Miscellaneous Release—Data 352

Petrology and Geochemistry of the Copper Bar Cu-Ni-PGE Prospect, Northwestern Ontario

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Summary

This document provides a brief overview of the geology of the Stuart Location copper-nickel-cobalt-platinum group element (PGE) property, which hosts the Stuart Location (also spelled as Stewart Location) copper-nickel-cobalt-PGE occurrence (MDI52A04SE00034: Ontario Geological Survey 2017) and the Copper Bar copper-nickel-platinum group element prospect. In addition, it summarizes geochemical data from the mafic intrusion (referred to as the Copper Bar dike, *see* Puumala et al. 2017) that hosts the Copper Bar prospect and provides a brief interpretation of the geochemical and petrographic data on the dike obtained by the study of Melchiorre (2017). A total of 22 samples were collected from surface exposures in order to characterize the petrology and geochemical footprint of the Copper Bar copper-nickel-platinum group element prospect and place the Copper Bar dike and its associated mineralization within the context of the North American Mesoproterozoic Midcontinent Rift (MCR).

The Copper Bar prospect is located in Pardee Township, approximately 45 km southwest of Thunder Bay, Ontario. Access is obtained by travelling south from Thunder Bay along Highway 61 to the junction of Highway 593. Once there, travel approximately 2.8 km west along Highway 593 to a gated property access road on the north side of the highway. The mineralized showings can be accessed by all-terrain vehicle using a network of bush roads and trails.

The area surrounding the Copper Bar prospect is underlain by Paleoproterozoic sedimentary rocks of the Rove Formation (sandstone, siltstone and shale) that have been intruded by Mesoproterozoic intrusive igneous rocks that were emplaced during the Midcontinent Rift event at *circa* 1100 Ma (Geul 1970; Smith and Sutcliffe 1989). These intrusive rocks include the Logan sills and the Pigeon River dikes (Geul 1970; Smith and Sutcliffe 1989). The most prominent intrusion in the immediate area is a Pigeon River dike, striking 055°, which forms a major (up to 180 m high) topographic ridge immediately to the south of the Copper Bar prospect (Furlong and Miller 1971). This dike (referred to below as the Stuart Location dike) is up to 250 m wide and has a strike length in excess of 8 km (Geul 1970). The Copper Bar dike, an approximately 600 m long intrusion, is parallel to the Stuart Location dike, and likely is also a part of the Pigeon River dike swarm. The general geology of the Copper Bar area is shown on Figure 1.

Copper, nickel and PGE mineralization is hosted in the Copper Bar dike. Historic mineral exploration activity along the Copper Bar dike included the blasting of a minimum of 5 exploration trenches. However, information about the historic assay results from those trenches is limited to a report of a grab sample that assayed a combined 0.72% Cu + Ni (Furlong and Miller 1971). The exploration history, geology and mineralization of the Copper Bar prospect were recently summarized in an Ontario Geological Survey property visit report (Puumala et al. 2017). Several grab samples were collected from the Copper Bar trenches during the OGS property visit, with reported assay values of up to 3467 ppm Cu, 2243 ppm Ni, 471 ppm Co, 59 ppb Pt and 68 ppb Pd (*see* Table 19 *in* Puumala et al. 2017).

A total of 22 grab samples were collected for this study. Twenty of these samples were obtained from the Copper Bar dike, whereas 2 additional samples (MM-021 and MM-022) were collected from mineralized

zones within the Stuart Location dike to allow for a mineralogical and geochemical comparison between the 2 intrusions.

