

## CONDENSED GEOLOGIC LOG FOR DDH SE-1

The hole was drilled at an angle of 51°, and an azimuth of 90°.

### 0'-66' Overburden.

**66'-401' Rhythmic layered(?) fine, medium and coarse-grained subophitic poikilitic gabbro with brecciated recrystallized textures and dark grey plagioclase.** Size-graded layering is indicated by increase and decrease of grain size downhole. At places the question arises whether the plagioclase is recrystallized or if there is an intrusion of very fine-grained gabbro or anorthosite into the fine to coarse-grained rock. Intercalations of the laminated sections increase in abundance towards the lower part of this zone. Veins and dikes of 0.02'-2.5' thickness of fine to medium-grained pink granophyric alkali granite, amphibole granite and tonalite occur all through this section. Intercalations of zoned veins up to 0.8' thick with quartz-microcline-carbonate-chlorite-epidote-saussurite cores, associated with fine-grained syenite and aplite and surrounded by epigabbro, occur at 240.6'-322'.

**401'-954' Mainly olivine-bearing rocks; olivine gabbros, troctolites and olivine-bearing anorthositic rocks.** These rocks alternate as a result of graded mineral layering. Micro-gabbros occur as intercalations of veins and clots. Rather persistent occurrence of alkalifeldspar frequently associated with apatite and quartz at 400'-750'. Olivine-graded layering culminating with picritic and ultramafic layers at 488'-664'. At 516'-623' intercalations of olivine-poor pegmatoidal anorthosite occur with dark coarse-grained plagioclase and grey fine to medium-grained intergranular plagioclase. The lower 10' carry biotite booklets and show pink discolouration of plagioclase.

Mixed zone of brecciated and recrystallized layered olivine-bearing anorthositic rocks, olivine gabbros, troctolites and anorthosites with ragged contacts at 680'-954'. As a whole, the plagioclase is lighter coloured than higher up in the drill hole. Plagioclase and pyroxene xenocrysts and traces of chalcopyrite occur in the upper 32'. At 680'-776' intercalations of veins of coarse-grained to pegmatoidal anorthosite, pyroxenite, amphibole-bearing granophyric granite, quartz and carbonate-chlorite occur. Up to 3' intercalations of cataclastic rock with secondary Fe-Mg hydrosilicates are present at 691'-735'. Intercalations of up to 2.2' of granite and diorite veins and dikes occur at 822'-875'. Intercalations of sulfide-bearing oxide and oxide-rich lenses of gabbroic composition are observed at 808'-967'.

**954'-1057' Mainly anorthositic rocks with diorite intrusion at 955'-1007' and intrusion of very fine-grained granular oxide-grabbro and anorthosite at 1033'-1042'.**

**1057'-1344 T.D.' Layered(?) alternation of mottled plagioclase-oxide gabbro, fine to medium-grained plagioclase xenocryst gabbro and medium-grained gabbro and anorthosite with intercalations of laminated plagioclase layers.** Overall the rock is brecciated and thoroughly recrystallized along veins.

1072.4' Pumpellyite (X-Ray Diffraction) bearing hydrothermally altered granophyre dikelet. Olivine bearing intercalations at 1129'-1147' and 1244'-1262'. Rather continuous stretches of white altered plagioclase, wherein hair-line plagioclase and granite veinlets pinch out in intergranular material at 1163'-1263'. Up to 1' thick intercalations of granophyric granites occur at 1167'-1191'. Up to 2.5' thick intervals of pegmatoids with ilmenite sheet-form crystals are present at 1255'-1259'. Cataclastic and mylonitic zones cemented by quartz associated with pseudomorphs after pyroxene consisting of Mg-Fe hydrosilicates including biotite occur at 1281'-1285' and 1329'-1336'. Granodiorite, tonalite and quartz-microcline veins rimmed by carbonate-chlorite-zeolite (?) are found at 1281'-1344'.

