

**Notes:** A detailed log is available for study. Four thin sections and three polished thin sections were made. Four core samples were assayed. Point analyses of coarse-grained ultramafics at depths of about 194' and 232.2' yielded copper and gold contents of 0.75-1.75% and 11-380 ppb, respectively and 1-4 ppm silver at 134.9', 194.3', 202' and 232.2'. The analytical results follow in Table BL-1.

## CONDENSED GEOLOGIC LOG FOR DDH IS-1

The hole was drilled at a 90° angle (vertical).

### 0'-109' Overburden.

**109'-121.3'** Mixed section of medium to coarse-grained laminated and chalcopyrite-bearing oxide gabbro and fine to medium-grained oxide-rich gabbro, with cross-cutting coarse-grained anorthosite veins(?).

**121.3'-169.4'** Alternation of mainly oxide-rich equant microgabbro having plagioclase xenocrysts and medium to coarse-grained brecciated gabbro, with cross-cutting medium to coarse-grained chalcopyrite-bearing clinopyroxene-magnetite veins and clots. Magnetite is present in a selvage against microgabbro. Mineral mode is variable. Fine-grained rocks range from 50-80% plagioclase, 15-25% clinopyroxene (locally both clinopyroxene and orthopyroxene are present in a ratio of approximately 3:1), 5-25% opaques and up to 1% apatite. Coarse-grained rocks generally are 50-60% plagioclase (locally 75-80%), 15-30% clinopyroxene, 5-20% opaques, and a trace of biotite. Veins are up to 60% pyroxene, 25% plagioclase, 5+ % opaques, and possibly olivine(?) to 5%. Trace of disseminated sulfides are present throughout.

**169.4'-218.7'** A mixture of equant microgabbro, medium-grained gabbro with plagioclase and (brecciated anorthosite) xenoliths, laminated anorthositic gabbro and very fine-grained microgabbro or hornfels.

At 213.1'-218.7' coarse-grained leucocrate chalcopyrite-bearing brecciated polyschematic rock occurs composed of coarse-grained plagioclase + apatite + clinopyroxene with intergranular graphic granite.

Mineral mode of medium-grained to coarse-grained rock has a range of: 60-90% plagioclase, 3-20% clinopyroxene, 1-20% opaques, and trace-1% apatite. Fine grained to very fine-grained zones have a mineral mode generally in the range of 70-90% plagioclase, 5-20% clinopyroxene, 4-15% opaques and less than 1% apatite. One zone, in the upper part of this interval, has a mineral mode of 40% opaques, 30% plagioclase, 30% clinopyroxene, and a trace of apatite. Three polished sections gave the following range of values for opaque minerals: 45-70% magnetite, 25-39% ilmenite, 0-25% pyrrhotite, and a trace-5% chalcopyrite. The mineral

mode of xenoliths is approximately 60% pyroxene and 40% plagioclase. Two of the polished sections were taken from the hornfelsed fine-grained to very fine-grained rocks, and one came from an oxide-rich vein.

**218.7'-440.6'** Equant microgabbro with coarse-grained pyroxenite-oxide veins and clots with very fine-grained hornfelsic(?) intercalations.

Very fine-grained greenish gabbro intercalation with strongly pleochroic orthopyroxene at 262.3'-277.7'. Chalcopyrite showings, associated with coarse-grained pyroxenite veins with strongly pleochroic orthopyroxene at 300'-307'. Relatively high concentration of pyroxenite veins and clots which are bornite and chalcopyrite-bearing at 359'-406.5'. Section with many flattened leucocrate xenoliths at 388'-396.4'.

Sulfides occur as fine disseminations, scattered blebs and interstitial concentrations, mostly associated with flattened xenoliths and veins with the coarser-grained pyroxene-rich oxide-bearing segregations. Chalcopyrite is generally most abundant followed by pyrrhotite, bornite and possibly pyrite. The mineral mode of the oxide-bearing microgabbro ranges generally from 60-90% plagioclase; 5-25% pyroxene, of which up to 10% may be orthopyroxene and the remainder clinopyroxene; 5-15% opaques; trace-1% apatite.

The mineral mode of the coarser grained oxide-bearing pyroxenite veins ranges from: 65-90% pyroxene, of which 25% may be orthopyroxene; 1-30% plagioclase; and 1-30% opaques.

Examination of three polished sections gave the following range of opaque mineral modes: microgabbros (2 locations) - 60-85% magnetite, 10-40% ilmenite, 0-.5% chalcopyrite; veinlets (1 location) - 30% magnetite, 10% ilmenite, 50% chalcopyrite, 5% bornite, 5% pyrite(?); pyroxenite (1 location) - 24% magnetite, 6% ilmenite, 70% pyrrhotite; flattened xenoliths (1 location) - 10% magnetite/ilmenite, 75% bornite, 15% chalcopyrite.

**440.6'-458.2'** T.D. Intrusive breccia of fine to medium-grained gabbro and coarse-grained gabbro to anorthosite with intergranular quartz. Plagioclase xenocrysts up to 3.5 cm in length. Scattered small grains and blebs of chalcopyrite, apparently associated with zones of oxide-rich gabbroic anorthosite. Mineral mode: plagioclase 85-90%; clinopyroxene 10-15%; oxides .5-1%; biotite, trace.

**Notes:** A detailed log is available for study. Twenty-seven thin section and seven polished thin sections were made. Gold values of 1-1.1 ppm were found at 170.2', 301.8' and 167.1'. Thirteen rock samples were assayed. The analytical results follow in Table IS-1.

## CONDENSED GEOLOGIC LOG FOR DDH R-1

The hole was drilled at a 90° angle (vertical).