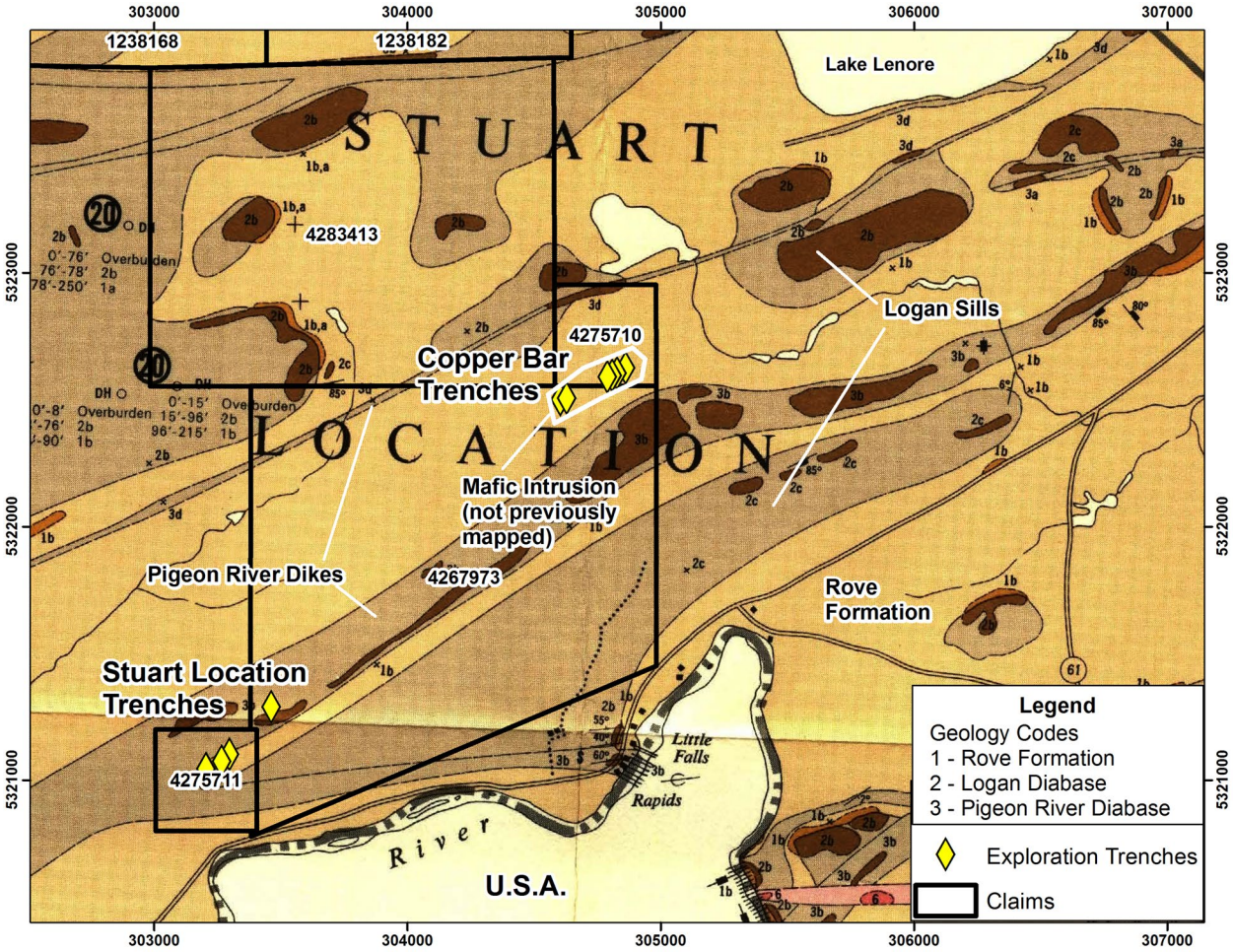

Figure 1. Geology of the Copper Bar prospect area (geology *from* Geul 1970). Twenty of the samples included in this study were collected from the Copper Bar trenches, whereas 2 samples were collected from the Stuart Location trenches. The Logan sills and the Pigeon River dikes are equivalent to the Logan diabase and Pigeon River diabase in the legend. Figure *from* Puumala et al. (2017). Universal Transverse Mercator (UTM) co-ordinates are provided using North American Datum 1983 (NAD83) in Zone 16.

The Copper Bar dike is a tholeiitic diabase intrusion, with a sub-ophitic texture of plagioclase and pyroxene (primarily orthopyroxene). Sulphide mineralization in the dike occurs as fine- to medium-grained blebs. Fine-grained disseminations of chalcopyrite, pyrite and sphalerite occur throughout the dike, with secondary chalcopyrite present in fractures in the more intensely altered samples.

