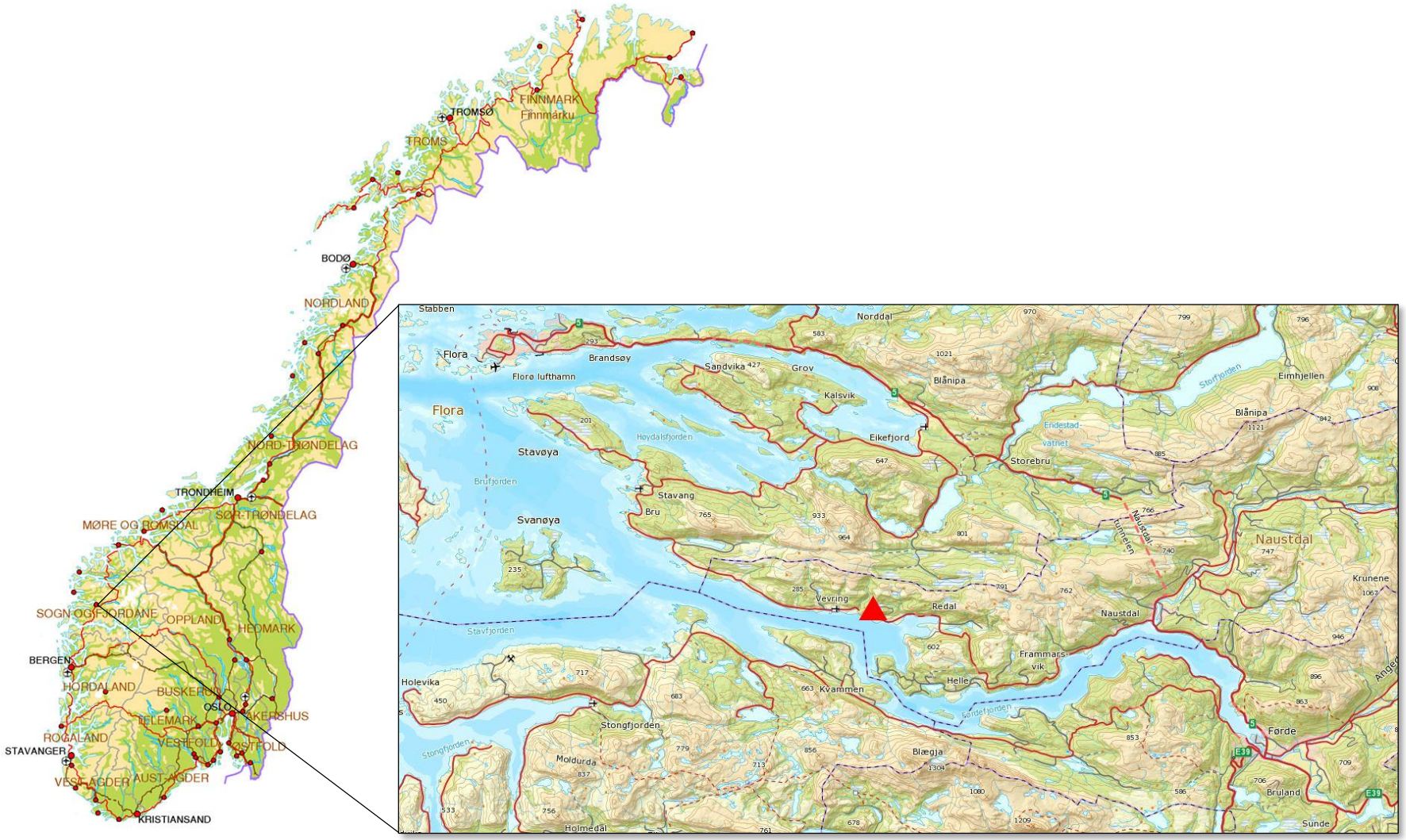
Focus: High-end industrial minerals in the Nordic Region



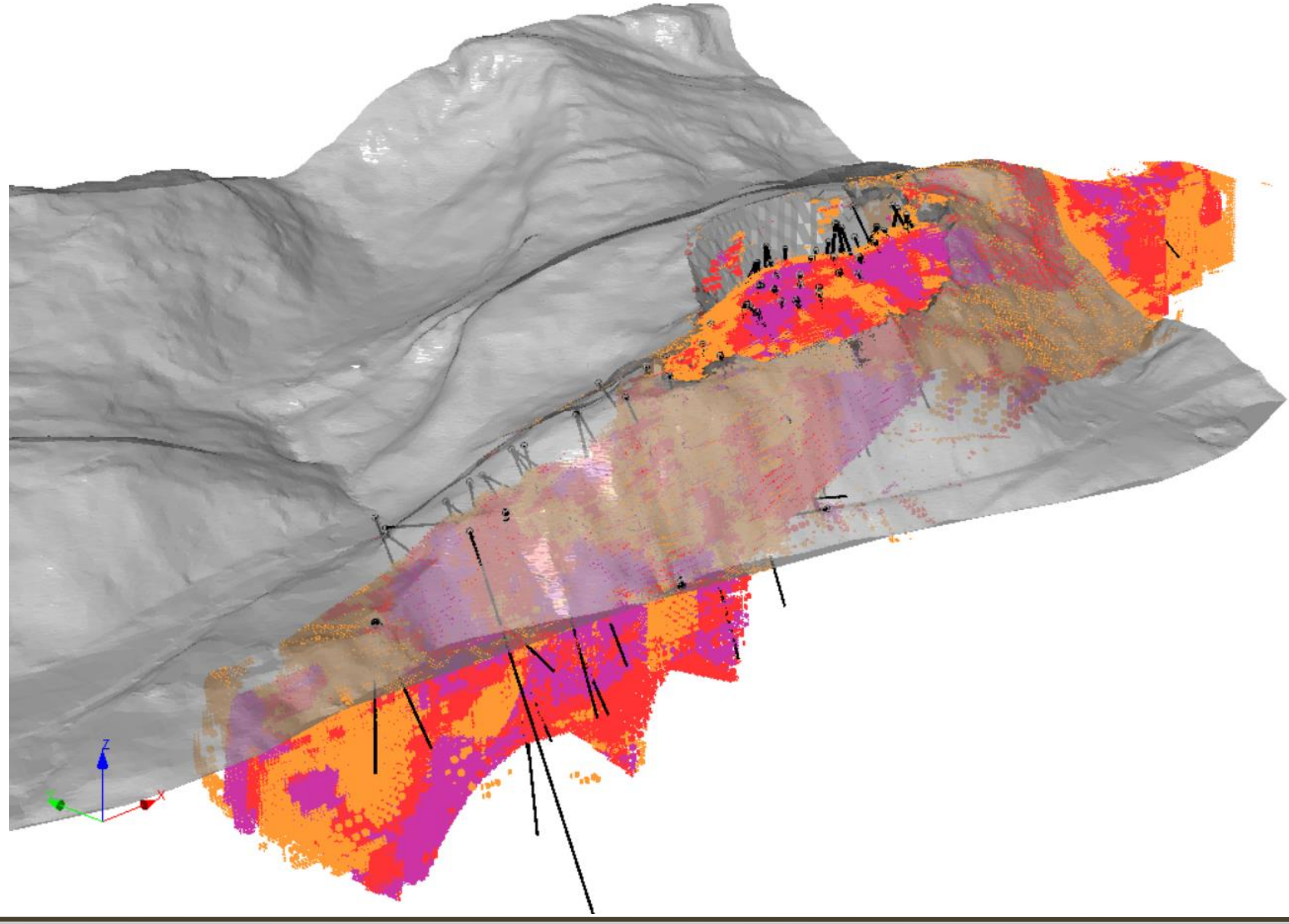
- Incorporated in Norway
- Listed on Oslo Axess (OAX:NOM)
- Market capitalization of USD 37m

