A Note on the Field Occurrence of a Large Eclogite on Hareid, Sunnmöre, Western Norway*

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B. O. Mysen & K. S. Heier: A note on the field occurrence of a large eclogite on Hareid, Sunnmöre, Western Norway. *Norsk Geologisk Tidsskrift*, Vol. 51, pp. 93–96. Oslo 1971.

The field occurrence of a large eclogite is described. The Ulsteinvik-Dimnöy eclogite has a total length of 6 km with a width between 200 and 1500 meters. The petrography of the eclogite and country rock gneisses is briefly described.

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Introduction

This paper presents a geological map and petrographic description of an unusually large eclogite body occurring in gneisses on Hareid, Western Norway. A detailed geochemical and petrological study of the eclogite is in progress.

The eclogite of Hareidland was first noted by Eskola (1921) and is referred to in later reviews (e.g. Gjelsvik 1951, Bryhni 1966, McDougall & Green 1964). However, it has not been studied in any detail, and the occurrence on Dimnöy of what is interpreted here as the same eclogite body has not previously been recognized. The Hareidland-Dimnöy eclogite is undoubtedly the largest continuous eclogite body so far described in literature. This large eclogite, which is referred to here as the Ulsteinvik-Dimnöy eclogite, is separated from a smaller eclogite, the Hareidseidet eclogite, some 3 km to the east. It is probable that the Ulsteinvik-Dimnöy eclogite and the Hareidseidet eclogite are parts of the same body (Fig. 1). The total length of the two limbs of the Ulsteinvik-Dimnöy eclogite is about 6 km with a width varying between 200 and 1500 meters.

The eclogites are commonly concordant to the foliation of the enclosing dioritic and garnet biotite gneiss. There are no signs of discordant movements along the contacts, but hydrous mineral phases are more abundant in the eclogite close to the gneiss contacts.

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* Publication No. 25 in the Norwegian geotraverse project.

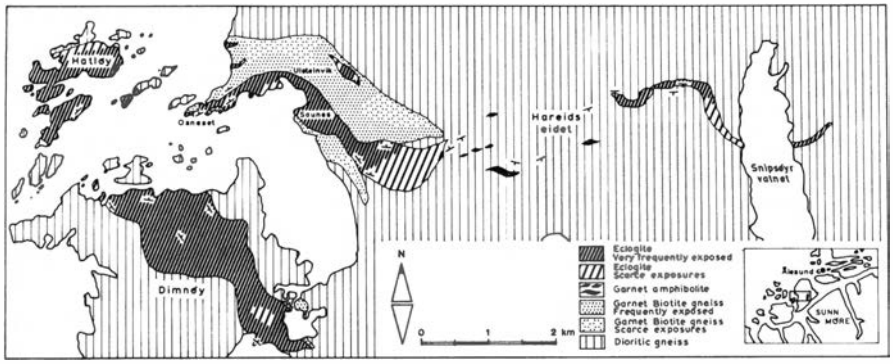

Fig. 1. The field occurrence of the eclogite bodies on Hareid, Sunnmöre, Western Norway.

The Ulsteinvik-Dimnöy body is generally well exposed. The Dimnöy part and the islands around Hatlöy are almost 100 percent outcrop. The north limb, from Osneset, through Ulsteinvik and about 1 km inland, is also well exposed. The easternmost 700 meters are heavily covered by vegetation, but its termination is exposed and has been accurately mapped.

The eclogite occurs as a pinch and swell structure folded together with the gneisses in the Ulsteinvik syncline (see Gjelsvik 1951). It is distinctly banded, and the bands are contorted and tightly folded. The banding is evidenced by variable size and frequency of the garnet porphyroblasts and is best studied on the shores of Osneset.

The Hareidseidet and Ulsteinvik-Dimnöy eclogites are separated by a heavily covered area. The few outcrops are of garnetiferous amphibolite of eclogitic appearance surrounded by dioritic, foliated gneisses.

The Hareidseidet eclogite appears as a band in foliated, sometimes migmatitic, dioritic gneiss and is parallel to the foliation of the gneiss country rock. The first 1.5 km eastwards is fairly well exposed in a steep slope, whereas the next kilometer is covered by scree containing blocks of eclogite. Eastwards from Snipsöyrvatnet outcrops are again rather frequent and define its termination to within 20 meters.

Only minor lenses of quartz-garnet-pegmatites occur in the area. The elongated lenses are generally parallel to the banding of the eclogites and the gneiss/eclogite contacts.

Petrography

Eclogite. Except for the increasing amounts of amphibole and biotite in the eclogites towards the gneisses, they are both mineralogically and texturally rather homogeneous.

Three minerals predominate in the eclogites. Two to eight mm large, red,

corroded garnets are found in a very fine-grained symplectite structure of nonpleochroic diopside and slightly zoned plagioclase (An_{20-30}). The diopside is sometimes uralitized or recrystallized to pleochroic, actinolitic amphibole. Further reaction to brown biotite may also be observed.

The garnets contain approximately 7 to 10 percent MgO, 22 to 24 percent FeO, and 8 to 13 percent CaO, and exhibit only slight zoning.

Inclusions of quartz and rutile are common in the garnets. The quartz grains are usually surrounded by a clinopyroxene rim. The rutile appears as trains of small needles. Hypidiomorphic omphacites, containing up to 7.8 percent Na_2O, are also conspicuous inclusions in the garnets. This is the only occurrence of omphacite, which elsewhere is broken down into diopside-plagioclase (see Kushiro 1965, 1969).