Three mineralization groups can be distinguished petrographically and geochemically. Group 1 corresponds to the more altered portions of the dike where complex mineralization is observed, with galena, pyrrhotite, pyrite, magnetite, sphalerite, bornite, chalcopyrite, covellite, chalcocite and pentlandite with other trace sulphide mineralization. Group 2 comprises relatively unaltered samples with a sub-ophitic texture. Mineralization in group 2 is minimal, usually occurring as fine-grained disseminations of chalcopyrite, sphalerite and pyrite. Group 3 consists of a single coarse-grained sample with overprinting blebby magnetite, pyrolusite and ilmenite phases.

Comparison of the Copper Bar dike and the Stuart Location dike samples (MM-001 to MM-020 and MM-021 to MM-022, respectively) showed geochemical and petrographic similarities between the two, though of the 2 samples collected from the Stuart Location dike, sample MM-021 displayed geochemical characteristics of intense alteration and element mobility and contained >80% sulphides. Thus, it was omitted from the sample set used to evaluate the geochemical evolution of the dike. Sample MM-021 also contained a concentration of sulphide minerals that was not observed at surface in the Copper Bar dike. Sample MM-022 plotted within the same field as the Copper Bar dike samples in all geochemical plots (not shown), including La/Sm_{cn} versus Gd/Yb_{cn} and Al_2O_3 versus TiO_2, which were used to compare the Copper Bar dike to other Midcontinent Rift intrusions in the Thunder Bay area. Petrography of the Copper Bar and Stuart Location samples showed similar characteristics of a dark-coloured, fine- to medium-grained sub-ophitic diabase containing a general mineral assemblage of plagioclase and pyroxene dominated matrix, with mineralization consisting of pyrrhotite and chalcopyrite with minor sphalerite, pyrite and magnetite.

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PETROGRAPHY - Thin Section Descriptions

MM-001 - Copper Bar dike

Mineralogy, Grain Size and Modal Percent (%)	Description
Plagioclase fine to medium grained (40%) Pyroxene fine to medium grained (23%) Pyrrhotite fine to medium grained (10%) Pentlandite fine grained (5%) Chalcopyrite fine grained (10%) Sphalerite fine grained (2%) Biotite fine grained (10%)	*Rock Type*: Diabase *Hand Sample Description:* White-grey (weathered) and black (fresh), fine-grained, sub-ophitic diabase. Predominantly composed of 40% white-grey plagioclase and 23% altered pyroxene forming the primary sub-ophitic texture. Nonmagnetic to weakly magnetic. Light brown sericite alteration is present between grains and overprinting plagioclase. Mineralization occurs as fine- to medium-grained blebs of chalcopyrite, sphalerite, pyrrhotite and pentlandite. *Thin Section Description:* Plagioclase and pyroxene are fine to medium grained and form a sub-ophitic texture. Minor granophyric texture in the plagioclase suggests the presence of quartz, though no individual quartz crystals were seen unless they were forming the granophyric texture with plagioclase. Two varieties of plagioclase are present: labradorite occurs as cream-coloured laths, mostly corroded, and as white-grey albite twinned plagioclase laths. The pyrrhotite and pentlandite form the majority of the mineralization in the sample with minor sphalerite and chalcopyrite forming either as rims or replacements around the pyrrhotite-pentlandite blebs. Exsolution flame texture is noted in the pyrrhotite and pentlandite.

MM-002 - Copper Bar dike

Mineralogy, Grain Size and Modal Percent (%)	Description
Plagioclase fine to medium grained (55%) Pyroxene fine to medium grained (15%) Quartz fine grained (7%) Chalcopyrite fine grained (10%) Sphalerite fine grained (1%) Biotite fine grained (5%) Unknown lath shaped mineral (3%) Hematite (4%)	*Rock Type*: Diabase *Hand Sample Description:* White-grey (weathered) and black (fresh), fine-grained, sub-ophitic diabase. Predominantly composed of 55% white-grey plagioclase and 15% altered pyroxene forming the primary sub-ophitic texture. Nonmagnetic to weakly magnetic. Light brown sericite alteration is present between grains and overprinting plagioclase. Mineralization is fine grained and disseminated chalcopyrite and elongate sphalerite. A large pyrrhotite crystal seen in hand sample was not present in thin section. *Thin Section Description:* Less pyroxene in MM-002 than in MM-001 with plagioclase and pyroxene forming the dominant ophitic texture. Quartz is fine grained throughout sample, mostly forming granophyric texture with plagioclase. Biotite with red pleochroism forms fine-grained laths. Clinopyroxene occurs as large cream coloured laths and tabular crystals with orthopyroxene occurring as small higher birefringence grains throughout sample. Mineralization occurs mostly as fine-grained, disseminated sphalerite and chalcopyrite with a few lager blebby areas of galena with chalcopyrite exsolution. Hematite is less prevalent in this sample though it does rim some of the mineralization and is seen in fractures.