The layering makes an angle of 20-30° to the core axis. Cross-cutting dikes and veinlets have angles to core axis varying from 20-70°. Breaks in geochemical trends are indicated by TiO<sub>2</sub> and Pd content as well as the Cu/Cu + Ni ratio. TiO<sub>2</sub> shows breaks at about 950' and about 570' as reflected by sharp increases above these depths with gradually diminishing values further upwards. The Cu/Cu + Ni ratio shows the same trends at about 1050' and about 570'. Pd reflects breaks at about 900' and about 570', with elevated values in between which might be an indication of a potential zone of interest with a Pt kick of 120 ppb at the base. Additional elevated values found in this zone are for Cu, Ni, Co, Cr, Sb, C, Au, S, Rb, Zr, Th and U. The zone below 900' is interesting in that it is characterized by high Cl + F values of between 530 and 2000 ppm. A possible outlier of this zone was found between 906.6' and 808.8' with combined Cl and F of 1925 ppm.

## PETROGRAPHY OF MAIN ROCK TYPES DDH SE-1

### Poikilitic gabbros

These medium to coarse-grained brecciated-appearing rocks with recrystallized subophitic texture and locally developed plagioclase lamination occur in the upper and lower part of the drill hole. **PLAGIOCLASE** shows a bimodal distribution of grain size, occurs as up to 7.5 mm xenocrysts having a composition of An 75-78%, in a medium-grained subophitic groundmass with a composition of An 42-56%. Layering is reflected by a gradual increase downwards of the xenocryst content and ends in a coarse-grained rock with void fillings of medium-grained subophitic gabbro. The macroscopically dark grey **PLAGIOCLASE** crystals are heavily clouded with very fine **SEMI-OPAQUE** inclusions in the upper and lower part of the drill hole section and these display a patchy, normal and cyclic zoning, and occasional patches of basic composition parallel to (010). Twinning follows the albite, Carlsbad, pericline and acline laws. In the lower part of the drill hole, there are composition planes of twinning at an angle of 45° to (010). **CLINOPYROXENE** occurs as cumulus crystals as well as oikocrysts up to 1.5 cm across, showing symplectic exsolution and recrystallization patterns of **CLINOPYROXENE-ORTHOPYROXENE-PLAGIOCLASE** and **OXIDE ± RED-BROWN BIOTITE** and **OLIVE-GREEN HORNBLENDE**. **ORTHOPYROXENE** occurs as patchy recrystallized oikocrysts above 400'. **OLIVINE** may occur as

inclusions in the *CLINO-PYROXENE*. *ILMENITE* and *MAGNETITE* occur in roughly equal amounts and the former is partly surrounded by the latter. The granular to subhedral *OXIDE* crystals have reaction rims of *RED-BROWN BIOTITE* and *CLINOPYROXENE* symplectic with *PLAGIOCLASE*. The average modal composition of these rocks is 45-70% plagioclase, 20-45% clinopyroxene and 5-10% oxide.

