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The Seqi olivine deposit, Fiskefiord area
western Greenland

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<p>Summary:</p> <p>This report summarizes some of the open information about the Seqi olivine deposit on western Greenland. The deposit was called Itipilua in earlier works.</p> <p>The Seqi olivine deposit is situated in a side branch to Fiskefiord in western Greenland. It has been investigated in the 1970s and 1980s by Kryolittselskapet Øresund A/S and by the Geological Survey of Greenland. The deposit is a layered dunite, with a size of 1100x450 metres and is situated about 0.5km from the shoreline.</p> <p>The reserves have been estimated to be about 52 million tons. The dunite has a MgO content of 47.4%, 0.64% LOI and the $MgO/SiO_2 = 1.15$. Some individual olivine grains have been analysed and show that the olivine has a forsterite component of 86-87%. In thin section the rock has a grain size of 0.3 to 3 mm, the individual grains is fresh and with little internal fractures compared to the Åheim olivine. It appears to contain less chlorite than Åheim olivine.</p>				
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Industrial minerals	Dunite	Archean		
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1. INTRODUCTION

This report was made on the request by North Cape Minerals (NCM), which also supplied the samples and bulk chemical analysis.

1.1 Nomenclature and source of information

The name Seqi olivine deposited has led to confusion by some readers. It is the same occurrence that was previous called Itipilua by various mining companies and in earlier reports (Kalvig 1990, 1994, Gautneb & Nilsson 1997). Why Crew development, LKAB and Minelco, have choosen to give the occurrence a new name is not known (Per Kalvig pers. comm.). The name Seqi is used in this report for the occurrence that is called Itipilua in the references.

The text and data presented in chapter 2, is based on open information from GEUS (formerly Geological Survey of Greenland) and mainly from (Kalvig 1994).

The information in chapter 3-4 is new for this report.

2. GEOLOGICAL SETTING

The Seqi olivine deposit is located adjacent to Tasiusarsuaq, a branch of Fiskefiord about 35 km west of the settlement Atammik, and about 80 km north of the capital Nuuk. No infrastructure is available at the site area. The site can be reach by a chartered helicopter from Nuuk, or by a chartered boat. In general the fjords are navigable except for a few narrow inlets dominated by strong currents (Kalvig 1994).

The distance between the dunite and the shoreline is about 0.5 km; the dunite covers an area of about 1100 x 450 m and has a maximum elevation of about 140 m.a.s.l. The area of exposures consists of abundant dunite outcrops and talus and debris slopes, with almost no soil and vegetation (Fig. 1). As a result of erosion a considerable accumulation of unconsolidated olivine sand has been formed adjacent to the intrusion covering an area of about 200.000 m².

Kryolittselskapet Øresund A/S explored the dunite and the surrounding region in the 1970s. This work included geological mapping, drilling and ore beneficiation test. Regional geological studies were undertaken by the Geological Survey of Greenland (now GEUS). Various Greenland mineral and mining companies have had the mining concessions since.

2.1 Geological description

The Seqi dunite is one of a series of Archean ultrabasic intrusions in the Archean gneisses of the Fiskefiord area. The Seqi massif is a concentric intrusion composed of a central dunite, rimmed by peridotites and amfibole-pyroxene rock (pyribolite). A geological map is shown on Fig. 2. According to Kalvig (1994) serpentinised alteration zones are wide spread, up to 50 cm thick and traceable for up to 25 m. The peridotites generally appear as massive rocks. Some faults are seen, and fracture and joint patterns occur everywhere.

The dunite is present as a) massive dunite, b) rhythmic layered dunite with metre thick chromite layers. The overall texture is massive and medium grained. Kalvig (1994) lists the following composition for the massive dunite: 75-85 vol% forsterite (Fo 94-91) and 5-15 vol% plagioclase, accessory minerals are, pyroxene, biotite chromite, rutile and serpentine. Layered dunite contain up to 3 vol% of chromite, locally developed as up to 2 m thick layers. Serpentine minerals are confined to narrow alterations zones, frequently associated with tremolite and talc.



Figure 1 Aerial, summer photo of the Seqi deposit .