MM-003 - Copper Bar dike

Mineralogy, Grain Size and Modal Percent (%)	Description
Plagioclase fine to medium grained (45%) Pyroxene fine to medium grained (20%) Pyrrhotite (15%) Pyrite fine grained (3%) Chalcopyrite fine grained (5%) Biotite fine grained (5%) Hematite (2%) Serpentine (5%)	*Rock Type:* Diabase *Hand Sample Description:* White-grey (weathered) and black (fresh), fine-grained, sub-ophitic diabase. Predominantly composed of 45% white-grey plagioclase and 20% altered pyroxene forming the primary sub-ophitic texture. Light brown sericite alteration is present between grains and overprinting plagioclase. Pyrrhotite is nonmagnetic and shows some alteration; chalcopyrite formed along fractures within the pyrrhotite. *Thin Section Description:* Mineralization occurs in large isolated blebs of pyrrhotite, chalcopyrite in fractures, and minor pyrite with fine-grained sphalerite and chalcopyrite is disseminated throughout the sample. Micro-fracturing noted in pyrrhotite with intensifying deformation toward the centre of the grain. Sub-ophitic texture with plagioclase and pyroxene is present, trace hornblende and 90% serpentinized olivine. Orthopyroxene is the dominant pyroxene with elongate laths, although some are zoned with the rim displaying higher birefringence. Hematite in the sample occurs as botryoidal grains within fractures.

MM-004 - Copper Bar dike

Mineralogy, Grain Size and Modal Percent (%)	Description
Plagioclase fine to medium grained (35%) Quartz fine to medium grained (15%) Sanidine fine grained (5%) Pyroxene fine to medium grained (25%) Biotite fine to medium grained (10%) Sericite very fine grained (9%) Hematite fine grained (1%)	*Rock Type:* Diabase *Hand Sample Description:* White-grey (weathered) and black (fresh), fine- to medium-grained, sub-ophitic diabase. Predominantly composed of 35% white-grey plagioclase and 25% altered pyroxene forming the primary ophitic texture. Plagioclase crystals are tabular 0.1-2 mm in length. Hematite is seen on the weathered surface and along fractures. Light brown sericite alteration is present between grains and overprinting plagioclase. *Thin Section Description:* Plagioclase is fine to medium grained forming a sub-ophitic texture with pyroxene. It is partly to fully replaced by sericite or it forms a granophyric texture with quartz. Tabular elongate plagioclase crystals up to 2 mm are common and are arranged irregularly with no particular orientation. Orthopyroxene is fine to medium grained, tabular, subhedral, and highly fractured with sericite altering around and in fractures. No preferred orientation was observed in the pyroxene crystals. Hematite was found in secondary vugs and fractures, typically botryoidal. Biotite is found commonly as fine- to medium-grained laths randomly oriented throughout the sample. Biotite grew on the sides of the opaque mineral laths.