#### **Olivine gabbro and troctolite**

These are medium-grained, subophitic textured rocks which occur mainly between 400' and 954'. The *PLAGIOCLASE* has anorthite contents varying between 42% and 68% with a concentration of values around 55%. The crystals are less clouded than those of the overlying poikilitic gabbros. Patchy zoning and a composition of An 75% coincides with darker clouded parts of the crystals, as do oriented inclusions of *RUTILE* needles. The *PLAGIOCLASE* crystals exhibit cyclic zoning and simple twinning following the (001) plane additionally to twinning described in the foregoing section. *CLINOPYROXENE* occurs as inclusions parallel to the (010) plane and as cumulus crystals and oikocrysts. The latter are dusted with numerous fine *OPAQUE* inclusions and are frequently exsolved as described in the section above. *OLIVINE* has multiple coronas of *PYROXENE*, *PYROXENE SYMPLECTITE* and *GREENISH BIOTITE* from the inside-outwards. These reaction rims embay *OLIVINE* and may eventually replace it completely. *PYROXENE SYMPLECTITE* also occurs as a corroding intercumulus agent with respect to *PLAGIOCLASE*. Ultramafic patches and lenses may occur as picrite and dunite, with or without *ALKALI FELDSPAR* and *APATITE*. The *OXIDES* may form oikocrysts and discrete smaller crystals surrounded by red-brown *BIOTITE* or stout euhedral *APATITE* prisms. Sheet-form oikocrysts of oxide may occur as graphic intergrowths with *PLAGIOCLASE*. *ORTHOCLASE-SANIDINE*  $\pm$  euhedral *APATITE* and *QUARTZ* may occur in amounts of up to 5% in voids or as selvages around *PLAGIOCLASE* with *BIOTITE* and *OXIDE*. The average modal composition of these rocks is 50-75% plagioclase, 5-30% clinopyroxene, trace to 45% olivine and 3-10% oxide.

#### **Anorthosite and troctolitic anorthosite**

These coarse-grained rocks occur mainly between 692' and 1058', straddling the olivine gabbros, troctolites and underlying poikilitic gabbros. *PLAGIOCLASE*, of composition An 30-66%, exhibits, in addition to the patterns described above in the poikilitic gabbros, a crosshatch twinning following the (010) and the (001) planes as well as patchy zoning. Inclusions of *CLINOPYROXENE*, *ORTHOPIROXENE*, *OLIVINE-BROWN HORNBLende* and *OPAQUES* show a tendency to follow the crystal outline. Up to 5% *CLINOPYROXENE* may occur as oikocrysts and as equant crystals rimmed by *ORTHOPIROXENE*. *ORTHOPIROXENE* can also occur as discrete crystals. Up to 5% *OLIVINE* forms stringers surrounding and cross-cutting *PLAGIOCLASE*. *OXIDE* occurs as symplectic intergrowths with *PYROXENE*. *CLINOPYROXENE-BROWNISH HORNBLende-OPAQUES* and *APATITE* form veins and clots which are postcumulus with respect to *PLAGIOCLASE*. The anorthosites and poikilitic gabbros underwent rather strong recrystallization as is indicated by phenomena described in a later section on recrystallized rocks.

#### **Pegmatoids**

These rocks locally show *PLAGIOCLASE* lamination and occur mainly between 516'-565' and 939'-950'. The *PLAGIOCLASE* with anorthite contents ranging from 35-47% to 68-70% may show heavy clouding and cyclic zoning, the latter coinciding with zones containing *CLINOPYROXENE-OPAQUE-APATITE* inclusions. In addition to the twinning patterns described under the heading of poikilitic gabbros, twinning is also present as a crosshatch pattern on the (010), and (001), and simple composition planes with an angle of 45° to (010). Prismatic or tabular crystals are also intergrown following a configuration of crosslings. *CLINOPYROXENE* occurs as large strongly exsolved oikocrysts or as part of fine to coarse-grained complex intergrowths of *PYROXENE SYMPLECTITE*, *OPAQUE*, *APATITE*, *ORTHOCLASE*, *BIOTITE*  $\pm$  *QUARTZ*  $\pm$  *OLIVINE*  $\pm$  *ORTHOPIROXENE*. *CLINOPYROXENE* displays locally dense clouding with *OPAQUE* mineral inclusions. *ORTHOPIROXENE* is found as large subhedral crystals.