Complexes of Ti-bearing magnetite, zoned plagioclase and variable amounts of actinolitic amphibole occur along fractures within the garnets. Sometimes spinel, clinopyroxene and plagioclase appear instead. Kelyphite rims around garnets are characteristic features of the rocks (Bryhni 1969).

Kyanite, sometimes twisted, and surrounded by a symplectite-like intergrowth of spinel (Fe⟩Mg), and zoned plagioclase (oligoclase-andesine), occurs within the plagioclase-diopside symplectite (see Wickström 1970).

Accessories are apatite, very pure calcite, ilmenite, phyrotite, pyrite and quartz.

Ilmenite is usually rimmed by sphene while quartz in contact with garnet is rimmed by common hornblende, or sodium bearing clinopyroxene.

The gneisses

The country rock is a tectonically deformed dioritic gneiss and a less-deformed garnet-biotite gneiss.

All transitions between the two kinds occur, but sharp boundaries are also observed.

Plagioclase (oligoclase) is usually the major constituent of both gneisses.

K-feldspar (microcline) is more frequent in the dioritic variety and is found locally enriched in narrow bands (less than 1 m).

Microperthites and antiperthites are common. In the dioritic gneiss myrmekite is developed.

Common hornblende and actinolitic amphibole occur in both gneisses. However, they are more frequent in the garnet bearing variety.

1–5 mm, slightly pinkish, unaltered garnets are more almandine-rich in the garnet-biotite gneiss than in the eclogites. The inclusions are predominantly of quartz in apparent equilibrium with the host mineral.

Accessories are kyanite (at times rimmed with a symplectite-like zone of spinel and zoned plagioclase), quartz, ilmenite, calcite, apatite, muscovite, and clinozoizite.

A detailed petrological and geochemical study of the eclogites is in progress and will be presented later.

ACKNOWLEDGEMENTS. We would like to thank Dr. D. H. Green and Dr. W. L. Griffin for stimulating discussions and suggestions during this work. We also wish to acknowledge Dr. P. W. Weigand for critically reading the manuscript and correcting the English.

14 October 1970

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REVIEW – *NY LITTERATUR*

Sammlung geologischer Führer

HANS PICHLER: *Italienische Vulkangebiete I, Somma-Vesuv, Latium, Toscana XIII,* 258 sider, 48 figs., 9 plansjer, DM 37,50.

Italienische Vulkanbegiete II, Phlegräische Felder, Ischia, Ponza-Inseln, Roccamonfina X, 186 sider, 50 figs., 6 plansjer, DM 34,00.
(Gebr. Bornträger, Berlin, Stuttgart 1970).

I flere generasjoner har norske geologer vært interessert i vulkanologi. Dette kommer först og fremst av at Brögger gjorde Oslo-feltet til et klassisk område ved sine studier av de sub-vulkanske bergarter og av de eruptive effusiver. Arbeidet har vært fortsatt til denne dag med påvisning av cauldrons, innsynkningsområder, ring dikes og gangtog. I de senere år har de nordiske islandsekskursjoner stillet en lang rekke unge geologer overfor den levende vulkanisme, som på Island på en enestående måte dekker hele spektret fra de voldsomme spalte-utbrudd og Surtseys födsel til den betagende termalvirksomhet: geysirer, fumaroler, solfatarer og stille, rykende laugar med grönnblått vann kantet av hvite sinterskorper. Som prikken over i'en har Norges utpost mot nordvest, Jan Mayen, plutselig tendt, og et oseanisk storutbrudd undersökes og studeres.

Alt dette gjör at et annet klassisk vulkanområde, Italia, har påkalt levende interesse.

La meg med én gang si at disse to geologische Führer er noe av det beste jeg har lest ikke bare som håndböker og innföring i den italienske vulkanisme, men også generelt sett som vulkanologisk litteratur. Under *Vorword* og *Überblick* finner man i et nötteskall alle viktige vulkanologiske fakta, nomenklatur, systematikk, magmaers sammensetning og genese, vulkanismens relasjon til tektogenese og bergartsdannelse. Her er ingen rutinemessig oppramsning; gjennem hele teksten legges vekt på den genetiske sammenheng; på basis av mineralbestand (fenokrysts og grunnmasse) diskuteres differentiasjonsretninger, kontaktsoner beskrives og benyttes som temperaturindikatorer. Alt dette kommer med uten å fortrenge de detaljer som er nyttige for en besökende geolog. Eksempelvis beskrives i detalj de berömte soffioni-områder ved Larderello i Toscana. Dampens kjemiske sammensetning angis, hvorav særlig innholdet av borsyre og ammoniak er av betydning; produksjonsstatistikken viser en utvinning av 8 mill. tonn borsyre + boraks + ammoniumsulfat + etc. Dampen fra 180 borhull ledes nu gjennem turbiner og anslutte generatorer og leverer (1961) 2300 mill. kWh (= 4 % av Italias energibehov). Det rent praktiske er heller ikke glemt: »Zwecks Betriebsbesichtigung wende man sich an die Società Boracifera di Larderello, Firenze/Toscana. Empfehlenswerte Übernachtungsmöglichkeit in Larderello: »Stazione Termale la Perla« (mit Naturdampfheizung und Thermal-Wasser Schwimmbad). Man versäume nicht, das Museum in Larderello zu besuchen«.

Alt dette kan man lese om i to relativt små böker. Jeg har aldri funnet så mange relevante opplysninger og så megen kunnskap konsentrert i en tekst som samtidig er lettlest og engasjerende.

Alle geologer som reiser til Italia *må* skaffe seg disse to böker.

T. F. W. Barth.