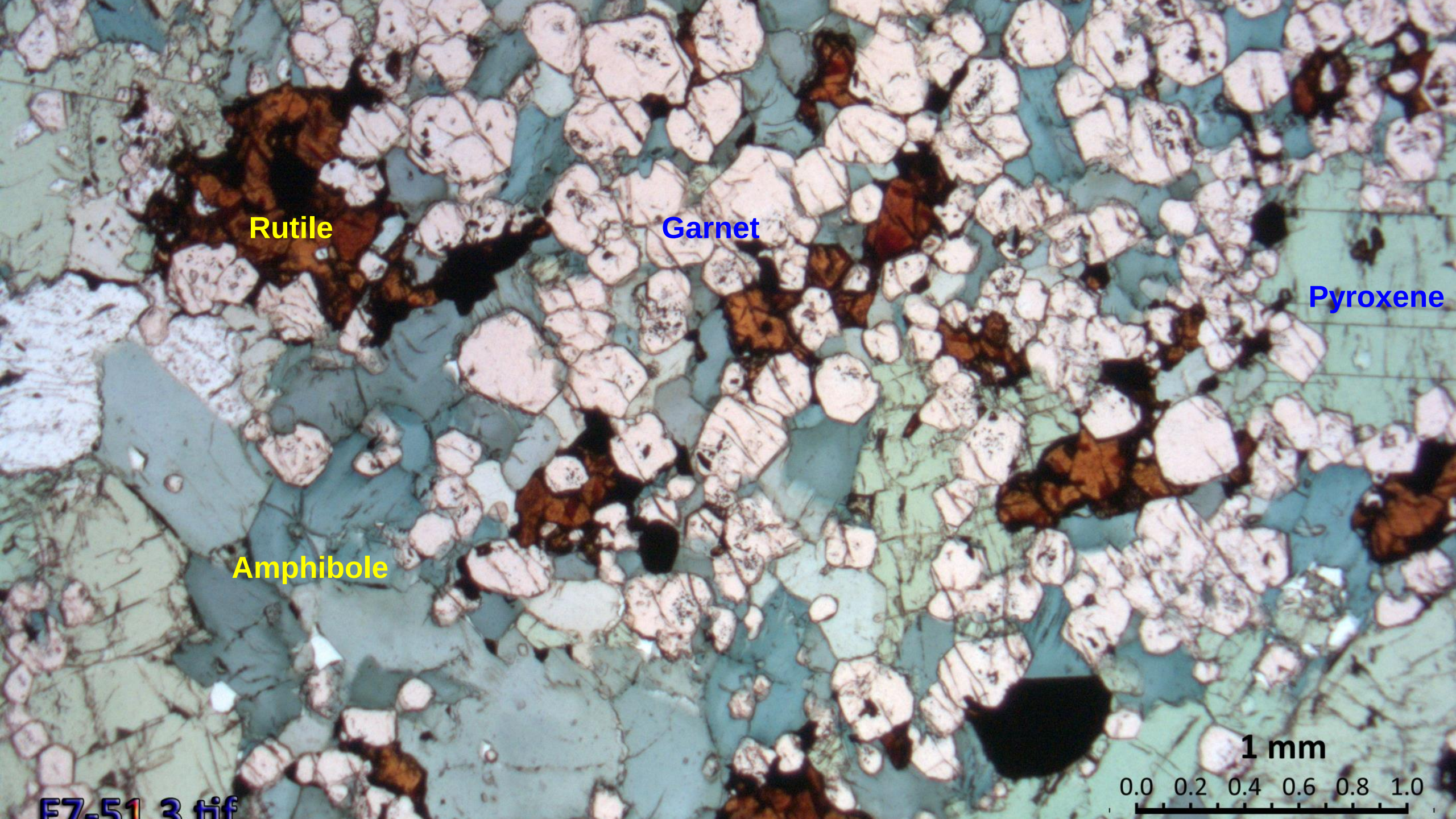
Engebø Rutile and Garnet



Location: west coast of Norway close to the North Sea

Engebø, a world class rutile and garnet deposit




Rutile
Garnet
Pyroxene
Amphibole
1 mm
0.0 0.2 0.4 0.6 0.8 1.0
EZ-51 3.tif

High grade rutile and garnet mineralisations

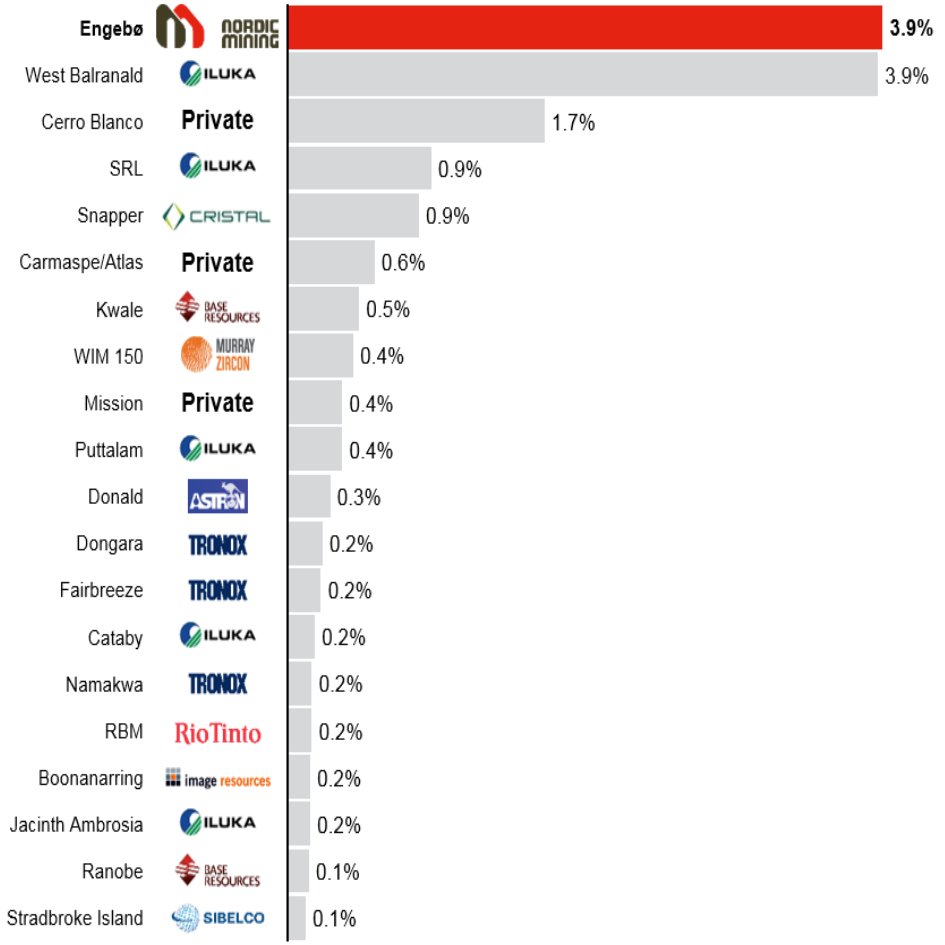
Mineral resource and reserve classifications*

	3% cut-off grade		
	Tonnage Mt	TiO_2 %	Garnet %
Measured	15	3.97%	44.6%
Indicated	78	3.87%	43.6%
Measured & indicated	**93**	**3.89%**	**43.7%**
Inferred	138	3.86%	43.5%

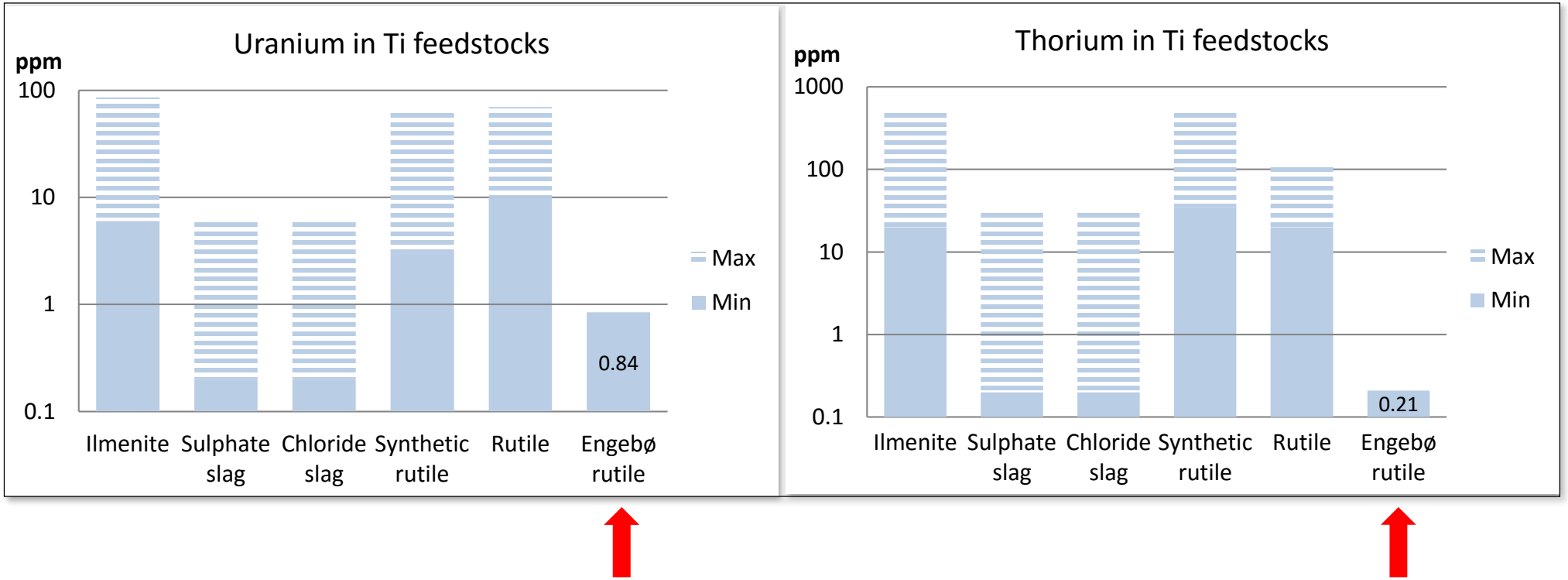
	Ore reserves		
	Tonnage Mt	TiO_2 %	Garnet %
Proven	10.194	3.81%	43.4%
Probable	31.702	3.35%	39.5%

* Resource estimates and reserve statement completed by Competent Person Adam Wheeler, corresponding to the guidelines of the JORC Code (2012 edition).