Kalvig (1994) give the following chemical data (Table 1):

Table 1 Chemical analysis of the Seqi deposit (from Kalvig 1994)

Elements	Sample A	Sample B
SiO ₂	40,98%	40,45%
Al ₂ O ₃	0,28%	1,74%
Fe ₂ O ₃	0,96%	0,92%
FeO	6,28%	6,46%
MgO	49,89%	47,94%
CaO	Trace	0,30%
Cr ₂ O ₄	<0,10%	<0,10%
NiO	0,38%	0,38%
CuO		0,02%
CoO		0,02%
MnO		Trace
LOI	0,44%	2,00%
Total	99,31%	99,04

Sample A is a single analyses from the massive dunite. Sample B is an average analysis of 30 samples, collected by Kryolittselskapet Øresund A/S

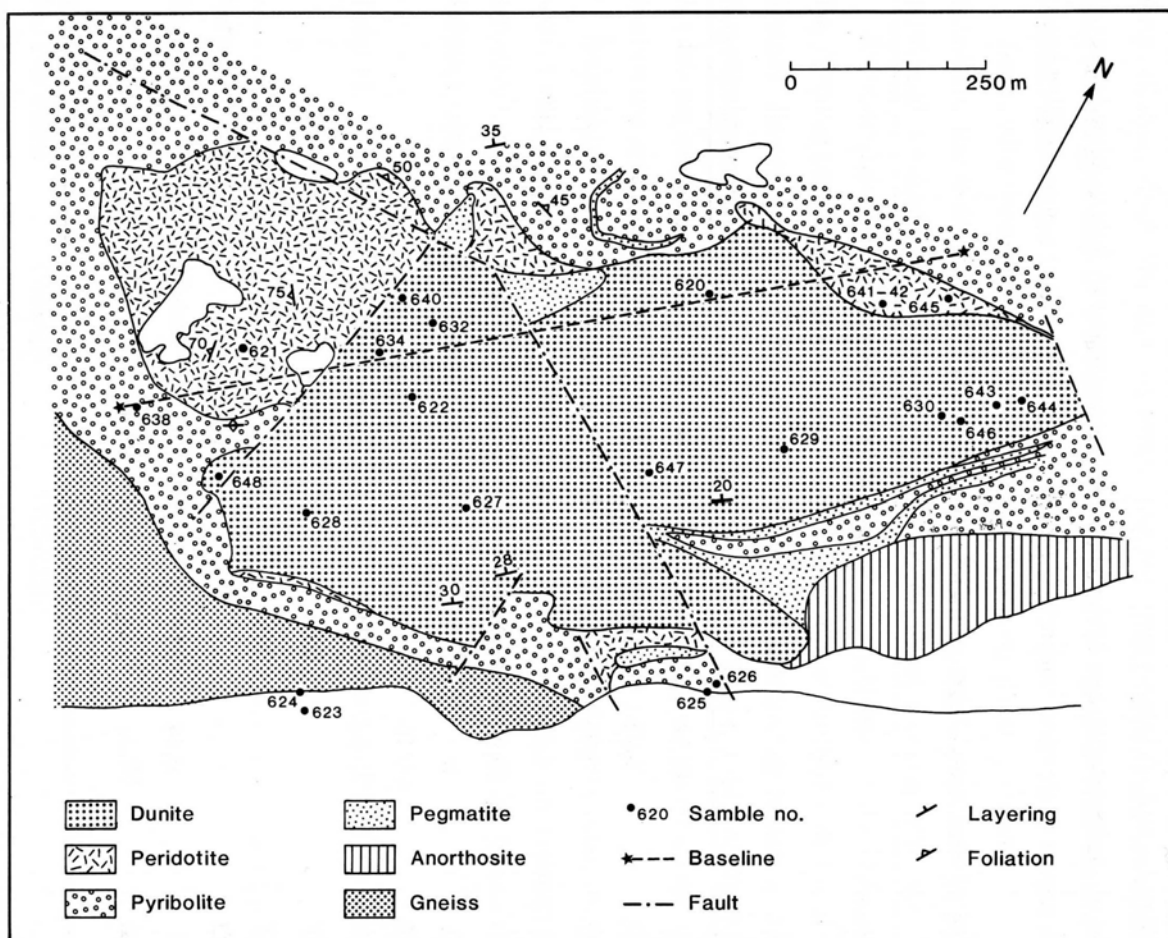


Figure 2 Geological map of the Seqi deposit, by rotating the map approximately 90 degrees clockwise, it will conform to the aerial photo in fig. 1 (from Kalvig 1994)

2.2 Technical testing

Kalvig (1994) described that the Seqi desposit has been drilled in five drill holes (total length 300m) and resources has been estimated to 52 million tons. The tonnages of the olivine sand have been estimated to be 800.000 tons of which 400.000 are on the bottom of the lake. The company *Kryolittselskapet Øresund*, performed some technical tests (Table 2) and concluded that the commercial specifications of sand blasting products and foundry sand can be met provided that size classification is carried out in advance.

