

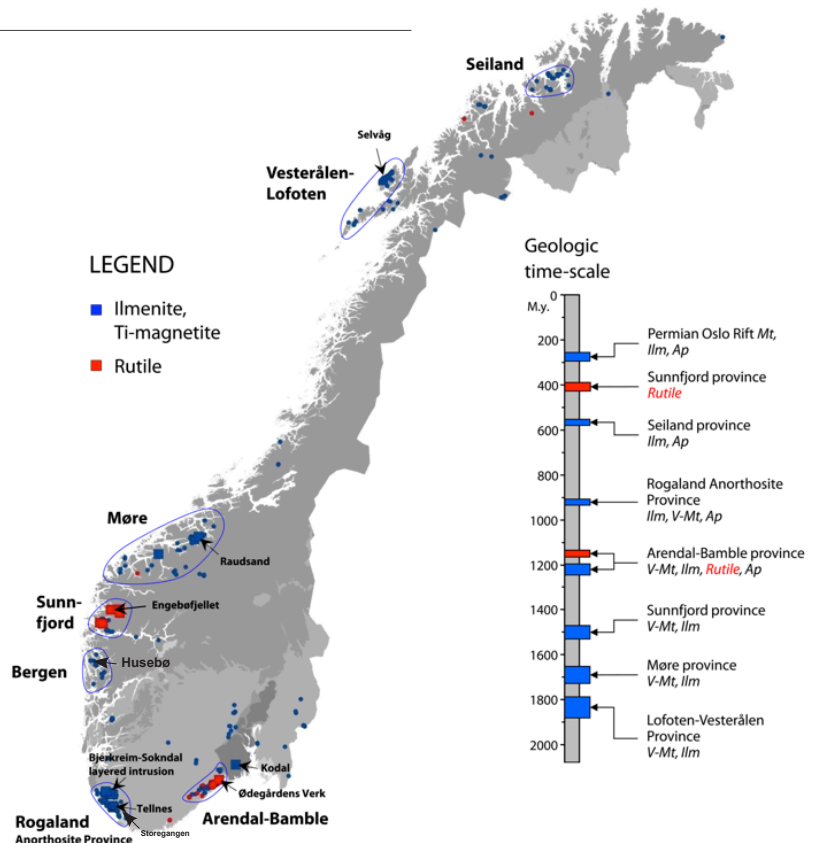
Engerbøfjellet rutile/eclogite deposit, Naustdal, Sogn og Fjordane



## TITANIUM AND IRON-TITANIUM DEPOSITS IN NORWAY

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Approximately 300 titanium and iron-titanium mineral occurrences and deposits are known. The most significant deposits are (1) the Tellnes ilmenite deposit (in operation), (2) the Storgangen deposit (abandoned), (3) the Bjerkreim P-Ti-V deposit in the Rogaland Anorthosite province in southernmost Norway, and (4) the Engerbøfjellet rutile/garnet/eclogite deposit in the Sunnfjord region of western Norway.



PROVINCE/ REGION	TYPE OF DEPOSIT		C. AGE	MAJOR DEPOSIT	% TiO <sub>2</sub>	MINERAL RESOURCE (MT ORE)			COMMENTS
						RESERVE	IDENTIFIED RESOURCE	POSSIBLE RESOURCE	
Arendal -Bamble	Ilm-Mt (V)	igneous	1250		5-20				0.7-1.0% V in Mt
	Rutile	metasomatic	1180	1 Ødegården	2-4			> 50	> 30 ppm U in rutile
Rogaland	Ilm	igneous	925	2 Tellnes	18	180		> 100	
Anorthosite Province	Ilm	igneous	930	3 Storgangen	17		60		
	Ap, Ilm, V-Mt	igneous	930	4 Bjerkreim	4-10			> 300	c. 30% Ap+Ilm+Mt (av. 0.7 % V)
Bergen	Ilm-Mt	igneous	950						
	Rutile	metamorphic	400	5 Husebø	3-6			> 50	
Sunnfjord	Ilm-Mt	igneous	1200		5-10				<1.5% MgO in ilm.
	Rutile	metamorphic	400	6 Engebøfjellet	3.51	133		254	44% garnet, <1% U in rutile
Møre	Mt(V), ilm	igneous	1700	7 Raudsand	4		11	> 100	25-30% Mt (0.5% V)
Lofoten-Vesterålen	Mt(V), ilm	igneous	1900	8 Selvåg	4			44	c. 30% Mt (0.4% V)
Other	P, Mt, Ilm	igneous	270	9 Kodal	3-7		15	34	

1. Rutile-bearing scapolitized metagabbro exploited for apatite at Ødegården between 1872 and 1918 in the rutile-bearing scapolite-hornblende-apatite rock (Ødegårdite).

2. Mine in operation since 1960, operated by Titania AS (Kronos Worldwide Inc.). The yearly mine production is about 500.000 t ilmenite concentrate with 44-45 % TiO<sub>2</sub>.

3. The Storegangen mine, abandoned since 1964 after producing 10 Mt of ilmenite ore, still contains 60 Mt of demonstrated remaining resources.

4. Recent studies and extensive drilling by Norge Mining plc have reported an indicated and inferred mineral resource of 1.55 billion tonnes, made up of consistent grades of vanadium-bearing magnetite, titanium-containing ilmenite and phosphate-rich apatite. <https://norgemining.com/>

5. The Husebø rutile-bearing eclogite deposit consists of variably eclogitized jotunite affected by retrograde alteration, with 3-5 % TiO<sub>2</sub> outcropping more than 100.000 m<sup>2</sup>.

6. Two types of Ti deposit occur in the Sunnfjord region: magmatic ilmenite-titanomagnetite deposits associated with Palaeoproterozoic mafic intrusions, and rutile-bearing Caledonian eclogitic rocks. The ilmenite deposits in the region are of minor economic interest, while the rutile-bearing eclogites represent a major mineral resource, particularly the Engebøfjellet deposit.

7. The Rødsand deposit (in operation from 1899 to 1981) is disseminated to semi-massive Fe-Ti oxides within amphibolite. The crude ore produced contained 25-30 % magnetite, 3.5-4 % ilmenite and 0.15-0.20 % V. The magnetite concentrate contained 64% Fe, 2 % TiO<sub>2</sub> and 0.7 % V<sub>2</sub>O<sub>3</sub>, and was the raw material for production of pig iron and ferrovandium.

8. Massive and disseminated Fe-Ti deposits occur in gabbros and anorthosites. Selvåg is the only deposit considered to be of potential economic interest in the Vesterålen-Lofoten region, with 44 Mt probable ore with 20-30 % titanomagnetite (0.6 % V<sub>2</sub>O<sub>3</sub>) and minor ilmenite.

9. The larvikite-lardalite complex in the southernmost parts of the Permian Oslo Rift host a number of titanomagnetite-ilmenite-apatite concentration, of which the Kodal deposit was investigated for apatite in the 1970's and 80's, and the deposit has recently been evaluated by Kodal Minerals. The mineral resource is c. 50 Mt with c. 5 % P<sub>2</sub>O<sub>5</sub> (12 % apatite), 25-40 % titanomagnetite and 5-10 % ilmenite.

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