At 557.3' cavity fillings are found with *CALCITE*, *TALC*, *BIOTITE* and *ANTIGORITE* (X-Ray Diffraction). *ILMENITE* comprises up to 80% of the oxide and is surrounded by *MAGNETITE* with *ILMENITE* exsolution lamellae. Christmas tree-form symplectic intergrowth of *OXIDE* with recrystallized *PLAGIOCLASE* and *PYROXENE* is common and is locally associated with *APATITE* and *ALKALIFELDSPAR* concentrations. *ILMENITE* sheets may reach dimensions up to 2.5" between 1255' and 1259'. The main sulfide mineral, *CHALCOPYRITE*, is intergrown with *PYRRHOTITE*. It occurs in *ILMENITE* and *PYROXENE*, mainly along crystal boundaries. Occasionally, *ARSENOPYRITE* prisms are observed between *CHALCOPYRITE*, *PYRRHOTITE* and a variety of spinel. *PYRITE* occurs along cracks in *PYROXENE*. The composition of these rocks varies around plagioclase 25-40%, clinopyroxene 5-35%, orthopyroxene trace-45%, oxide about 15-30% and traces of sulfide. Anorthositic compositions have been found as well.

#### **Recrystallized subophitic microgabbro**

These fine-grained slightly hornfelsic rocks are found mainly between 600' and 940'. The anorthite content of *PLAGIOCLASE* in these rocks falls in two ranges, namely, 31-36% and 52-55%. Euhedral *PLAGIOCLASE* phenocrysts with inclusions of *RUTILE* needles are twinned following the albite law. The *PLAGIOCLASE* of the groundmass has subophitic to subparallel texture and is mostly twinned following the albite and Carlsbad laws. The crystals show patchy zoning coinciding with dusty patches and are intergrown with *APATITE* needles, *ALKALIFELDSPAR* and *CLINOPYROXENE*. Locally, granular recrystallization with *CLINOPYROXENE* and *ORTHOPIROXENE* can be observed. *ORTHOPIROXENE* oikocrysts up to 1.3 cm and crowded with *OPAQUE* grains are occasionally present. These are rimmed with a corona of *CLINOPYROXENE* at the inside and *BROWN HORNBLende* at the outside. *ORTHOPIROXENE* may also occur as poikiloblasts enclosing *PLAGIOCLASE*. *OLIVE-BROWN HORNBLende* forms poikiloblastic to granuloblastic aggregates overgrowing the subophitic texture of groundmass. A strong increase of *HORNBLende* content towards the contacts of granite dikes and veins was also observed. *RED-BROWN BIOTITE* forms

poikiloblasts overgrowing *HORNBLende* and *PYROXENE*. *OXIDES* occur as small subhedral to anhedral grains, evenly dispersed and enclosed by *SILICATES*. In one sample at 601.70', xenoliths of anorthosite(?), charnockite, different kinds of gabbro, ultramafics and pyroxene with rims of hydrous Fe-Mg silicates are observed. The composition of these rocks averages 20-50% plagioclase, 35-55% clinopyroxene, trace-30% orthopyroxene, 5-50% amphibole, trace-5% biotite, trace olivine, trace-5% alkalifeldspar and about 10% oxide.