Among the highest rutile grades



Low radioactive impurities vs other titanium feedstocks



Source: Company websites, "Production of titanium dioxide" (2007) by Fahli and Martin-Matarranza, IFE, Norway

Rutile and Garnet - unique mineral properties

Rutile (TiO_2)

Current world production: ~ 0.8 million tonnes

PIGMENT

WELDING RODS

TITANIUM

Tests have demonstrated that Engebø can produce 95% TiO_2 rutile suitable for pigment and titanium production

Garnet

Current world production: ~ 1.4 million tonnes

WATERJET CUTTING

SAND BLASTING

ABRASIVES

Tests have demonstrated that Engebø can produce coarse and fine garnet suitable for a broad range of applications

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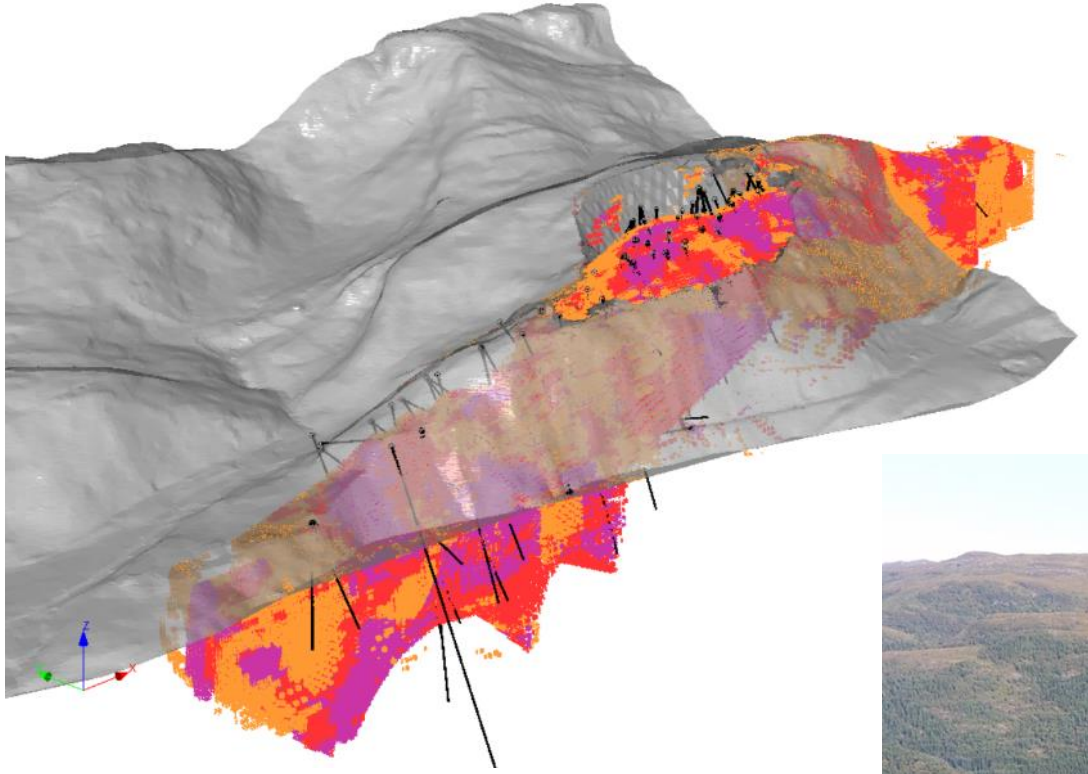
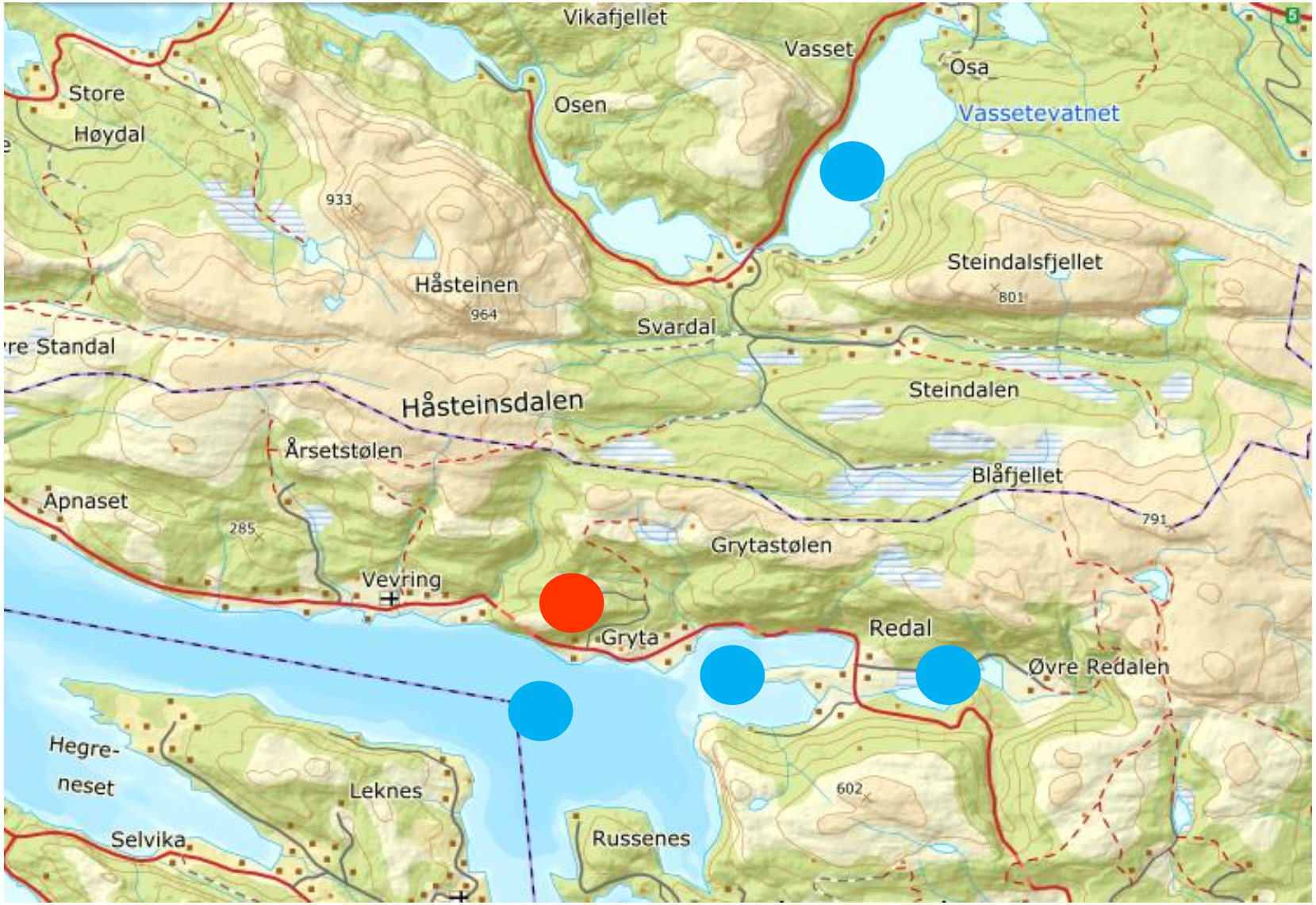
Outcropping orebody: Elevated open pit with limited visual impact

