

OCCURRENCE OF GABBRO-WEHRLITE NEAR LOCHALSH, ONTARIO

M. H. FROHBURG, *Macassa Mines, Limited, Toronto, Ontario.*

ABSTRACT

Gabbro-wehrlite consisting of more than 80% dark constituents, but in excess of 10% plagioclase, forms the marginal facies of a mela-olivine gabbro intrusion near Lochalsh, about 150 miles north of Sault Ste. Marie, Ontario. This exceptionally fresh rock is of interest as a link between the gabbro and peridotite clans.

In his report on the iron deposits of the Missinaibi map area, E. Thompson¹ mentioned the occurrence of peridotite at the northwest end of Dog Lake, about 1½ miles southeast of the Canadian Pacific Railway station Lochalsh. The intrusive body is roughly elliptical in outline, with its major axis striking almost due east. It is slightly over one mile long and up to 1,500 ft. wide, forming a prominent ridge rising more than 300 ft. above the level of Dog Lake. Thompson described this remarkably fresh basic rock as consisting essentially of pyroxene and olivine, with lesser quantities of plagioclase and biotite, and some serpentine and hornblende as secondary products.

The present writer investigated the occurrence referred to by Thompson, in connection with a search for war-important minerals. Microscopic examination of a considerable number of samples taken at various points of the intrusion revealed that its plagioclase content exceeds the amount of leucocratic constituents allowed by most petrographers in rocks classed as peridotites. Actually the mass consists of a core bearing from 20 to 45% plagioclase, and a more melanocratic border zone averaging less than 20% plagioclase. In no instance was the feldspar content less than 10% of the total constituents.

According to the amount of feldspar present, the intrusive ranges in composition from a mela-olivine gabbro (3312 P) to a rock approaching wehrlite. Following Johannsen's classification,² the marginal facies may be termed gabbro-wehrlite (3'312) as a rock containing in excess of 80% but less than 95% dark constituents. With an average content of more than 60% olivine, the border zone represents a rather unusual rock linking the gabbro and peridotite clans.

The marginal facies has a mean width of approximately 300 ft. and attains about 700 ft. at the east and west ends of the intrusive body, respectively. The change from the mela-gabbro core to the gabbro-wehrlite

¹ Collins, W. H., Quirke, T. T., and Thompson, Ellis, Michipicoten iron ranges: *Can. Geol. Surv., Mem.* 147, 152 (1926).

² Johannsen, A., *A Descriptive Petrography of the Igneous Rocks*, I, insert slip, p. 145 (1931).

border is gradational though in places the transition appears in less than 50 ft.

Megascopically, the gabbro-wehrlite is a massive, dark-green to dark-

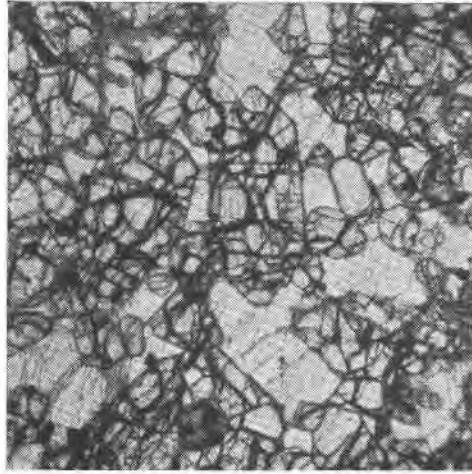


FIG. 1. Thin section of gabbro-lherzolite showing olivine (gray, high relief), bytownite (light-gray, low relief), and iron ore (black). $\times 22$. One Nicol.

