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Chemical and mineralogical analysis of a sample from Mugla Tepe, Turkey

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REPORT

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Title:
Chemical and mineralogical analysis of a sample from Mugla Tepe, Turkey.

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Summary:

This report presents the results from chemical, petrographical and mineral chemical analyses of a sample from Mugla Tepe, Turkey. The rock is a serpentinised dunite, the degree of serpentinisation is about 50% (LOI = 6.63). The rock contains 44.2% MgO 7.8% FeO and has a total alkali content of 0.02% The primary rock has been a homogenous dunite. The present mineral content is: Olivine 83.0%, serpentine 11.7%, enstatite 4.5%, chromite 0.5%, and magnetite 0.3%. Selected individual olivine crystals contain about 49% MgO and 8% FeO, which corresponds to a forsterite content of about 86%.

The rock originates from a geological setting where a considerable variation is expected on the scale of several metres. Mapping and detailed sampling is necessary if representative chemical data is desirable for a larger area of the deposit.

Keywords:	Dunite	Serpentine
Industrial minerals	Enstatite	Forsterite
Olivine	Chemical analysis	

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1. INTRODUCTION

This report presents the results of chemical analysis and mineralogical description of a sample from Mugla, southwestern Turkey, and comparison with rocks from Åheim Norway.

The sample was supplied by A/S Olivin, no further information is known regarding the geographical or geological setting of the sample locality.

2. MATERIALS AND METHODS

One fist size sample was delivered to NGU marked "Mugla Tepe" No further information is known other than the sample is from the Mugla area in south-western Turkey.

The sample was analysed using the following methods:

1) Chemical analysis by XRF performed at A/S Olivin laboratory facilities in Åheim.
2) Thin section analysis with mineral description and photography, in NGU laboratory, 2 thin sections were produced, one of the Mugla Tepe sample and one of the Åheim rock for comparison.
3) Mineral analyses of selected olivine crystals in the thin section.

3. GEOLOGICAL SETTING

The exact locality is not known, however it is evident that the sample originates from one of the numerous peridotite bodies in the Lycian Tauride mountains of south-western Turkey. This area comprises of several thrust sheets, in which mafic and ultramafic rocks of the Marmaris ophiolite are major rock units (Collins & Robertsson 1998). This area is famous for its large number of ultramafic rock bodies often associated with chromite mineralisation and mining.

4. RESULTS

4.1 Chemical analysis

The rock was analysed by XRF at A/S Olivin laboratory, Loss on ignition was determinedby heating the sample at 900º C for 30 min.

Table 1: Chemical analysis of Mugla Tepe sample and comparison with Mugla-Idil average composition (Gautneb & Furuhaug 2000)

Samples	Sample 1	***Average values from Mugla-IDIL
ELEMENT	% CONTENT	% CONTENT
MgO	44,2	45,3
SiO_2	40,4	41,9
Fe_2O_3	7,8	8,7
Cr_2O_3	0,35	0,40
Al_2O_3	0,36	0,84
NiO	0,30	0,30
MnO	0,10	0,11
CaO	0,36	0,89
L.O.I	6,63	2,09
Na_2O	0,02	0,04
K_2O	0,00	0,00

The Mugla Tepe sample has a rather high loss on ignition. A mineralogically pure serpentine mineral would have a loss on ignition of about 13%. This shows that the Tepe samples have a degree of serpentinisation of about 50%. The main elements show low Ca, Na and K, an indication that the primary rock was a relatively pure dunitic rock.

4.2 Thin section description

The mineral content in the Mugla Tepe rock was determined by standard point counting and the results are shown in Table 2. A micro photo is shown in Fig 1. For comparison a micro photo of the Åheim rock is shown in Fig. 2.

Table 2: Modal mineral content in Mugla Tepe rock

Mineral	Vol. %
Olivine	83.0
Serpentine	11.7
Enstatite	4.5
Chromite	0.5
Magnetite	0.3

The Mugla Tepe rock is clearly quite serpentinised, and is dissected by a network of serpentine veins. These veins are randomly oriented and pervasive in the rock. The primary texture is still observable. The rock has a MgO content of 44.2%

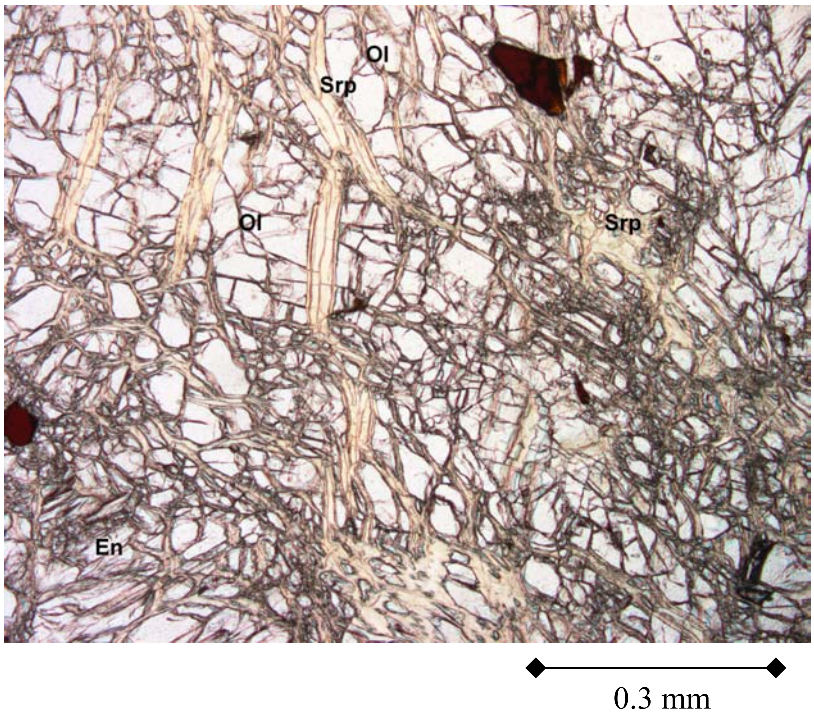

Figure 1: Micro photo of Mugla Tepe sample, veins of serpentine in light yellow are clearly visible between fractured olivine grains (Ol = olivine, Srp = serpentine, en = enstatite).