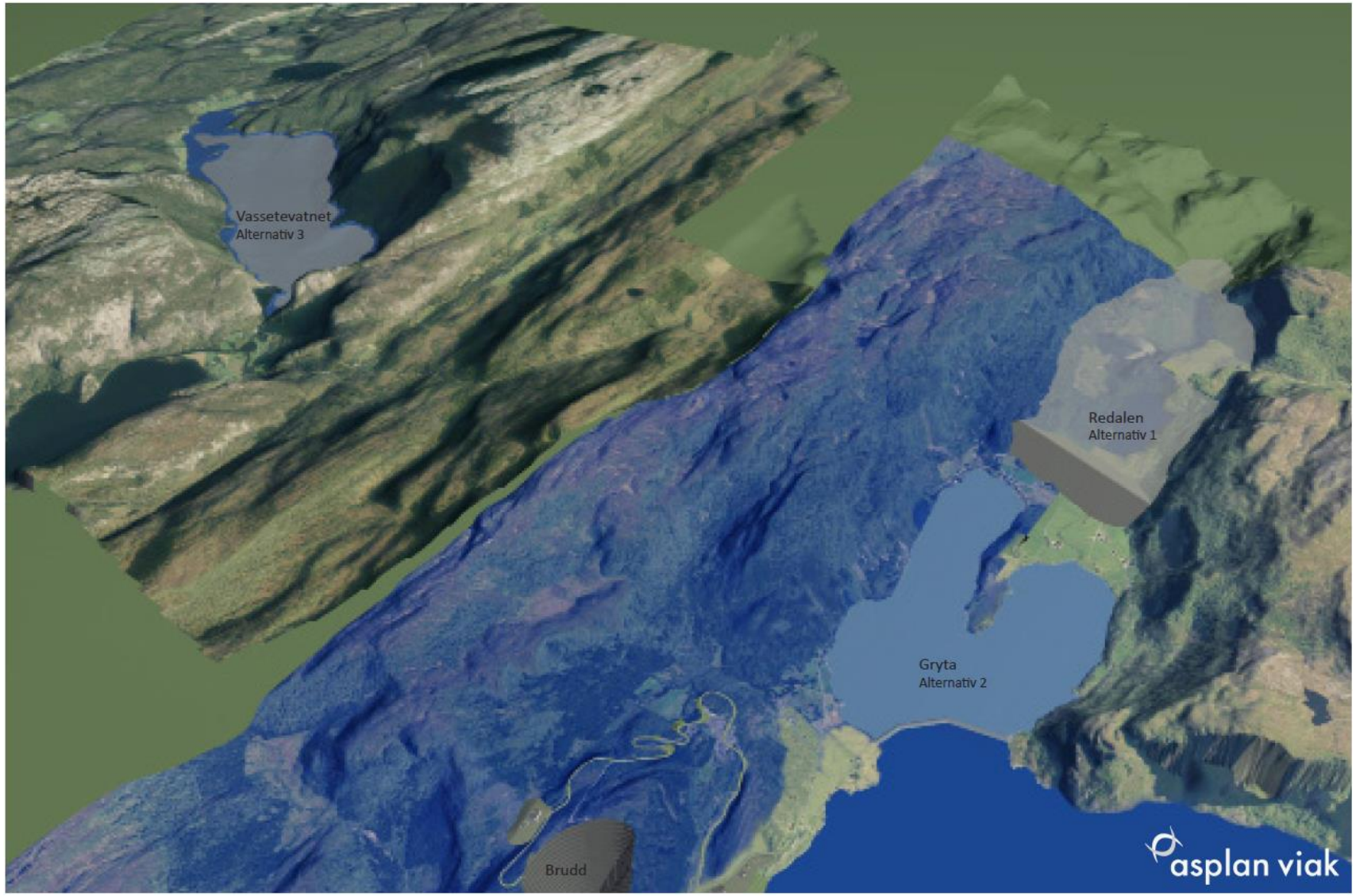


Underground crushing and ore transportation

Tailings management: challenging regional topography



Various options for onshore tailings dams were considered



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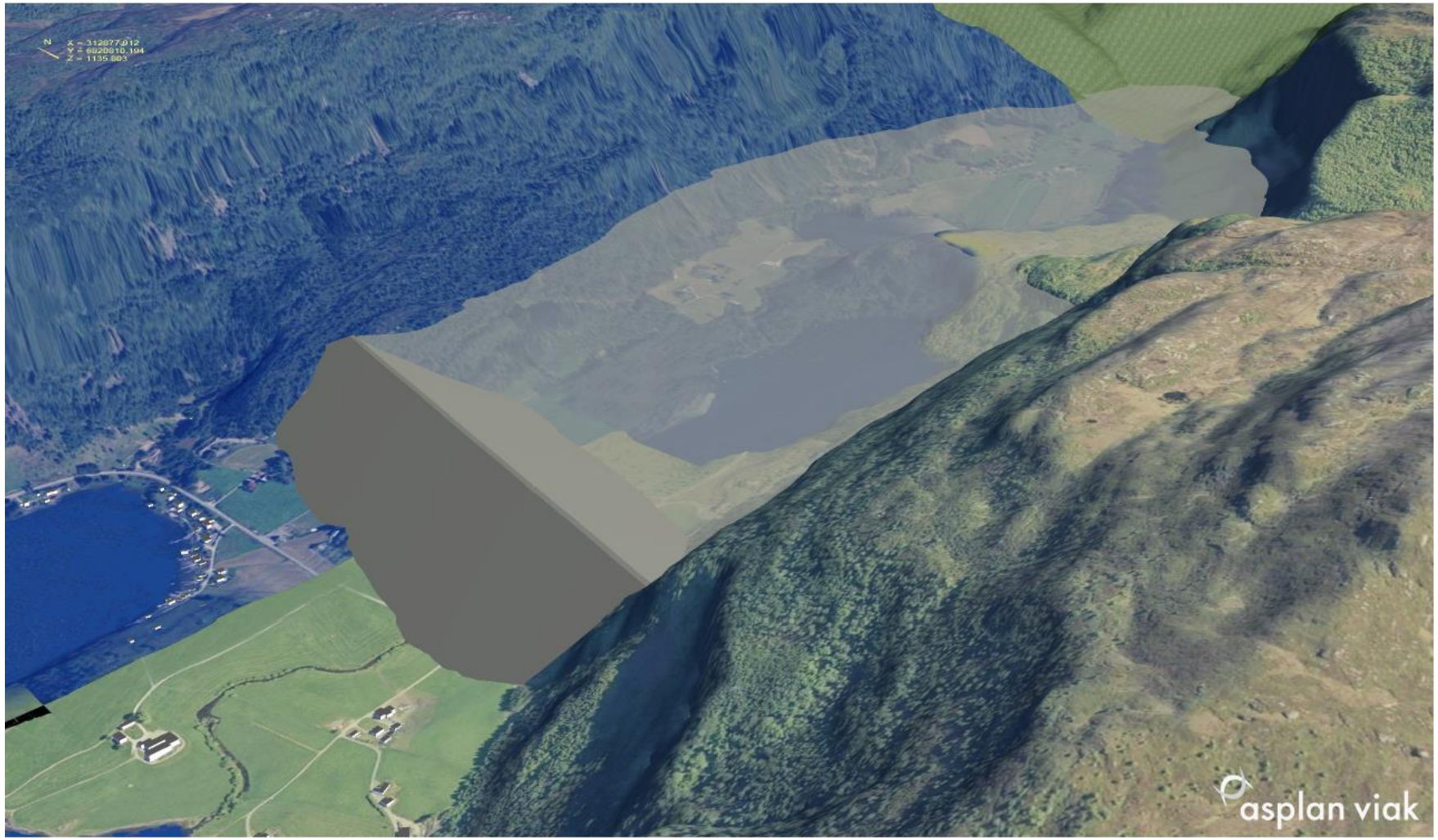
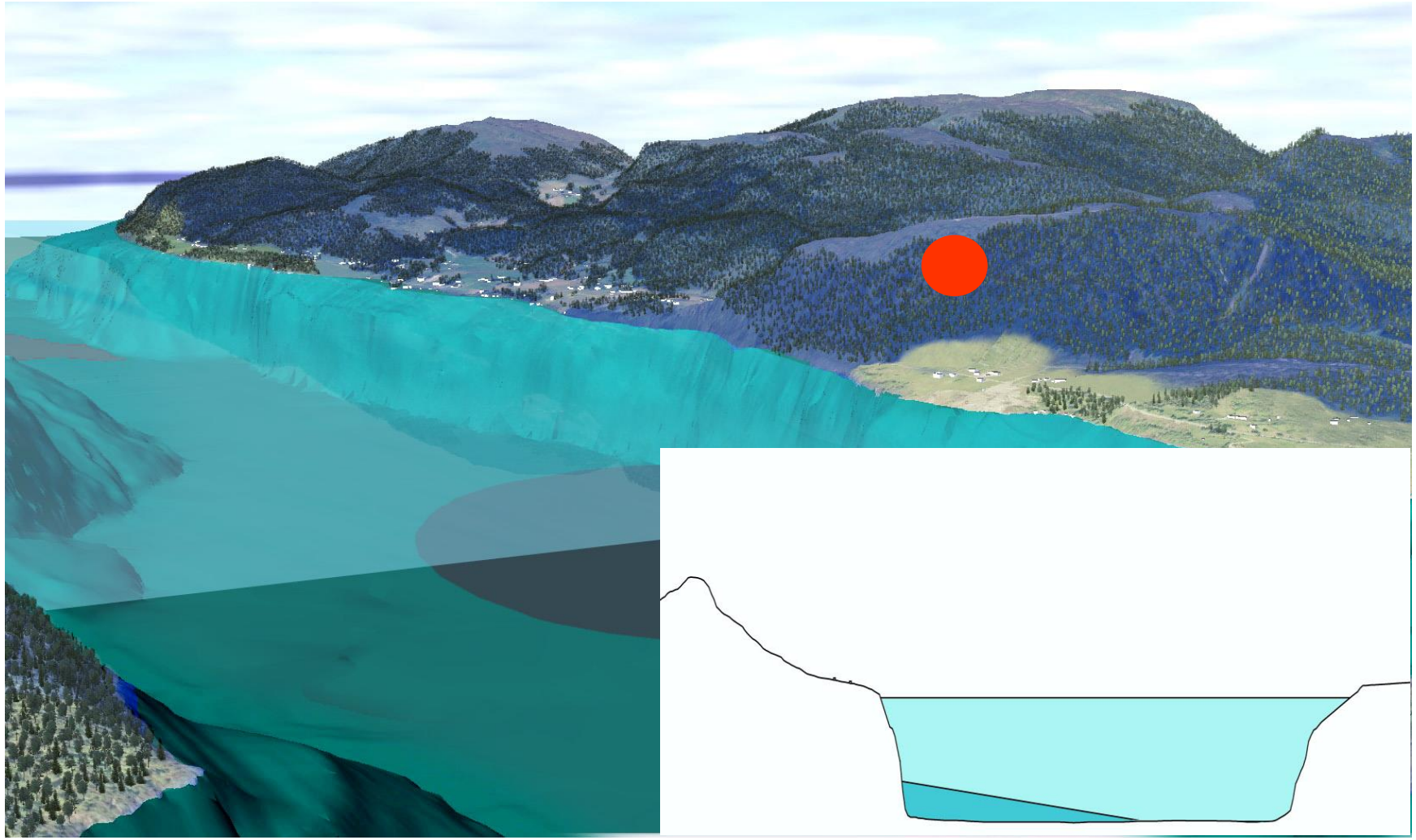
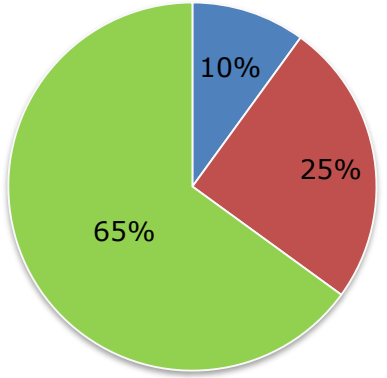