### Oxide-rich gabbros

These fine-grained rocks occur as lenses ranging up to 1.4' in thickness and probably have an intrusive relationship with anorthositic rocks between 808' and 967'. The *PLAGIOCLASE* has a questionable anorthite content of 32% and 52%. It is slightly clouded and altered and may also occur as oikocrysts. The crystals are twinned following the albite law and may have oriented diaper-form colourless inclusions. *ORTHOPYROXENE* and *GREENISH-GREY CLINOPYROXENE* form granular aggregates. *ILMENITE* constitutes about 65% of oxide and may occur in symplectic intergrowth with *MAGNETITE* and *SILICATES*. *MAGNETITE* may occur as discrete crystals, with a few *ILMENITE* exsolution lamellae, and surrounding *ILMENITE*. The major sulfides, *CHALCOPYRITE* and *PYRRHOTITE*, are occasionally intergrown with *PYRITE* and *PENTLANDITE*. *PYRITE* is occasionally associated with *ARSENOPYRITE*. *PYRRHOTITE* may show the same kind of possible replacement by *MARCASITE* and *PYRITE* as observed in DDH FHL-1. The *SULFIDES* are mostly intergrown with *OXIDES* and occur as minute specks in *PYROXENE*. The modal composition of these rocks varies from 15-45% plagioclase, 25-45% orthopyroxene + clino-pyroxene, 30-40% oxide and tr-10% sulfides. At 829.6'-830.3' a Pt + Pd kick (170 ppb) was found with elevated values for S, Sb, V, Cr, Ni, Cu, Rb, Zr, Th, U and a Cu/Cu + Ni ratio of 0.89. At 117.4'-117.90' a modal layered oxide bearing gabbro occurs with *PLAGIOCLASE* of composition An 44-47%, which is laminated and shows compaction of tabular *PLAGIOCLASE*, on prismatic *ORTHOPYROXENE* cumulus paralleling the *PLAGIOCLASE* lamination. The composition of these rocks varies from 45-55% plagioclase, 35-45% clinopyroxene, 3-5% orthopyroxene, 2-3% biotite, 1-2% apatite and about 10% oxide. On a microscopic scale, layers of oxide gabbro, with a composition of 50% plagioclase, 25% clinopyroxene, 25% oxide and 2-3% apatite are intercalated. This plagioclase orthopyroxene cumulate resembles rocks found in the upper part of DDH NE-2.

### Alkalifeldspar-quartz-apatite intercumulus

These minerals occur as void fillings and filaments between *PLAGIOCLASE*, mainly in the interval from 400'-750', in poikilitic gabbro, olivine-bearing gabbro, troctolite, anorthositic rocks, anorthosites and recrystallized microgabbros. Aggregates of *THESE MINERALS* ± *RED-BROWN BIOTITE* ± *OLIVE-GREEN HORNBLende* and *OXIDE* may constitute up to about 5% of the rock. The *APATITE* has developed as coarse-grained euhedral prisms and the alkalifeldspar is of the *SANIDINE-ORTHOCLASE* variety (-2V less than or equal to about 30°).

### Recrystallized, high-temperature, anhydrous textures

These are best developed in macroscopic breccia-like, medium to coarse-grained varieties of the previously described rocks, especially between the top of the hole and 300' and from 700' to the bottom of the hole. The most characteristic features, on a microscopic scale, are fine-grained veins which occur in strongly altered *PLAGIOCLASE* domains having a composition of An 56-75%. The altered aspect is reflected by diffuse and spotted extinction as well as ragged twin composition planes. In the less altered parts of *PLAGIOCLASE*, a crosshatch twin pattern on the (010) and the (001) is present. In the altered zones the coarse-grained *PLAGIOCLASE* crystals, composition An 56%, may gradually develop as fine-grained and very fine-grained granular mosaics, composition An 56%, dissecting the larger *PLAGIOCLASE* crystals and filling voids. *CLINOPYROXENE* oikocrysts can concomitantly show increase in size and intensity of exsolved domains. Next, there is an increase in greenish tones of *CLINOPYROXENE* and *PLAGIOCLASE* inclusions appear in the *PYROXENE* crystals that have assumed the habit of poikiloblasts. The poikiloblasts continue to break up into smaller granular aggregates to end as fine-grained granuloblastic intergrowths of *CLINOPYROXENE* ± *ORTHOPYROXENE* + *PLAGIOCLASE* + *BIOTITE* + *OPAQUE*. These aggregates are sometimes overgrown by *ORTHOPYROXENE* porphyroblasts with coronas of *RED-BROWN BIOTITE* and *OPAQUE* minerals. Inclusions of *CLINOPYROXENE* and *BROWNISH HORNBLende* are oriented in *PLAGIOCLASE* along the (010) and (001), and non-crystallographic directions ± *SANIDINE*, *ORTHOCLASE*, *BIOTITE* and *OPAUQUES*, forming a network of veins connected with voids and intergranular spaces filled with recrystallized material. *OLIVINE* and *ORTHOPYROXENE* participate as well in the recrystallization process. *ILMENITE* occurs as symplectic intergrowths with recrystallized *CLINOPYROXENE* and *PLAGIOCLASE*. These rocks have considerable similarity with the igneous breccia described in DDH NE-2 at a depth of 250'-354' and also with certain features of recrystallization in *PLAGIOCLASE* crystals of anorthosite described in the same drill hole.