MM-005 - Copper Bar dike

Mineralogy, Grain Size and Modal Percent (%)	Description
Plagioclase fine to medium grained (40%) Pyroxene fine to medium grained (20%) Pyrrhotite medium grained (7%) Sphalerite fine grained (1%) Chalcopyrite fine grained (5%) Pumpellyite fine grained (5%) Chlorite fine grained (7%) Biotite fine to medium grained (10%) Hematite fine grained (5%)	*Rock Type: Diabase* *Hand Sample Description:* Grey to black, fine- to medium-grained, sub-ophitic diabase. 40% plagioclase, 20% pyroxene, with obvious sericitization in hand sample appearing as light brown alteration. Hematite is present on the weathered surface and along fractures. Grain size is slightly larger compared to samples (MM-001, MM-002, MM-003 and MM-004), likely because of this sample's location near the centre of the dike. *Thin Section Description:* Plagioclase and pyroxene form sub-ophitic texture and are subhedral with pervasive sericite alteration throughout the sample. Pumpellyite and chlorite occur around mineralization. Granophyric texture is also pervasive. Pyrrhotite, chalcopyrite and sphalerite share the same relationship as in the previous samples (MM-001, MM-002, MM-003 and MM-004), with chalcopyrite occurring in fractures in pyrrhotite and disseminated in sample with sphalerite.

MM-006 - Copper Bar dike

Mineralogy, Grain Size and Modal Percent (%)	Description
Plagioclase fine grained (40%) Pyroxene fine grained (25%) Pyrrhotite fine grained (13%) Sphalerite fine grained (2%) Chalcopyrite fine grained (10%) Biotite fine grained (10%)	*Rock Type:* Diabase *Hand Sample Description:* White-grey (weathered) and black (fresh), fine-grained, sub-ophitic diabase. 40% plagioclase 25% pyroxene with obvious sericitization in hand sample appearing as light brown alteration. Large 1.5 mm elongate plagioclase crystal noted next to a 2 by 2 mm bleb of very fine-grained diabase within the fine-grained diabase. *Thin Section Description:* Plagioclase and pyroxene form sub-ophitic texture and are subhedral with pervasive sericite alteration throughout the sample. Two distinct feldspar phases are present with 1 large, slightly altered, plagioclase crystal occurring next to a large blade of identical composition but significantly finer in grain size. Zoning is present in some plagioclase laths. Mineralization is fine grained and disseminated in this sample.

MM-007a - Copper Bar dike

Mineralogy, Grain Size and Modal Percent (%)	Description
Galena medium grained (3%) Chalcopyrite fine to medium grained (10%) Pyrrhotite fine to medium grained (10%) Hematite fine grained (5%) Sphalerite fine grained (2%) Plagioclase fine to medium grained (30%) Pyroxene fine to medium grained (20%) Biotite fine grained (8%) Quartz fine grained (7%) Pumpellyite fine grained (5%)	*Rock Type:* Diabase *Hand Sample Description:* Grey (weathered and black (fresh), fine-grained, sub-ophitic diabase. 30% plagioclase 20% pyroxene with obvious sericitization in hand sample appearing as light brown alteration. Sample is heavily mineralized with 25% blebby and disseminated galena, chalcopyrite and pyrrhotite. Weathered surface is fairly rusted with pits formed by washed-out minerals. *Thin Section Description:* Plagioclase and pyroxene dominate the groundmass, are moderately sericitized, and form a sub-ophitic texture. Granophyric texture is also abundant in this sample, specifically approximately 35% of plagioclase grains present. Minor pumpellyite is present with pyroxene partially rimming it. Galena is in contact with pyrrhotite separated by a chalcopyrite-filled fracture. Hematite fills minor fractures. Chalcopyrite rims pyrrhotite and also occurs as very fine-grained disseminations throughout the sample. It is also present in the galena in the sample, possibly as an exsolution phase.

MM-007b - Copper Bar dike

Mineralogy, Grain Size and Modal Percent (%)	Description
Galena medium grained (3%) Chalcopyrite fine to medium grained (10%) Hematite fine grained (5%) Pyrrhotite fine to medium grained (15%) Plagioclase fine to medium grained (30%) Pyroxene fine grained (15%) Biotite fine grained (5%) Quartz fine grained (7%) Pumpellyite fine grained (5%) Magnetite fine grained (6%)	*Rock Type:* Diabase *Hand Sample Description:* Grey (weathered and black (fresh), fine-grained, sub-ophitic diabase. 30% plagioclase 15% pyroxene with obvious sericitization in hand sample appearing as light brown alteration. Sample is strongly mineralized with 25% blebby and disseminated galena, chalcopyrite and pyrrhotite. Weathered surface of the sample is fairly rusted with pits formed by washed out minerals. *Thin Section Description:* Gangue minerals occur in the same habit as in sample MM-007a. Pyrrhotite is in contact with galena separated by a chalcopyrite-filled fracture.