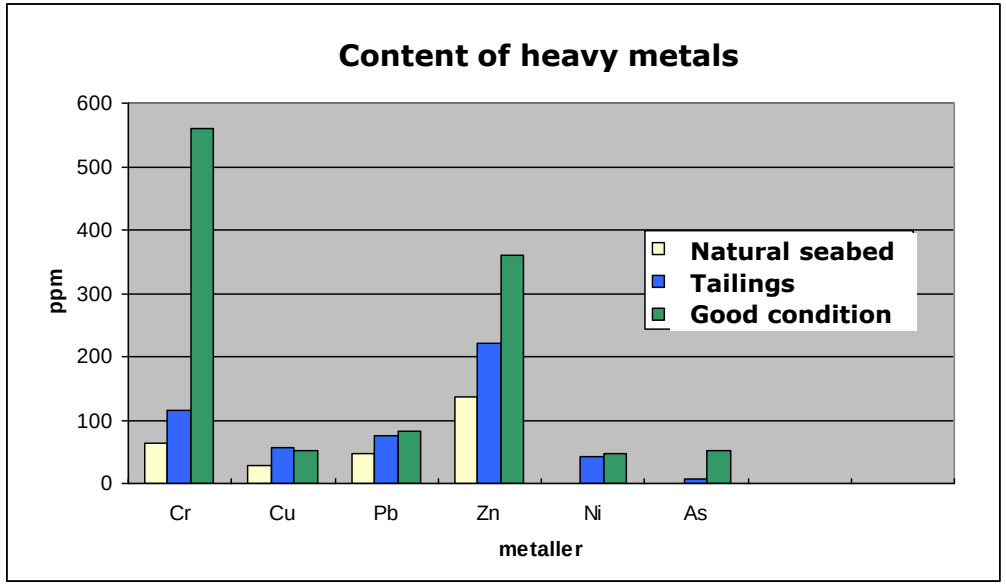
The adjacent fjord has a particular submarine topography

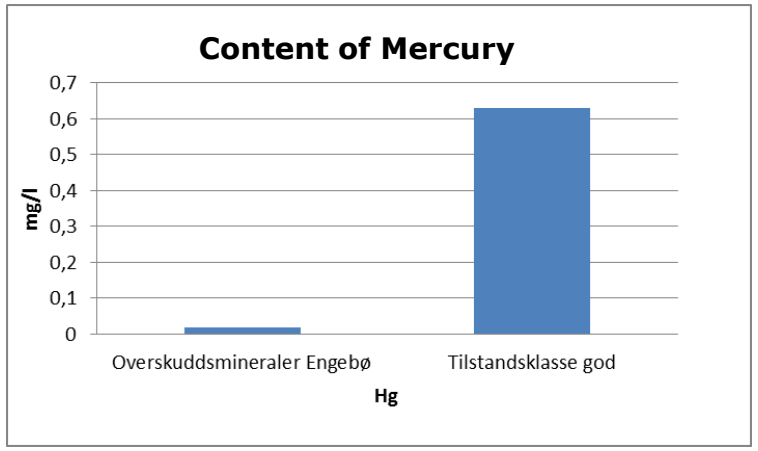


Eclogite tailings, main characteristics

- Tailings mainly consists of normal rockforming minerals like garnet, pyroxene and amphibole
- Very low content of heavy minerals
- The tailings are quite coarse, only approx. 10 % is in the fractions of finer particles, e.g. fine silt and clay
- Residues of additives are present in low concentrates with negligible effects on environment

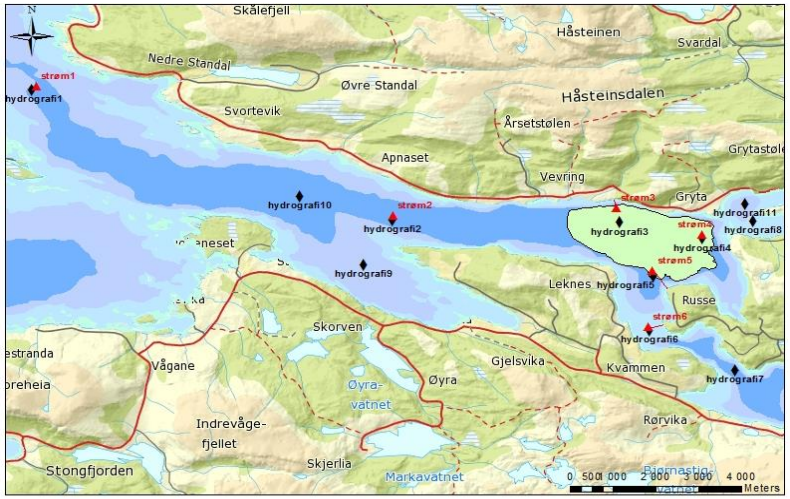






Tailings are approved as capping material by Directorate of Minerals

Comprehensive impact assessment (EIA)



Advanced measuring stations measured currents over the entire water depth in the area through a 12 month period.

DNV

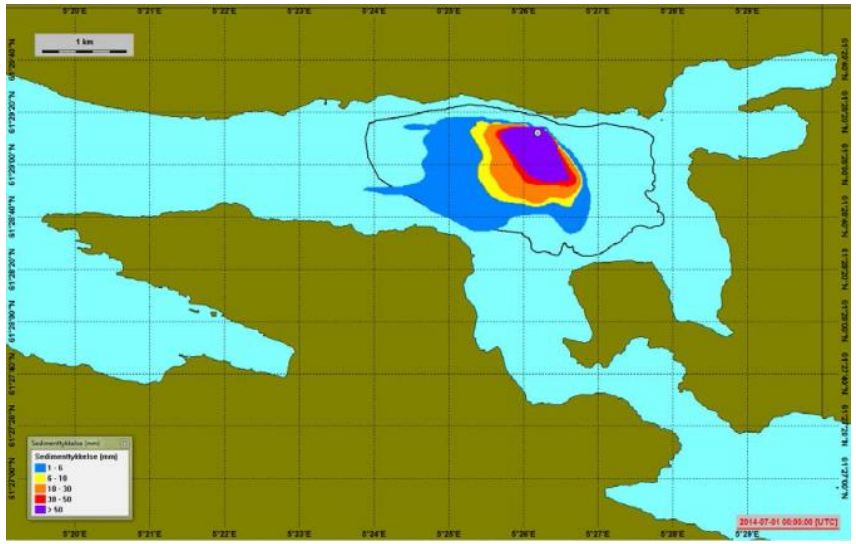
DET NORSKE VERITAS

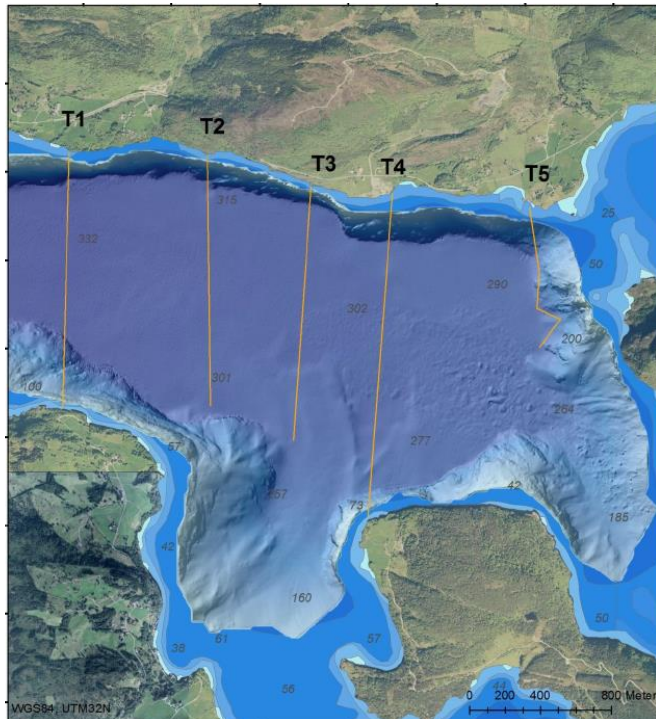
Program - tilleggsutredning strøm og hydrografi Førdefjorden

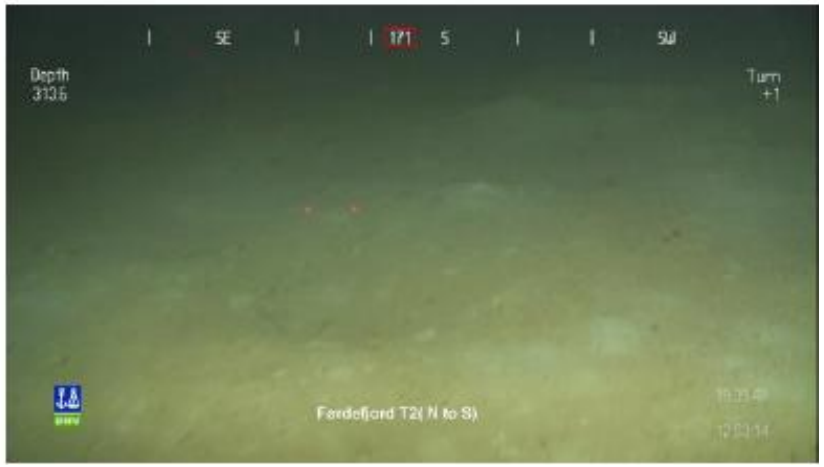
Nordic Mining ASA

Current data were collected every month and used as input in a hydraulic 3D model

Impact assessments & model simulations







Evaluating acceptance criterias for various species

Key findings from EIA document the sea disposal as safe and sustainable

- The tailings will mainly sediment within the regulated area (Approx. 5% of the total fjord area)
- The currents in the tailings area are moderate and there is limited risk for erosion currents
- Limited effects are expected outside the regulated area and in the water column above the tailings
- There are no corals found in the tailings area or surroundings
- The tailings disposal pose little threat to cod that has its breeding grounds in shallow fjord areas
- The tailings disposal pose little threat to endangered fish that dwell in the fjord
- Bottom living organisms will be affected within the regulated area where the sedimentation rate is high.
- The tailings area will likely be recolonized within 5 years after the disposal ceases.
- Possibilities for recreational fishing in the fjord will not be affected
- The tailings will not affect fish farms that are operated in the fjord