### Recrystallized, low-temperature, hydrous textures

Near granite veins and dikes, *BROWN-GREEN HORNBLende* and *BROWN BIOTITE* seem to overtake the process of gradual unmixing and recrystallization of *CLINOPYROXENE* and *ORTHOPYROXENE* oikocrysts, by replacing part of the exsolved phases and ending with poikiloblastic overgrowth of *GREY-BROWN HORNBLende*. Aggregates of *ACTINOLITIC HORNBLende*, *POIKILITIC BROWN BIOTITE* ± *APATITE* ± *QUARTZ* ± *SPHENE*, are formed as well.

### Epimetamorphic or hydrothermally altered gabbros

These rocks show patchy replacement of *PLAGIOCLASE*, composition An3%, by *CARBONATE*, *COLOURLESS MICA*, *SPHERULITIC CHLORITE*, *ACTINOLITIC HORNBLende*, *EPIDOTE/ZOISITE*, *SPHENE*, *ORTHOCLASE* and probably *ZEOLITE*. The *SPHENE* is crowded with numerous unmixed short prismatic *RUTILE* inclusions.

## Granitoids

### *Granophyric alkalifeldspar granite*

These rocks occur mainly between 66' and 423'. The *PLAGIOCLASE* seems to be replaced by *ORTHOCLASE*. The *QUARTZ* content goes up to about 60%. At 361.5' almost complete replacement by *PUMPELLEITE* (X-ray diffraction) was observed. *BROWN BIOTITE* and *OPAQUE* minerals are associated with short, rounded, prismatic *ZIRCON*, *EPIDOTE/ZOISITE*, and *ALLANITE* (?) aggregates.

### *Amphibole granite.*

These hypidiomorphic granular rocks occur mainly between 730' and 760'. The *PLAGIOCLASE* phenocrysts, composition An 20-30%, are rounded, corroded, and twinned following albite, Carlsbad and acline laws. They also display patchy saussuritization. *ORTHOCLASE* is anhedral and twinned following Carlsbad law. *QUARTZ* is lensoid and graphically intergrown. *OLIVE-GREEN* to *BROWN HORNBLende* has a slightly porphyroblastic and graphic appearance. *BIOTITE* is of the brown variety.

### *Diorite.*

A cross-cutting intrusion was observed between 999.5' and 1006.70' in sharp contact with gabbroic anorthosite. The *PLAGIOCLASE* is strongly zoned, composition An 20% (rim) to An 50%, and twinned following the albite and Carlsbad laws. *QUARTZ*, up to 5% present, is intergranular and intergrown with *PLAGIOCLASE*. *ORTHOPYROXENE* occurs as large crystals and is rimmed by *OLIVE-GREEN HORNBLende*. *CLINOPYROXENE* is granular and the exsolved phase is partly replaced by *HORNBLende*. *OLIVE-GREEN HORNBLende* forms large oikocrysts enclosing *PLAGIOCLASE*. *RED-BROWN BIOTITE* forms poikiloblasts and encloses *APATITE*. *APATITE* occurs as short euhedral to subhedral prisms. *OPAQUE* minerals occur as evenly distributed anhedral crystals.

### *Alkali zircon granite.*

One sample of this rock was described at 920.8' overlying an oxide-rich gabbro lens. *QUARTZ* and *ORTHOCLASE* occur in these rocks as symplectic intergrowths. *CLINOPYROXENE* is a greenish-greyish variety and *BIOTITE* has yellow-brown colours. *ZIRCON* occurs as a major mineral along the contact with the oxide-rich gabbro in the form of medium to coarse-grained euhedral prisms. *APATITE* is present as small prisms. *ILMENITE* is the main oxide and occurs in symplectic intergrowth with *SILICATES* along the contact. *CHALCOPYRITE* is intergrown with *PYRRHOTITE* and occurs mainly along the contact with oxide-rich gabbro and is intergrown with *ZIRCON* and *OXIDES*.