MM-008 - Copper Bar dike

Mineralogy, Grain Size and Modal Percent (%)	Description
Sphalerite fine to medium grained (2%) Chalcopyrite fine grained (8%) Plagioclase medium grained (40%) Pyroxene fine to medium grained (30%) Biotite fine grained (10%) Pumpellyite fine grained (5%) Quartz fine grained (5%)	*Rock Type:* Gabbro or Diabase *Hand Sample Description:* White-grey (weathered surface), medium-grained gabbroic rock. Pyroxene (30%) and plagioclase (40%) form a sub-ophitic texture with fine-grained, disseminated mineralization and elongate sphalerite randomly oriented throughout sample. *Thin Section Description:* Equigranular sub-euhedral plagioclase forms a sub-ophitic texture with pyroxene; both are weakly sercitized. Granophyric texture is present affecting approximately 30% of the plagioclase grains. Minor anhedral quartz is present also.

MM-009 - Copper Bar dike

Mineralogy, Grain Size and Modal Percent (%)	Description
Pyrrhotite medium grained (17%) Sphalerite fine grained (1%) Chalcopyrite fine to medium grained (10%) Covellite fine grained (5%) Quartz fine grained (7%) Plagioclase medium grained (40%) Pyroxene fine to medium grained (15%) Biotite fine grained (5%) Pumpellyite fine grained (5%)	*Rock Type*: Diabase *Hand Sample Description:* Mineralized white-grey, medium-grained sub-ophitic diabase. Groundmass of sub-ophitic pyroxene and plagioclase with pyrrhotite mineralization throughout. Fine-grained chalcopyrite also disseminated in the sample. *Thin Section Description:* Plagioclase and pyroxene form sub-ophitic texture and are subhedral with pervasive sericite alteration throughout the sample. Mineralization occurs as blebby pyrrhotite rimmed by chalcopyrite. Chalcopyrite and sphalerite are disseminated throughout the sample. Covellite forms discrete grains in a deformed gangue mineral. Plagioclase and quartz form a moderately pervasive granophyric texture. All minerals in the sample are subhedral with partially corroded grain boundaries.

MM-010 - Copper Bar dike

Mineralogy, Grain Size and Modal Percent (%)	Description
Plagioclase fine grained (35%) Pyroxene fine grained (20%) Olivine fine grained (13%) Biotite fine grained (5%) Hornblende medium grained (5%) Pyrrhotite coarse grained (10%) Magnetite fine grained (6%) Chalcopyrite fine grained (6%)	*Rock Type:* Diabase *Hand Sample Description*: Dark grey, fine-grained diabase. Sample was taken from the margin of Copper Bar dike not far from sample MM-009 but this sample represents a much finer grained chill margin. One large bleb of pyrrhotite and chalcopyrite is present in the sample. *Thin Section Description:* Fine-grained plagioclase and pyroxene define a sub-ophitic texture with fine-grained olivine occurring randomly throughout the sample. Minor serpentinization of olivine is present, as well as minor sericitization of plagioclase. Plagioclase and pyroxene are anhedral to subhedral. A once coarse-grained hornblende crystal is now almost completely replaced by intergranular plagioclase. Mineralization consists of very fine-grained disseminated pyrite and magnetite and large blebby pyrrhotite. Ore minerals are brecciated by pervasive fractures but remain relatively close together.

MM-011 - Copper Bar dike

Mineralogy, Grain Size and Modal Percent (%)	Description
Plagioclase fine grained (45%) Pyroxene fine grained (25%) Olivine fine grained (10%) Biotite fine grained (5%) Pumpellyite fine grained (5%) Chalcopyrite fine grained (5%) Magnetite fine grained (5%)	*Rock Type:* Diabase *Hand Sample Description:* Dark grey, fine-grained diabase. Sample was taken from the margin of Copper Bar dike directly across from sample MM-010 and represents a similar fine-grained plagioclase- and pyroxene-dominated rock with less than 10% mineralization. Fine-grained disseminated chalcopyrite was observed in the hand sample. *Thin Section Description:* Fine-grained plagioclase and pyroxene define a sub-ophitic texture with fine-grained olivine occurring randomly throughout sample. Weak sericitization of plagioclase and minor serpentinization of olivine was noted. Plagioclase and pyroxene are anhedral to subhedral. Pumpellyite occurs as subhedral radial spots. Minor chalcopyrite and magnetite are disseminated throughout the sample.