Comparison of potential effects from land vs sea disposal

Effects	Tailings dam	Sea disposal
Areal occupation	Yes	Yes
Bury non-mobile organisms	Yes	Yes
Natural rehabilitation, revegetation	Slow	Fast
Effects on onshore areas, waters and rivers	Yes	No
Effects in the sea	Not likely	Yes
Potential dam break, and severe consequence	Yes	No
Local dust problems	Yes	No
Leaching of metals/acids	Yes	Not likely
Long term effects	Yes	Not likely
Visual impact for landscape	Yes	No
Re-use of tailings	Yes	Difficult
Visual monitoring	Easy	Difficult/costly

Ref: Cornwall 2013, og Thyve og Iversen 2012

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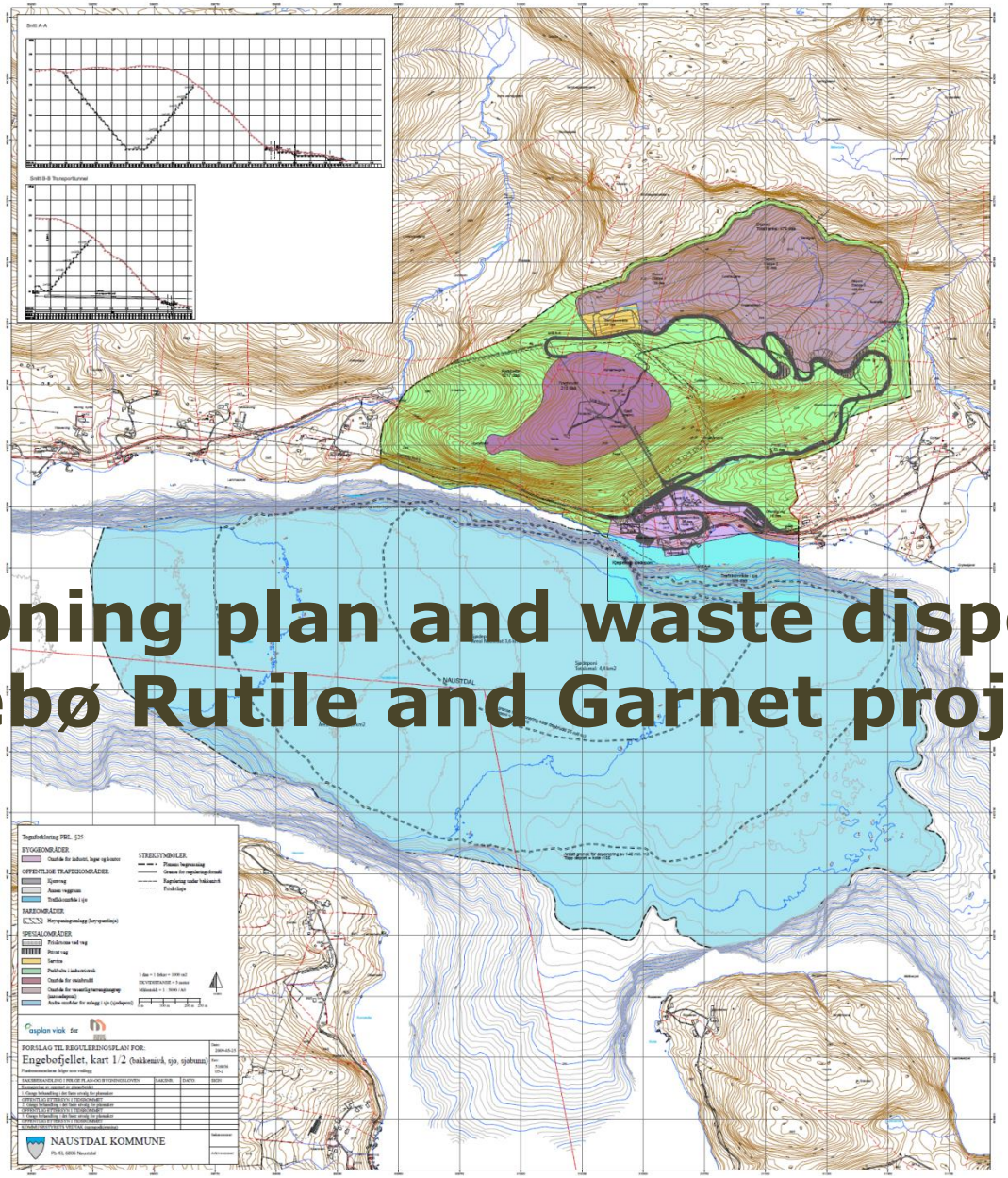
April 2015



Approved zoning plan and waste disposal permit for the Engebø Rutile and Garnet project

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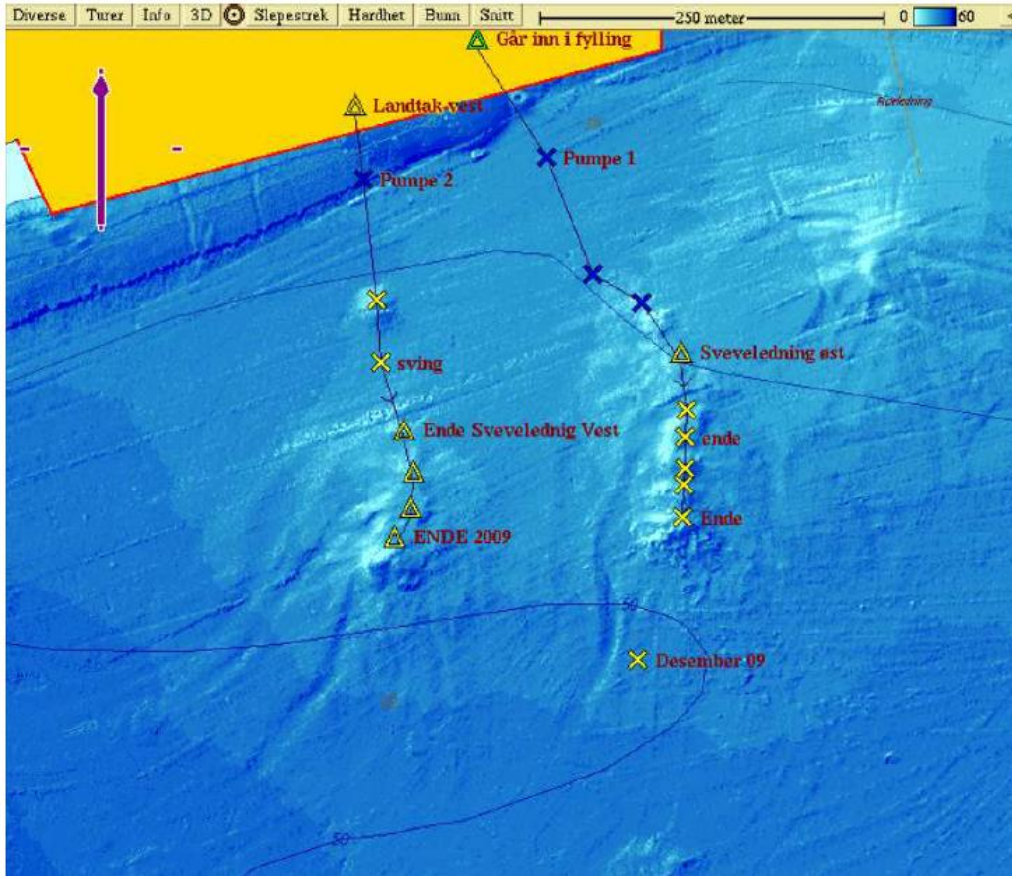
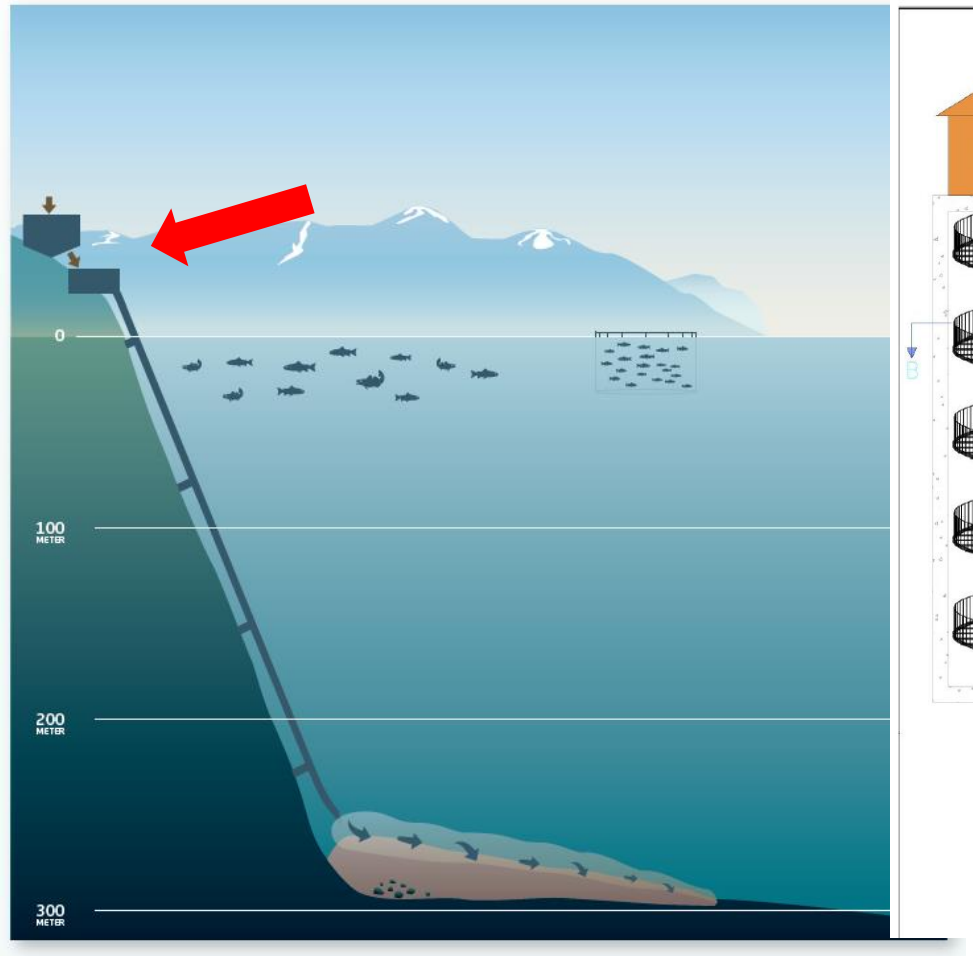
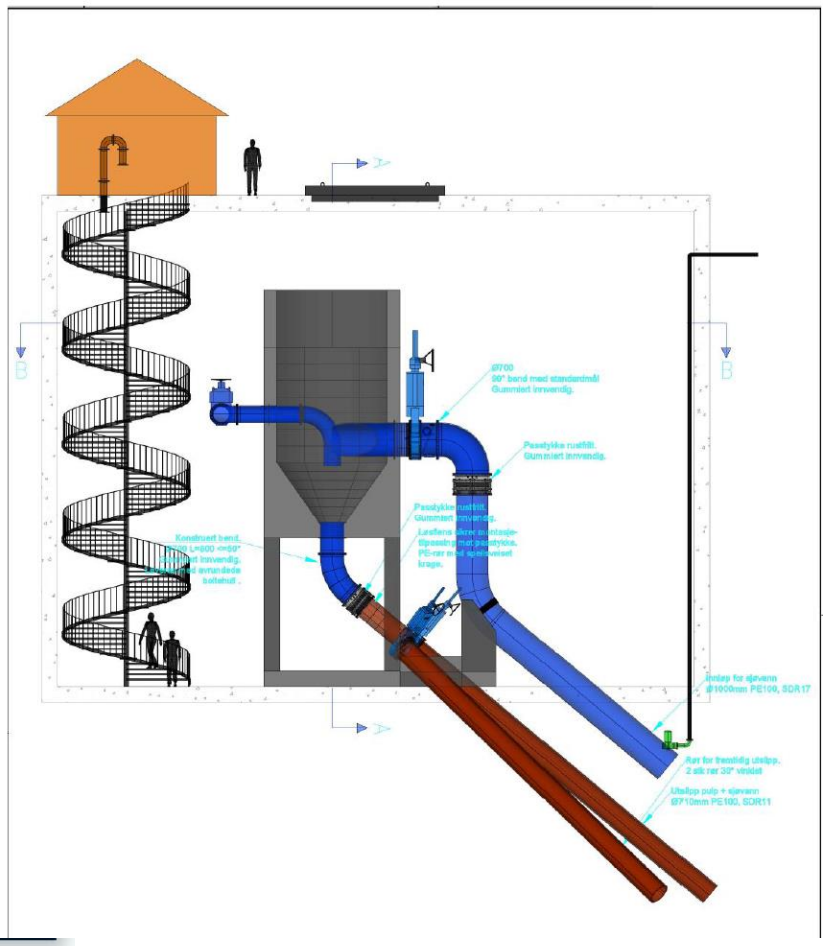
Three dimensional and dynamic discharge permit