## Acid Tests

Footage	Angle with Horizontal
100'	49°
200'	47°
500'	42°
800'	40°
1000'	36°
1345'	34°

**Notes:** Twenty-nine thin sections and fourteen polished thin sections were made from this drill hole. A total number of sixteen rock samples were assayed. Analytical results follow in Table SE-1.

## CONDENSED GEOLOGIC LOG AND PETROGRAPHY FOR DDH FHL-1

The hole was drilled at an angle of 61° and an azimuth of 263°.

### 0'-129' Overburden.

**129'-189' Fine-grained and medium-grained mottled troctolite.** This unit is made up of layered alternations and subtle mixtures of fine and medium-grained mottled troctolite transected by partly saussuritized anorthosite veins and pegmatoidal intercalations showing hydrothermal alteration. *PLAGIOCLASE*, composition An 62-80%, is cumulus textured with normal, patchy and occasionally inversed zoning and twinning following albite, Carlsbad, acline and pericline laws. This pattern of twinning is repeated in the rock types described below. *OLIVINE* cumulus is *FORSTERITE*, -2V = 80-90°. Pink *CLINOPYROXENE* is anhedral and developed as oikocrysts against the basic rims of plagioclase in mottled troctolite. *ILMENITE* is present as oikocrysts and replaces part of the *OLIVINE*. *MAGNETITE* surrounds and is intergrown with *ILMENITE*. The fine-grained anorthosite has *PLAGIOCLASE* with an anorthite content of 65%, and is found in subparallel recrystallization. Intercalations of hydrothermally altered pegmatoids constitute about 10% of this unit. These are distinguished by reddish-brown *BIOTITE* poikiloblasts with inclusions of *APATITE* and *PREHNITE*, overgrowing secondary formed *CUMINGTONITE*, *ACTINOLITIC AMPHIBOLE* and *CHLORITE*. Disseminated *PYRRHOTITE* and *CHALCOPYRITE*, grading up to 10% in the pegmatoids, replace altered *PLAGIOCLASE*. *PYRRHOTITE* is replaced by *PYRITE* and *MARCASITE*. *ILMENITE* occurs as poikiloblasts in *BIOTITE*. Veins of hydrous Fe-Mg silicate transecting fresh troctolite reflect hydrothermal conduits. The average sulfide content is about 0.5%.

### 189'-323' Igneous and hornfelsic troctolites

This unit is composed of a mixture of medium to coarse-grained olivine gabbro-norite and troctolite, fine-grained hornfelsic olivine gabbro-norite and troctolite, with intercalations of pegmatoidal norite, orthopyroxenite, picrite, olivine gabbro-norite, contaminant rock and sulfide lenses. Apart from the occurrences in lenses as matrix and massive *PYRRHOTITE* + *CHALCOPYRITE* + *PENTLANDITE*, *SULFIDES* in this unit occur as blebs and clots. The pegmatoidal and contaminant rocks are frequently hydrothermally altered.

### Medium to coarse-grained troctolites and olivine gabbro-norites.

The *PLAGIOCLASE*, composition An 70-85%, is twinned following the albite and Carlsbad laws. *OLIVINE* is developed as fair-sized cumulus crystals. *ORTHOPYROXENE* is present as large oikocrysts, enclosing *PLAGIOCLASE* and *OLIVINE*. *CLINOPYROXENE* with numerous opaque needles may surround *OLIVINE* as well. A slightly differing variety includes pericline and acline twinning of *PLAGIOCLASE* with An contents down to 62%, and has