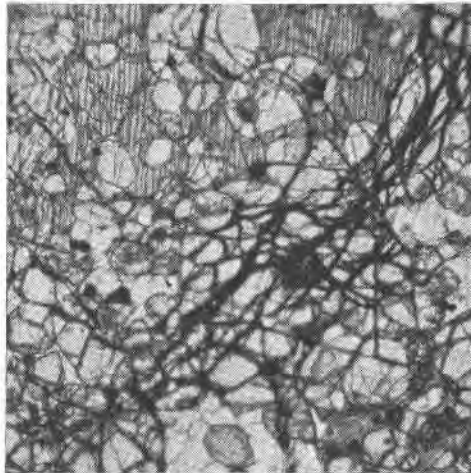


FIG. 2. Thin section of gabbro-lherzolite showing olivine (medium-gray, high relief), augite (dark-gray, distinct cleavage), bytownite (light-gray, low relief) and iron ore (black). $\times 23$. One Nicol.

gray rock. More exposed surfaces generally are somewhat lighter in color, owing to a bleaching of the feldspar. In contrast to the rather coarse appearance of the mela-gabbro, the gabbro-wehrlite gives the impression of a fine-grained rock although reflected light discloses scattered poikilitic cleavage surfaces of pyroxene up to $\frac{3}{4}$ centimeter long.

The microscopic texture of the gabbro-wehrlite is characterized by a hypautomorphic pattern of plagioclase and pyroxene several millimeters in diameter, which contain abundant poikilitic inclusions of olivine.

The fine-grained appearance of the rock in the hand specimen is accounted for by the fact that quantitatively speaking the olivine inclusions exceed the host minerals plagioclase and pyroxene. Occasionally the pyroxene encloses not only olivine but also more or less corroded small laths of plagioclase. Apatite, magnetite and chromite form automorphic crystals of microscopic size, the ores occurring mainly in the olivine.

At places there are indications of what might be called a banded texture. Individual bands are generally quite irregular and extend only short distances. They appear to be a primary feature and owe their origin to a process by which the light or dark components were slightly concentrated. This texture is prominent in the mela-gabbro facies (Fig. 3). Light colored irregular masses up to 3 ft. in diameter resembling fragments were observed in the center of the intrusion. Here and there dikes consisting of essential bytownite and accessory diallage were seen traversing both the gabbro-wehrlite and mela-gabbro. According to microscopic evidence, these dikes were formed after the consolidation of the two main facies.

Under the microscope, the primary constituents of the gabbro-wehrlite are olivine, bytownite, augite, biotite, pigeonite, chromite, magnetite, and apatite, named in the order of their abundance. Secondary minerals include serpentine, talc, chlorite, hornblende, iddingsite, carbonate and magnetite. The alteration products rarely exceed 10% of the total components, and in some thin sections are less than 1%.

The constituents of the gabbro-wehrlite are essentially the same as those observed in the mela-gabbro facies, the difference in the composition of the two rocks being due to the smaller plagioclase content in the outer portion of the intrusion.

Under the microscope, olivine, the most abundant constituent, appears as more or less well developed crystals representing doubly terminated prisms (Fig. 1). Their size varies from 0.1 to 3.0 millimeters, the average being approximately 0.4 millimeter. Many individuals show signs of magmatic corrosion, particularly those enclosed in pyroxene. The mineral is clear and colorless in transmitted light. In general there is extraordi-

narily little alteration of the olivine except on more exposed surfaces, but even here the development of serpentine has only infrequently advanced beyond the initial stage.

The plagioclase is a colorless bytownite close to Ab_1An_3 in composition. It occurs as polysynthetic twins after the albite law. Pericline twinning is not uncommon, but combinations of albite and Carlsbad twins are rare. Individuals average about 2 millimeters in diameter and attain



FIG. 3. Banded texture of mela-gabbro facies. Note late labradorite dikelets (white).
Horizontal width of picture about 7 ft.

a maximum size of 5 millimeters. In most thin sections, the plagioclase is traversed by numerous cracks radiating from the olivine inclusions, even where the latter appear to be quite fresh.

The microscope reveals the presence of two clinopyroxenes. Predominating is augite which forms xenomorphic individuals up to $\frac{3}{4}$ centimeter long. It shows distinct pleochroism in brownish shades, rather strong birefringence, positive optical character, $2V = \text{ca. } 65^\circ$, and $Z \wedge c = 48^\circ$.