Table 2 Technical specifications of Seqi olivine (from Kalvig 1994)

Refractory grade Rock type	Method	Refractory temperature (°C)
Massive dunite	Cone-fall	1705-1710
Olivine sand	Cone-fall	1540
Massive dunite	Sintering point	1300-1400
Olivine sand	Sintering point	1300

3. ANALYSES

3.1 Binocular description

The available material was examined with a binocular microscope. The rock is massive and homogenous with no preferred orientation of the minerals grains (Fig. 3). The individual grains are angular to sub angular, and showing the irregular fracture typical for olivine.

3.2 Thin section description

One polished thin section was produced from a small amount of gravel size olivine grains supplied by NCM.

In thin section the Seqi rock is granular, with a grain size that ranges from 0.3 to 3 mm (Fig. 4). The grain boundaries are straight and triple grain contacts show often a 120° angle between grain boundaries, typical for minerals grown during hydrostatic conditions. The olivine grains are fresh with very little internal fractures, something that is clearly different from Åheim olivine (Fig. 5). The mineral content is listed in Table 3. Compared to Åheim the rock contains less chlorite and enstatite. However it would be normal to expect some variation and a single thin section may not be representative.

Table 3 Mineral content of Seqi dunite.

Mineral	Vol%
olivine	97
chlorite	2.5
Enstatite	0.5
chromite	0.5

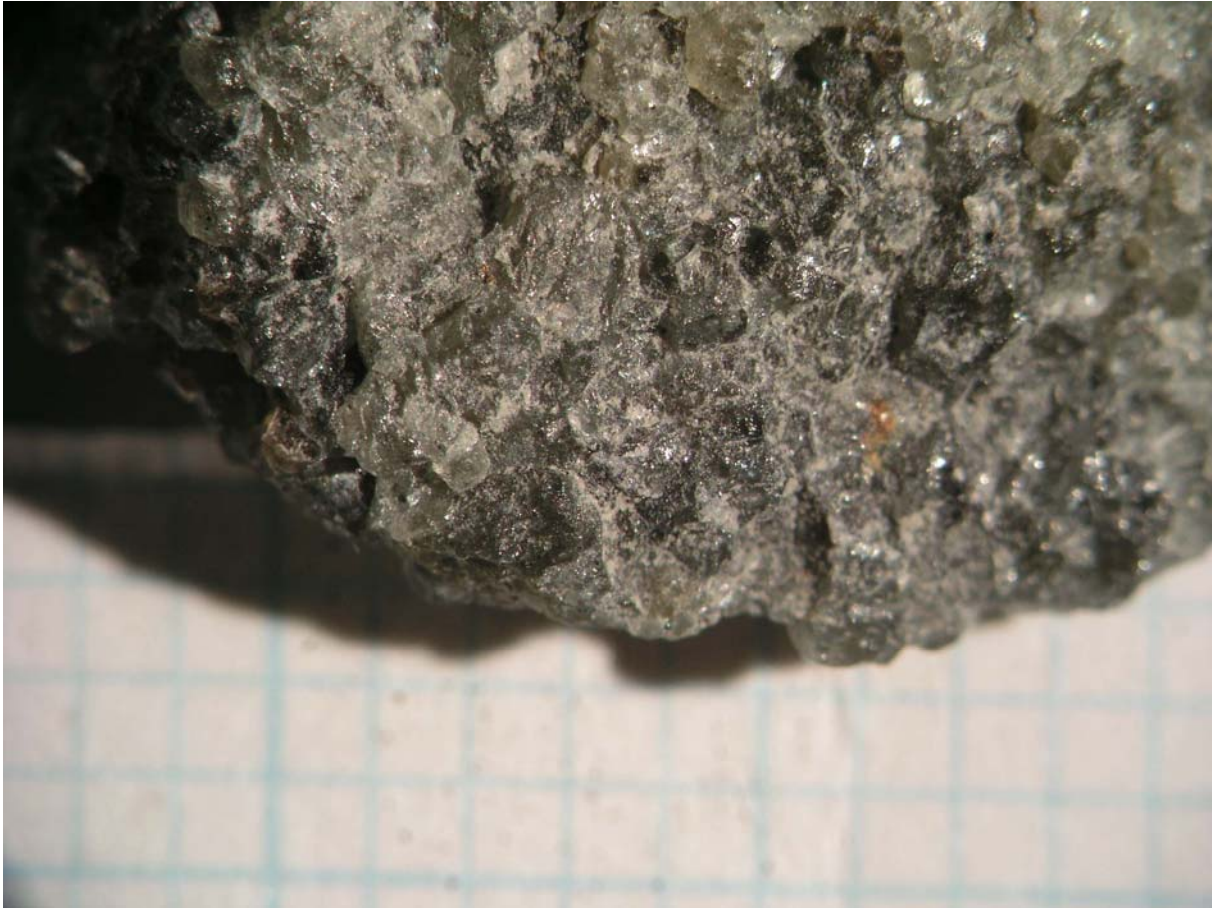


Figure 3 Microscopical picture of Seqi rock, blue line equals 1mm

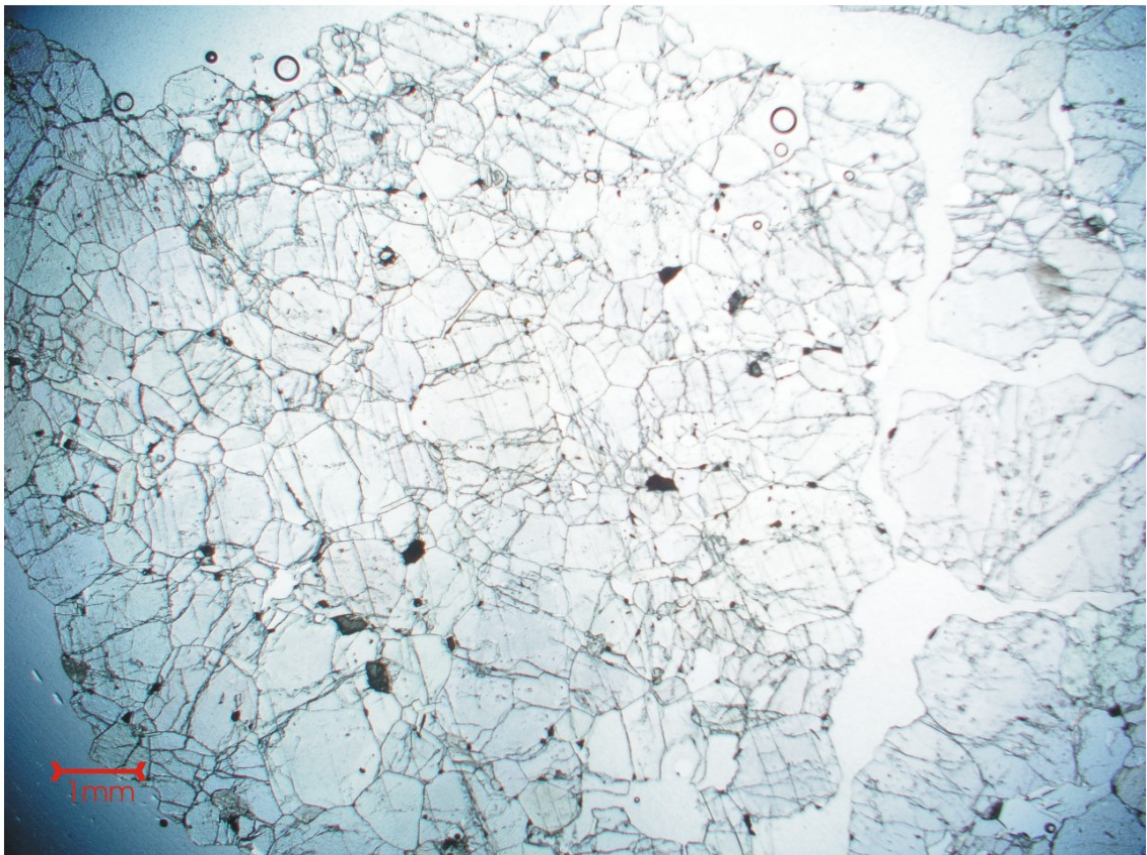
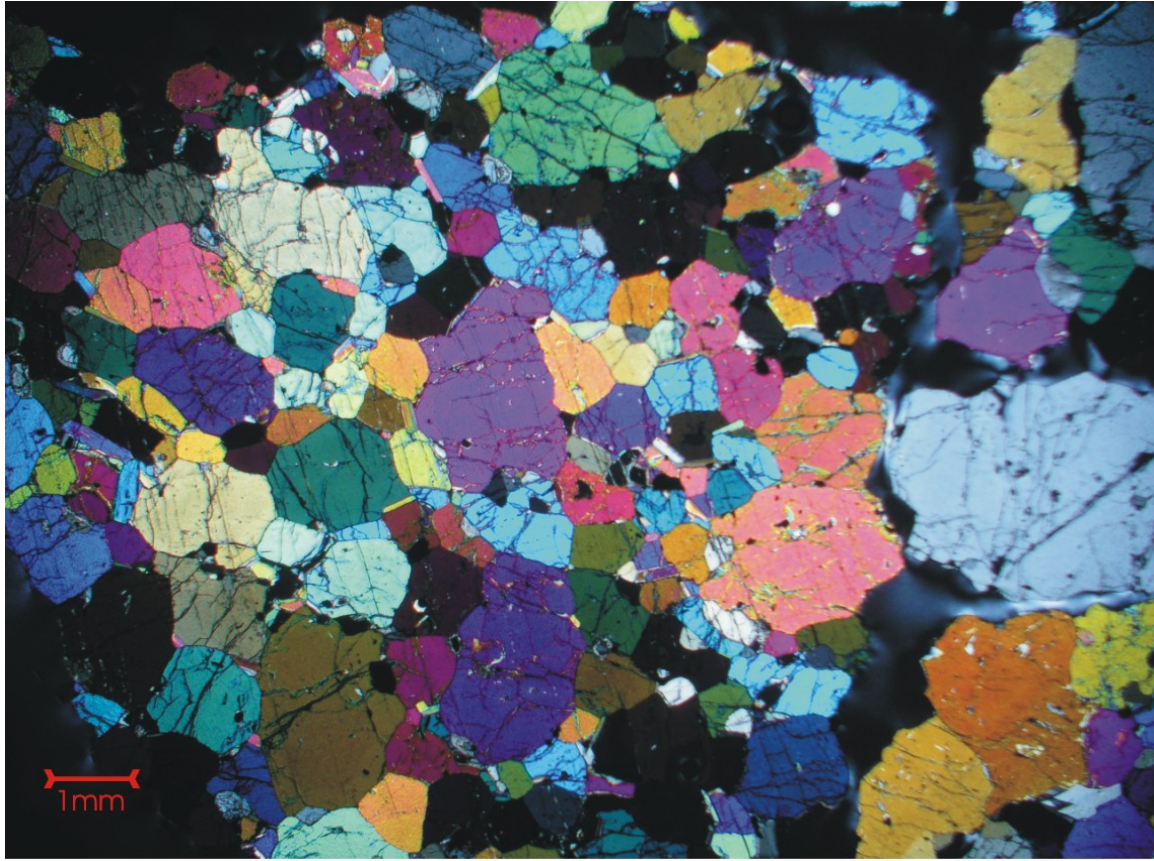


Figure 4 Polarised and parallel light picture of the seqi samples, microscope magnification 12.5x, the opaque grains are chromite, note the fresh olivine with little fractures.