- The tailings shall have a maximum height after cease of operation
- An accumulated maximum of 250 million tonnes of tailings
- A maximum turbidity level above the point of disposal
- A maximum turbidity level at the border of the tailings area
- A maximum mineral deposition per year at the border of the regulated tailings area

Hydraulic disposal system down to 300 meters depth





Mixing chamber for air removal and seawater conditioning

Extensive environmental monitoring program during production, outlined by the permits

Scope of work:

- Proposed **measuring** program for critical parameters according to the waste disposal permit
- Proposed **monitoring** program for the surrounding area, onshore and in the fjord and neighbouring riversystems
- Test work related to additives for processing and water recirculation
- DNV GL is engaged as main advisor/coordinator

Proposed programs to be submitted to the Directorate of Climate and Environment

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Favourable internal logistics, short haulage distance

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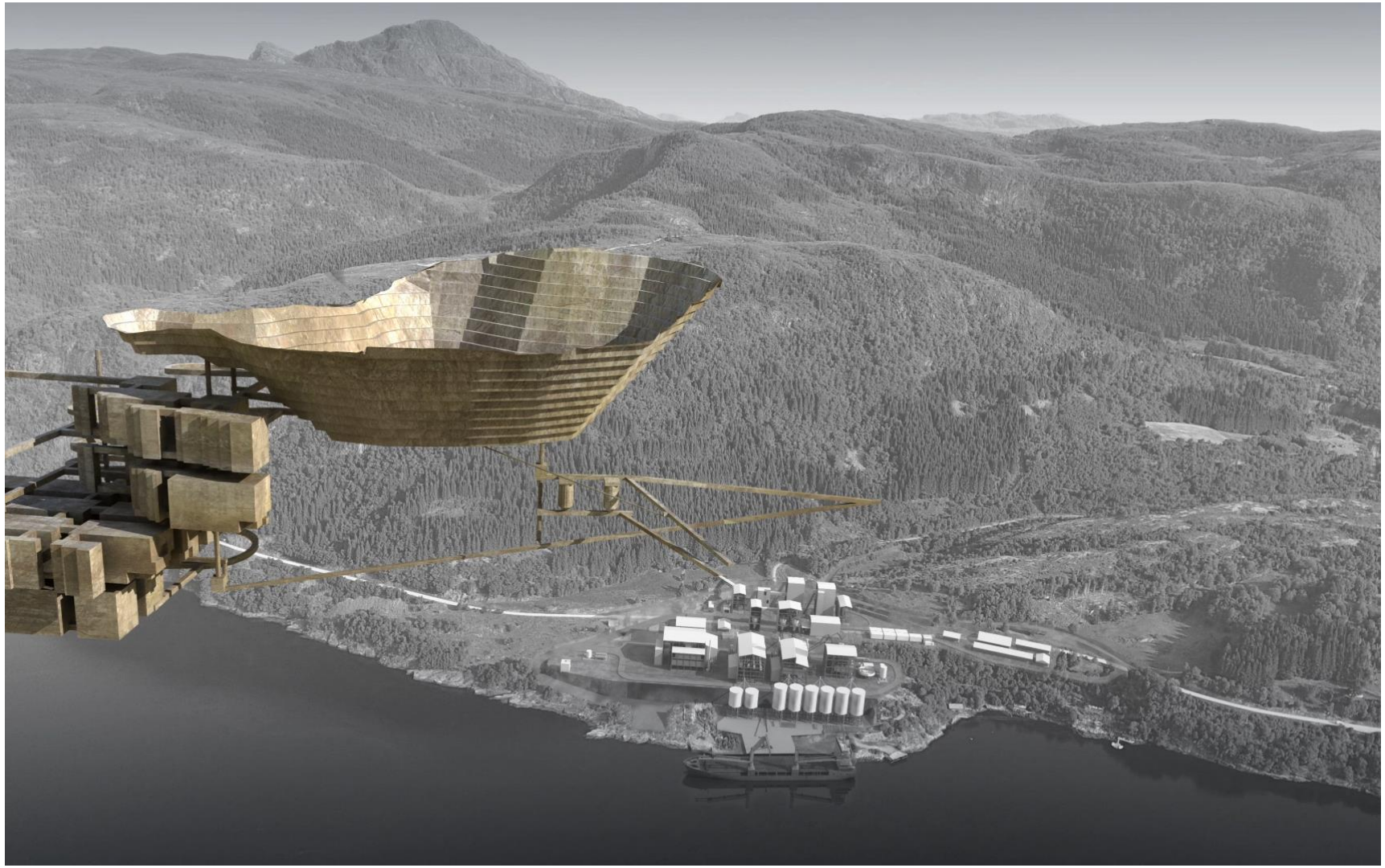
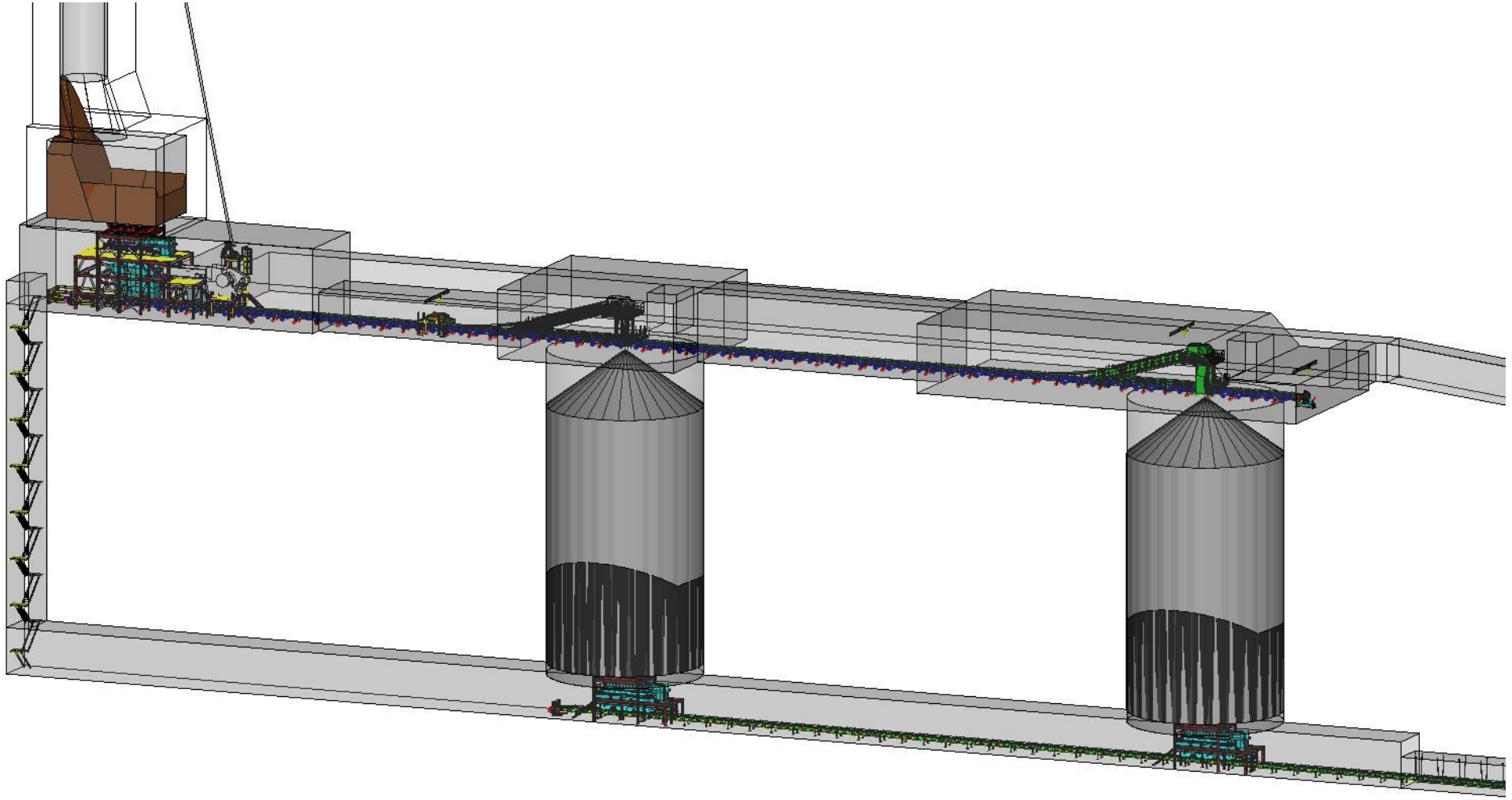
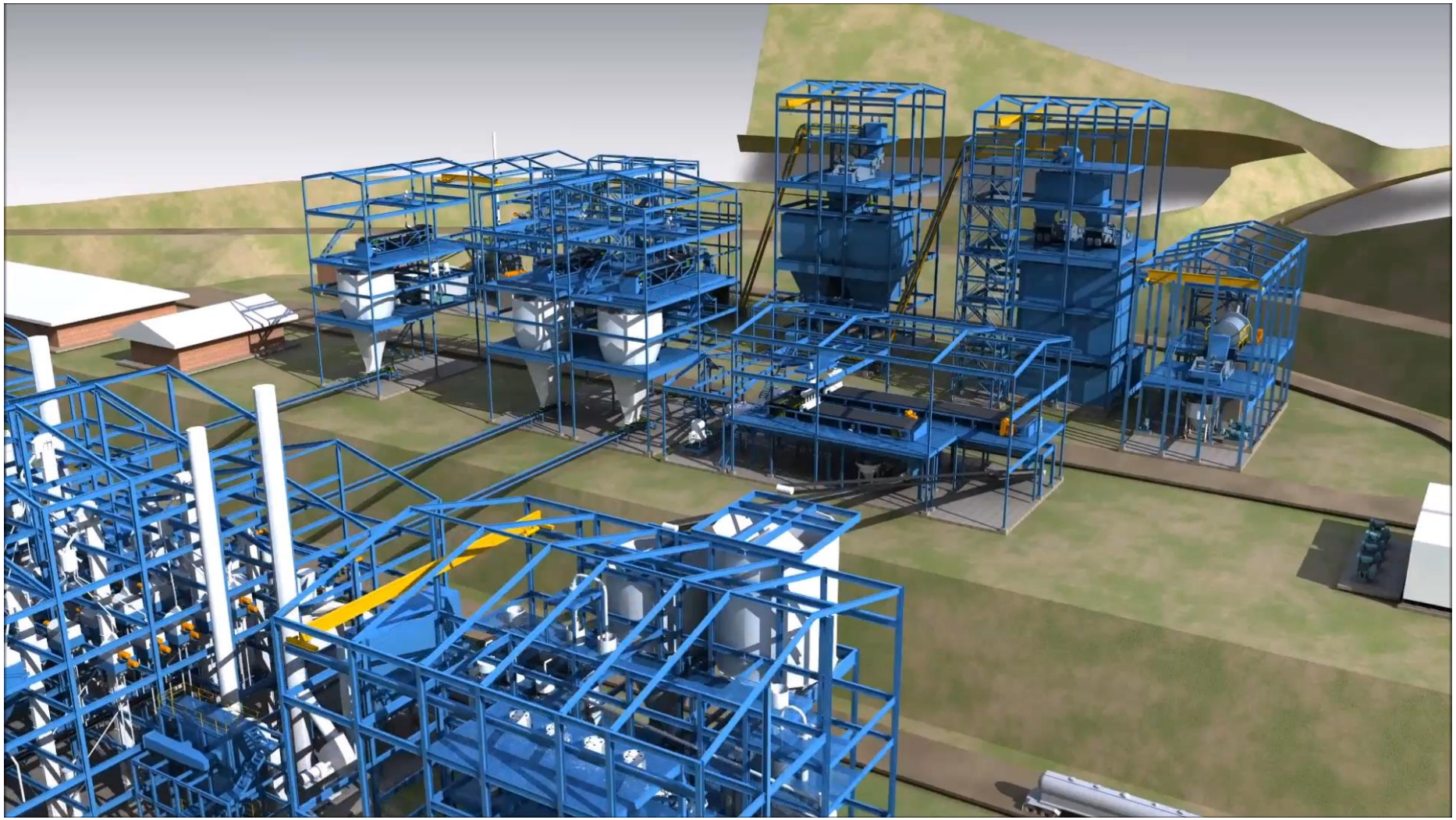