MM-012 - Copper Bar dike

Mineralogy, Grain Size and Modal Percent (%)	Description
Plagioclase medium to coarse grained (35%) Pyroxene medium grained (20%) Hematite medium grained (15%) Biotite fine to medium grained (10%) Pumpellyite (10%) Chalcopyrite fine grained (3%) Pyrrhotite fine grained (5%) Magnetite fine grained (2%)	*Rock Type*: Diabase or gabbro *Hand Sample Description:* Dark grey-white, medium-grained sub-ophitic diabase. Sub-ophitic texture is readily visible with 1 to 3 mm grains of plagioclase within pyroxene. Hematite visible along fractures. *Thin Section Description:* Recognition of individual minerals in this thin section is difficult because of the high degree of sericitization and alteration present. Sericitization of plagioclase and pyroxene ranges from 30 to 70% and is pervasive throughout the sample. Hematite is very common, filling voids and fractures in the rock. Pumpellyite is more common in this sample than in any other samples (MM-001 to MM-011); radial pumpellyite is clustered and disseminated in sample. Trace disseminations of pyrrhotite, chalcopyrite and magnetite are also present.

MM-013 - Copper Bar dike

Mineralogy, Grain Size and Modal Percent (%)	Description
Plagioclase fine to medium grained (35%) Pyroxene fine to medium grained (20%) Olivine fine to medium grained (10%) Biotite fine grained (5%) Pyrrhotite fine grained (10%) Chalcopyrite fine grained (5%) Magnetite fine grained (5%) Hematite fine grained (10%)	*Rock Type:* Diabase *Hand Sample Description*: Dark grey-white, medium-grained sub-ophitic diabase. This sample displays an odd texture with irregular spheres of diabase separated by hematite-filled fractures. The sample was taken from a trench on the Copper Bar dike that had a columnar texture next to the irregular sphere texture next to competent diabase. Sample is fairly unweathered with sub-ophitic texture visible in hand sample. *Thin Section Description*: Equigranular subhedral plagioclase and pyroxene comprise the sub-ophitic texture observed in this sample. The irregular circular texture observed in this rock appears to be formed by fractures filled with botryoidal hematite. It was observed that the plagioclase laths are broken but with their respective parts present on each side of the fractures. Mineralization is composed of brecciated and disseminated chalcopyrite, pyrrhotite and magnetite.

MM-014 - Copper Bar dike

Mineralogy, Grain Size and Modal Percent (%)	Description
Plagioclase medium grained (35%) Pyroxene fine to medium grained (25%) Magnetite fine to medium grained (8%) Chalcopyrite fine grained (7%) Hematite fine grained (5%) Olivine fine grained (10%) Biotite fine grained (5%) Pumpellyite fine grained (5%)	*Rock Type:-* Diabase *Hand Sample Description:* White-grey, medium-grained, gabbro. Compositionally, pyroxene (25%) and plagioclase (35%) form a sub-ophitic texture with fine-grained disseminated mineralization. Hematite-filled fractures form a stockwork throughout the sample. *Thin Section Description*: Equigranular subhedral plagioclase and pyroxene comprise the sub-ophitic texture present in this sample. Mineralization consists of disseminated chalcopyrite and magnetite. Minor pumpellyite occurs throughout sample along with sericite alteration.

MM-015 - Copper Bar dike

Mineralogy, Grain Size and Modal Percent (%)	Description
Plagioclase fine grained (40%) Pyroxene fine grained (15%) Serpentine fine grained (5%) Olivine fine grained (15%) Biotite fine grained (5%) Pyrrhotite fine grained (10%) Chalcopyrite fine grained (7%) Magnetite fine grained (3%)	*Rock Type* - Diabase *Hand Sample Description:* Grey (weathered surface) and black (fresh), fine- to medium-grained, sub-ophitic diabase. 40% plagioclase and 15% pyroxene with obvious sericitization in hand sample appearing as light brown alteration. Fine-grained chalcopyrite and pyrrhotite are disseminated throughout sample. *Thin Section Description:* Equigranular sub-euhedral plagioclase and pyroxene form sub-ophitic texture. Olivine is completely serpentinized on one end of the thin section; however, it grades into less serpentinized olivine. Mineralization occurs as pyrrhotite, chalcopyrite and minor magnetite disseminated throughout the sample.