In some thin sections, the augite is accompanied by small amounts of pigeonite. Its optical properties include weak pleochroism, moderate to low birefringence, positive optical character, $2V = \text{ca. } 50^\circ$, and $Z \wedge c = 40^\circ$. The mineral shows a tendency to be automorphic.

At places the pyroxenes have been altered to a greenish hornblende. The secondary nature of the hornblende is attested to by the fact that it penetrates the pyroxene in fibers.

Strongly pleochroic, reddish-brown biotite occurs as an accessory in the form of irregular flakes intergrown with the other dark constituents. Some flakes attain a size of 3 millimeters, being visible in the hand specimen. In slides of weathered gabbro-wehrlite, biotite may be observed along cleavage planes in pyroxene and in cracks traversing olivine. This secondary biotite is commonly associated with irregular aggregates of secondary magnetite.

Chromite and magnetite occur in sharp, small crystals in olivine and, to a minor extent, in the other constituents. Some secondary magnetite was observed in partially decomposed olivine and pyroxene. It forms small irregular aggregates intimately associated with the other decomposition products.

Though persistent the chromite content rarely exceeds 1%. It is interesting to note that on the average the gabbro-wehrlite border zone carries more chromite than the mela-gabbro core. According to the observations of the writer, however, there are no indications of chromite concentrations in the portions of the intrusion that are accessible to examination.

Apatite is present in exceedingly small quantities. It forms minute, more or less corroded prisms.

The order of crystallization of the primary constituents of the gabbro-wehrlite is ores, apatite, olivine, pigeonite, plagioclase, augite, biotite.

Specimens from different points of the border zone show certain variations in the proportions of the primary minerals of the gabbro-wehrlite. Rosiwal counts gave the following range expressed in volume percentages: olivine 55 to 75%, bytownite 11 to 21%, pyroxene 6 to 22%, biotite 0 to 2%, ores 0.7 to 3.2%. The following average figures were obtained from 18 thin sections: olivine 61%, bytownite 18.5%, pyroxene 12.4%, biotite 1.6%, ores 1.8%, serpentine and other secondary products 5.1%.

The age relations of the intrusive body consisting of gabbro-wehrlite and mela-olivine-gabbro to the surrounding rock formations are somewhat obscured by the fact that its periphery is largely buried under talus slopes and glacial debris. The older rocks are essentially Keewatin volcanics which in places are invaded by minor masses of pink granite. At one point, tongues of the latter were seen to be cut off by the basic intrusion.

Several dikes of fresh quartz diabase striking in a northwesterly direction can be traced close to the gabbro-wehrlite border. Their older age

CHEMICAL ANALYSIS OF GABBRO-WEHRLITE FROM NW-FLANK OF
"PERIDOTITE HILL" NEAR LOCHALSH

SiO ₂	41.38
Al ₂ O ₃	6.00
Fe ₂ O ₃	2.16
FeO	10.23
MgO	31.89
CaO	4.13
Na ₂ O	.76
K ₂ O	.08
H ₂ O+	2.19
H ₂ O-	.10
CO ₂	.40
TiO ₂	.28
P ₂ O ₅	.04
Cr ₂ O ₃	.40
MnO	.18

100.22

Spec. Grav. 3.144

Analysts R. B. Ellestad and B. Smith, Minneapolis

may be inferred from the fact that no quartz diabase dikes are observed traversing the basic mass.

At the west end of the prominent ridge composed of olivine rich rock, the gabbro-wehrlite border zone is cut by a dike of coarse olivine gabbro about 40 ft. wide. Striking approximately northwest this dike resembles lithologically the late olivine diabase intrusions found in the region east of Lake Superior.

The foregoing evidence places the age of the ultra-basic body between the intrusion of the quartz diabase and olivine diabase dikes. Both are generally regarded as Keweenawan. The mineralogical composition and extraordinary freshness point toward a possible affiliation with the olivine diabase intrusions.

ACKNOWLEDGMENTS

The writer is greatly indebted to Dr. F. F. Grout, Minneapolis, for the photomicrographs and helpful criticism in connection with the preparation of this paper.