Underground facilities for crushing, ore storage and conveyors



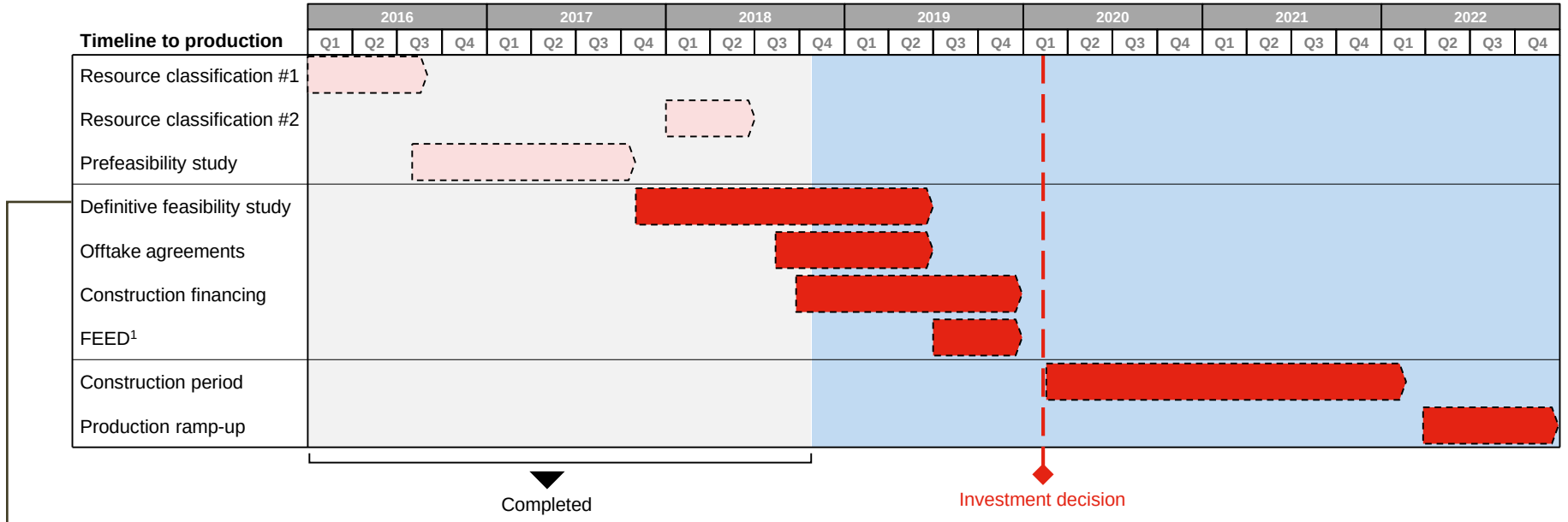
Well suited for modular construction



Process test work: Large scale process equipment

- Rutile concentrate of 95% TiO_2 have been produced in accordance with market specifications
- Test work has demonstrated rutile recoveries of up to 60%
- Both fine and coarse garnet products have been produced according to market specifications

Engebø timeline towards construction



Definitive Feasibility Study (DFS) status

Scope of work for the Definitive Feasibility Study (DFS)

- Mining trade-off studies, mine design and schedule
- Mineral processing testwork, ore variability and flowsheet optimisation
- Modularisation and logistical studies
- Procurement strategy and procurement operating plan
- Multi-disciplinary design and engineering work
- Development of Project Execution Plan (PEP) and Construction Schedule
- Quantitative risk analysis (QRA)
- Building «Owners team» including local project team
- Cooperation and anchoring with local society

Progress

Source: Management and project manager's estimates
Note: 1) Front End Engineering & Design

Thank you for your attention!

NORDIC MINING

Safety – Environment - Innovation