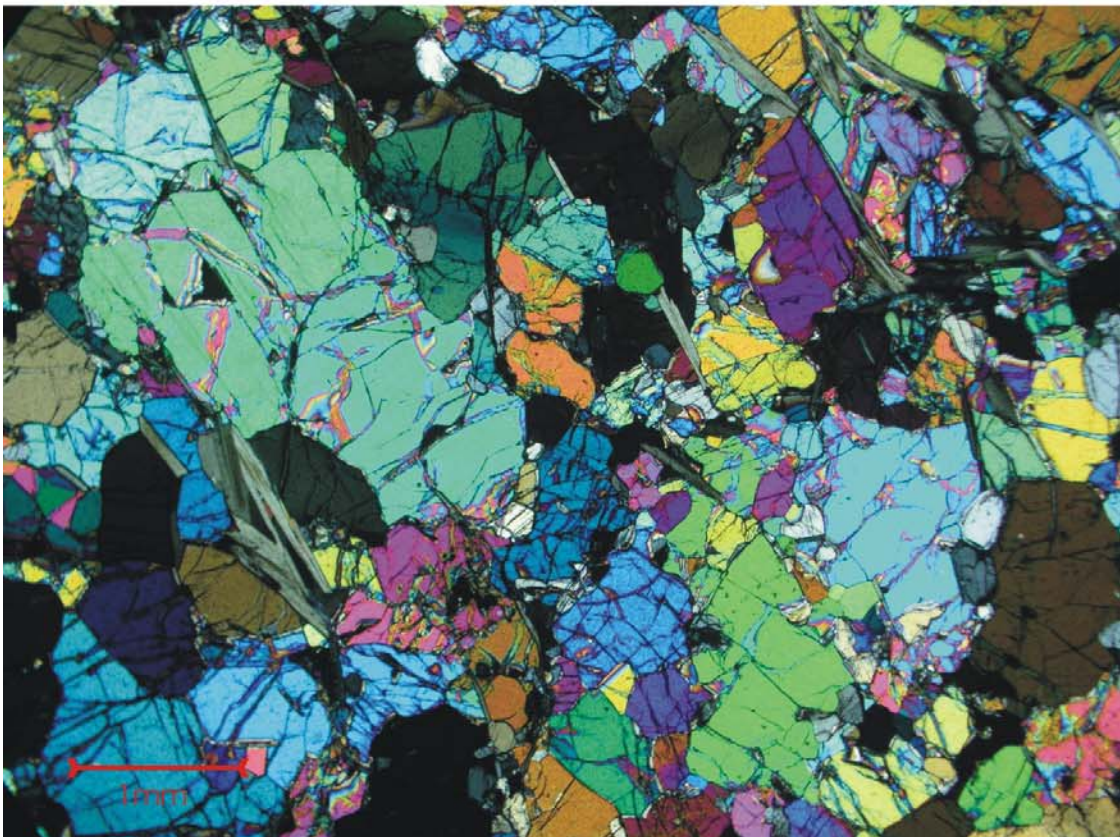
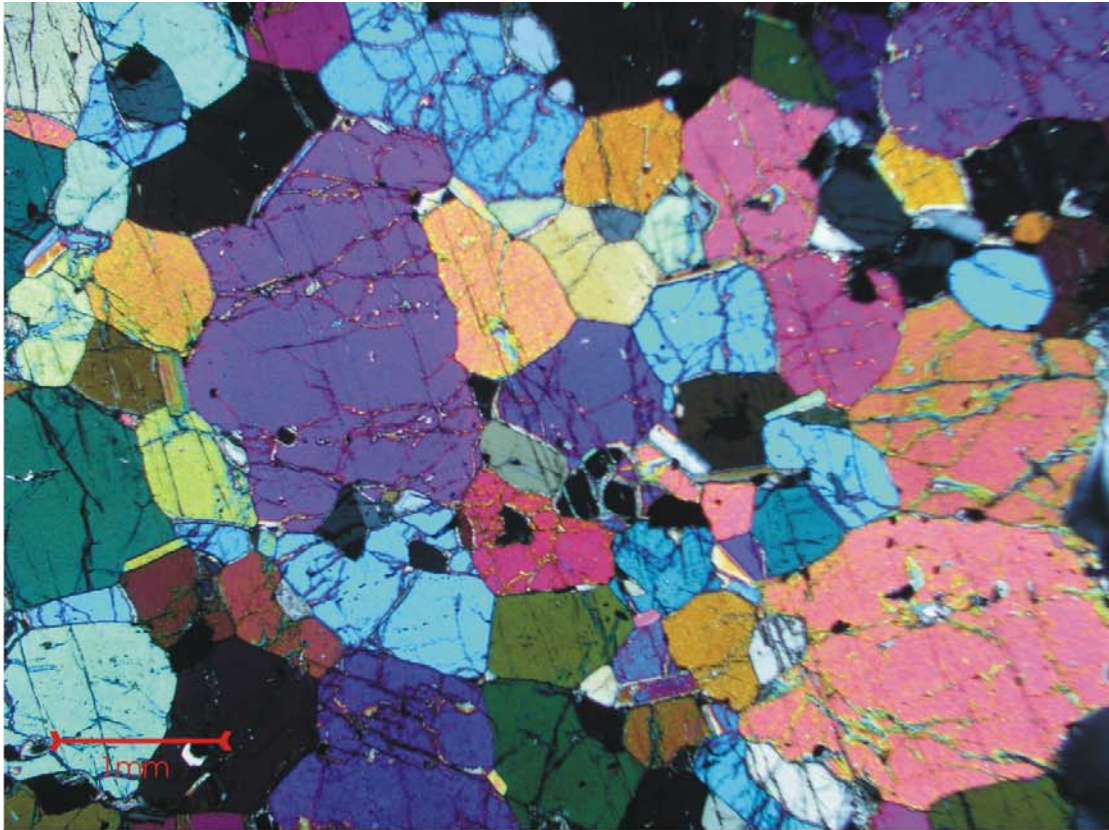