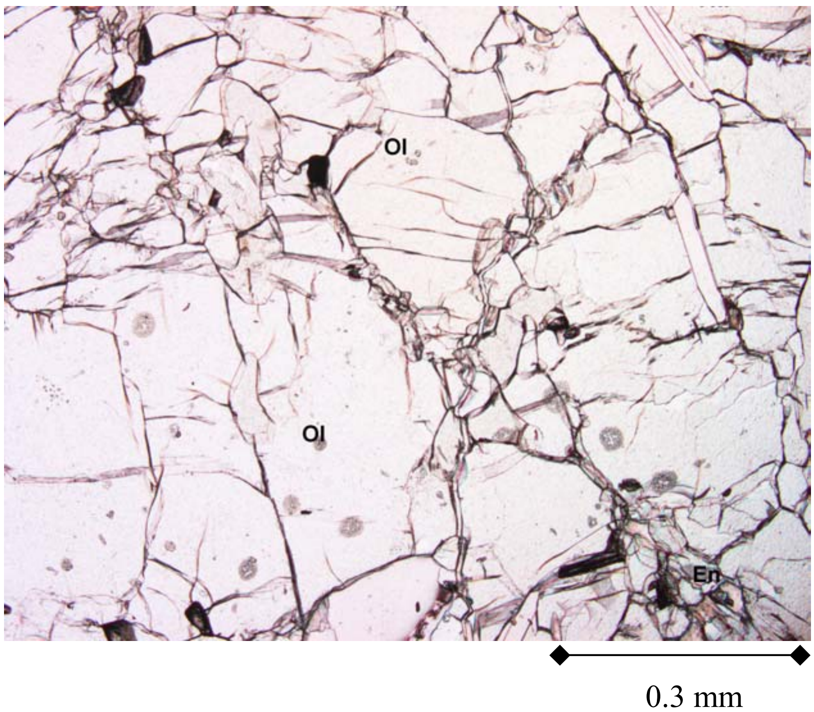

Figure 2: Micro photo of Åheim dunite, uniform and unaltered grains of olivine occurs together with scattered grains of enstatite. (Ol = olivine, En = enstatite).

The grain sizes of the primary olivine grains have been in the order of 0.1–0.3 mm. The primary rock seems to have been a homogenous dunite. The content of enstatite was measured to 4%. Scattered grains of chromite are observed and small grains of magnetite (0.05-0.1mm) are observed within the serpentine veins.

For comparison we include a micro photo of the Åheim dunite. (Fig. 2). This rock is completely without traces of serpentine and is a homogenous rock, the grain contacts and mineral texture show that the rocks has crystallised during high pressure conditions.

4.3 Chemical composition of olivine crystals

Some few grains of olivine were analysed by SEM using standard EDS methods. The results are shown in table 3.

The olivine crystals in the Mugla Tepe rock contain lower Mg and higher Fe than the Åheim rock: This results in lower forsterite component (%Fo), which is about 86% in the Mugla Tepe and about 88% in the Åheim rocks.

Table 3: Composition of individual olivine grains in Mugla Tepe and Åheim rocks

Mineral	MgO	SiO_2	CaO	Cr_2O_4	MnO	FeO	NiO	Total	%Fo
Mugla Tepe 1	48.81	40.84	0.05	0.06	Bd	8.02	0.41	98.15	85.89
Mugla Tepe 2	49.12	41.07	bd	0.03	0.15	8.04	0.63	98.96	85.93
Mugla Tepe 3	48.75	41.20	0.04	0.04	0.11	8.00	0.31	98.45	85.90
Åheim 1	50.84	42.87	0.06	0.01	0.02	6.68	0.44	100.91	88.39
Åheim 2	50.48	41.87	0.00	0.33	0.17	6.95	0.38	100.18	87.90
Åheim 3	51.06	42.41	bd	0.02	0.03	6.65	0.33	100.02	88.48

Bd = below detection limit

The difference in olivine composition between Mugla Tepe and Åheim rocks, is as expected as ultramafic rocks with their origin as part of an ophiolite is in general slightly less Mg rich than rocks formed deep in the mantle.

5. CONCLUSIONS

Chemical and mineralogical analyses of a sample from Mugla Tepe, Turkey show that this rock is a serpentinised dunite, the degree of serpentinisation is about 50% (LOI = 6.63). The primary rock has been a homogenous dunite with about 4% of enstatite, total alkali content is 0.02 %. Ophiolite hosted ultramafic rocks are known to be quite inhomogenous at a larger scale (tens of metres). These results may therefore not necessarily be representative for a larger volume of Mugla Tepe rocks. Mapping and detailed sampling would be essential to give a representative description of the locality.

6. REFERENCES

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