**0'-69' Overburden.**

**69'-207.3' T.D. Amphibole schist.** Generally medium-grained to coarse-grained, moderately magnetic, composed of medium to dark greenish-black prismatic amphibole crystals in a white to gray plagioclase feldspar matrix. Amphibole crystals exhibit foliation of approximately 20° to core axis. Fracturing and alteration is fairly common. Fracture angles generally are either approximately parallel or perpendicular to foliation or both. Traces of sulfide occur as scattered disseminated grains. The mineral mode is somewhat variable and is in the range of: 57-74% amphibole; 20-35% plagioclase; 3-7% opaques; trace-3% biotite as individual flakes and as alterations of amphiboles; trace of chlorite alteration of amphiboles and biotite; and a trace of apatite.

Altered fracture zones occur at 73.3'-83.5', 83.5'-84.5', 113.5'-114.7', and 131.9'-154.4'. They are generally fractured or brecciated in appearance and lighter dull green in color. Fracture surfaces are often coated with minerals which differ somewhat from those forming the matrix. The mineral mode of the matrix has the following range in composition: Amphibole, 15-66%; plagioclase, 30-35%; biotite and biotite/chlorite, 1-50%; opaques, 3-5%; sulfides, trace as (py?) (cpy?). The mineral mode of the fracture coatings is: Calcite, up to 97%; quartz, 2-3%; biotite/chlorite, trace-1%; opaques, 1-2%; apatite, trace.

Basalt and porphyritic basalt dikes are present from 98.4'-99.7'; 154.4'-157.1'; 166.1'-182.0'. They are very fine-grained, porphyritic, mostly greenish gray, slightly magnetic, locally fractured and exhibit slight to moderate alteration. The approximate range of mineral mode is: Ferro-magnesian (probably actinolite), 45-54%; plagioclase (combined phenocrysts and groundmass), 35-40%; opaques, 5-20%; chlorite, trace-1%. The phenocrysts are mostly subhedral to euhedral plagioclase and occasional opaque minerals. Sulfide is occasionally visible and amounts to probably less than 1% as pyrite and chalcopyrite(?).

Several veins occur at 69.1', 83.5', 161.4', 191.8' and at 198.7' and range in thickness from a fraction of an inch to just under one foot. Two of these are filled with calcite and lesser amounts of highly sericitized plagioclase and dark reddish-brown biotite. One is bounded by very fine-grained quartz and the contact zone is a highly altered "grungy" red-brown biotite(?). The other veins are composed primarily of pegmatitic plagioclase (up to 30 mm crystals), quartz and biotite (books up to 12 mm across). The veins are both high and low angle and the mineral mode of the thickest vein is approximately: Plagioclase, 57-62%; quartz, 35-40%; biotite, 3%; opaques, trace. Epidote and chlorite alteration is occasionally present in some of the veins as well as are traces of pyrite and chalcopyrite.

**Notes:** Ten thin sections were made. A detailed log is available for study. Three rock samples were assayed. The analytical results follow in Table R-1.

## **CONDENSED GEOLOGIC LOG FOR DDH NE-2**

The hole was drilled at an angle of 48° and an azimuth of 90°.

**0'-36' Overburden.**

**36'-269'** **Mainly fine-grained olivine-bearing oxide gabbro and mela-olivine gabbro** with zones of plagioclase lamination, plagioclase xenocrysts, plagioclase veins and conformable and cross-cutting pyroxenite-oxide veins. Locally fine to medium-grained and medium-grained to coarse-grained members occur in the upper 50'. Joints have been observed with coatings of *THOMPSONITE* and *ANALCIME* both determined by X-Ray Diffraction. The fluorine, phosphorous, chromium, cobalt, vanadium and TiO<sub>2</sub> contents are slightly elevated compared with the underlying rocks.

**269'-354'** **Mainly brecciated coarse-grained oxide gabbro with pyroxenite and oxide veins** and clots and higher chromium, nickel and cobalt values than the remaining part of the drill core.

**354'-470'** **Slightly brecciated medium to coarse-grained oxide gabbro with plagioclase xenocrysts.**

**470'-1038' T.D. Layered medium to coarse-grained and fine-grained oxide, olivine bearing gabbro, oxide olivine gabbro, troctolite, and anorthosite** are the major rock types. They are mixed with zones of patchy pyroxene concentrations, olivine and clinopyroxene oikocrysts, plagioclase xenocrysts and ophitic textures. Brecciated intercalations with coarse-grained pyroxenite and oxide veins and clots occur as well. Approximately the last 50' are cataclastic and epimetamorphic with *LAUMONTITE* veins, determined by X-Ray Diffraction. 450'-477' contains intercalated zones exhibiting pink staining on plagioclase with relatively high potash (K<sub>2</sub>O = 1.88%) and veinlets having the following composition: MgO = 26.00%, Al<sub>2</sub>O<sub>3</sub> = 11.18%, SiO<sub>2</sub> = 49.68%, CaO = 2.77% and FeO = 10.43%. Analyses by Energy Disperser Spectrometer. The plagioclase lamination at 220' and the layering at 825' have an angle of respectively 60 and 90° with core axis.

## **PETROGRAPHY DDH NE-2**

The following major rock types were found in this drill hole.

### **Fine-grained oxide gabbro**

Fine-grained oxide gabbro, and occasionally oxide-rich olivine-bearing gabbro and mela-olivine gabbro are found between 36 and 268.5'. These are composed of anhedral to subhedral crystals with laminated to equant texture and isomodal layering of the coarser-grained oxide pyroxenite and fine-grained oxide gabbro.

The composition of the *PLAGIOCLASE* is An 42-47%, and occurs as lensoid aggregates which accentuate the layering. The crystals, like those in the other parts of the drill core, are twinned following albite, Carlsbad, and acline laws. *AP-*