Figure 5. Comparison of Seqi dunite (upper), and Åheim dunite, note the higher chlorite and more fractured appearance of the Åheim rock, microscope magnification 25x

3.3 Chemical analysis

Bulk rock xrf analysis of the described material is shown in Table 4. This single analysis is within the same range as was earlier reported by Kalvig. (1994). It can be noted that the MgO content of the Seqi analysis is slightly lower than an average Åheim value.

Table 4 Chemical analysis of Seqi sample (analysed by NCM lab. Åheim)

Element	vol%
MgO	47.4
SiO ₂	41.1
Fe ₂ O ₃	9.2
Cr ₂ O ₃	0.35
Al ₂ O ₃	0.96
NiO	0.33
MnO	0.09
CaO	0.29
L.O.I.	0.64
Na ₂ O	0.01
K ₂ O	0.09

The composition of some individual olivine grains and some chlorite grains was analysed by SEM, by EDS and WDS methods, using the facilities at the Geological Survey of Norway. The results are shown in Table 5.

Table 5 SEM mineral analyses of olivine and chlorite grains.

Spectrum	olivine 1	olivine 2	olivine 3	olivine 4	olivine 5	Olivine 6
Mg	52.02	51.97	52.66	51.28	51.27	51.05
Si	41.70	41.56	41.13	41.56	40.84	41.08
Ti	0.00	0.00	0.03	0.00	0.19	0.00
Mn	0.16	0.21	0.13	0.23	0.12	0.16
Fe	7.80	7.68	7.82	7.70	8.09	7.82
Ni	0.39	0.40	0.49	0.43	0.45	0.49
Total	102.07	101.82	102.26	101.20	100.96	100.60
% Fo	86.96	87.12	87.07	86.94	86.37	86.72
	chlorite 1	chlorite 2				
Mg	28.26	27.71				
Si	41.31	39.53				
Al	12.40	12.05				
Ti	0.65	0.52				
Mn	0.00	0.06				
Fe	2.59	2.49				
Ni	0.18	0.18				
Total	85.39	82.54				

The mineral analysis of the olivine grains are very similar, and shows that the olivine has a forsterite component of 86-87%, a value that is significantly lower than published values from Åheim. (Osland 1997) where the normal values varies from 91-93%.

4. SUMMARY

The Seqi olivine deposit, is situated in a side branch to Fiskefiord in western Greenland. The deposit is a layered dunite, with a size of 1100x450 metres and is situated 0.5km from the shoreline. The reserves have been estimated to be about 52 million tons. The dunite has a 47.4 % MgO, 0.64% LOI and $MgO/SiO_2 = 1.15$. Some individual olivine grains have been analysed and show that the olivine has a forsterite component of 86-87%.

5. REFERENCES

- Gautneb H. & Nilsson L.P. 1997: En sammenstilling av geologisk informasjon om noen utvalgte utenlandske olivin- og serpentinitforekomster. NGU report 97.151.
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