MM-016 - Copper Bar dike

Mineralogy, Grain Size and Modal Percent (%)	Description
Chalcopyrite fine grained (10%) Hematite fine grained (10%) Covellite fine grained (5%) Serpentine fine grained (15%) Olivine fine grained (10%) Plagioclase fine to medium grained (30%) Pyroxene fine grained (20%)	*Rock Type:* Diabase *Hand Sample Description:* Grey (weathered surface) and black (fresh), sub-ophitic highly fractured diabase. Dominant pervasive fractures criss-cross the sample and are filled with hematite. Disseminated chalcopyrite is also present throughout sample. Plagioclase and pyroxene are difficult to make out because of weathering and alteration, although they still form the typical sub-ophitic texture typical of this dike. *Thin Section Description:* Equigranular sub-euhedral plagioclase and pyroxene form sub-ophitic texture. Olivine is completely serpentinized along fracture planes along with pervasive hematite. Covellite mineralization is present throughout the sample in association with chalcopyrite and serpentinized olivine. Olivine proximal to fractures is serpentinized whereas olivine distal from the fractures is relatively fresh.

MM-017 - Copper Bar dike

Mineralogy, Grain Size and Modal Percent (%)	Description
Plagioclase fine to medium grained (40%) Pyroxene fine grained (20%) Magnetite fine grained (10%) Chalcopyrite fine grained (5%) Serpentine fine grained (10%) Olivine fine grained (15%)	*Rock Type:* Diabase *Hand Sample Description*: Grey (weathered surface) and black (fresh), fine- to medium-grained, sub-ophitic diabase. 40% plagioclase, 20% pyroxene with obvious sericitization in hand sample appearing as light brown alteration. Fine-grained chalcopyrite is disseminated throughout the sample. Two dark bands cross the hand sample along fracture planes. *Thin Section Description:* Equigranular sub-euhedral plagioclase and pyroxene form sub-ophitic texture. The fractures mentioned in the hand sample description contain serpentinized olivine. Relatively unaltered fine-grained olivine is found everywhere else in the sample. Disseminated chalcopyrite and magnetite are present.

MM-018 - Copper Bar dike

Mineralogy, Grain Size and Modal Percent (%)	Description
Plagioclase fine to medium grained (40%) Pyroxene fine to medium grained (25%) Pumpellyite fine grained (5%) Serpentine fine grained (5%) Olivine fine grained (10%) Magnetite fine to medium grained (12%) Chalcopyrite fine grained (3%)	*Rock Type:* Diabase *Hand Sample Description:* Grey (weathered surface) and black (fresh), fine- to medium-grained, sub-ophitic diabase. 40% plagioclase, 20% pyroxene with obvious sericitization in hand sample appearing as light brown alteration. The previously noted irregular spherical fracture pattern occurs in the sample although the sample lacks the hematite alteration in the fractures, which contain magnetite and minor chalcopyrite. *Thin Section Description:* Equigranular sub-euhedral plagioclase and pyroxene form sub-ophitic texture. Olivine occurs throughout sample and is partly to completely serpentinized with proximity to the fracture. Plagioclase is weakly sericitized. Magnetite and chalcopyrite occur in the fractures but are also disseminated throughout the sample.

MM-019 - Copper Bar dike

Mineralogy, Grain Size and Modal Percent (%)	Description
Ilmenite medium grained (5%) Chalcopyrite fine to medium grained (7%) Magnetite fine to medium grained (10%) Pyrrhotite fine to medium grained (10%) Pyrolusite fine grained (3%) Chlorite fine grained (10%) Serpentine fine to medium grained (10%) Plagioclase medium to coarse grained (25%) Pyroxene medium to coarse grained (20%)	*Rock Type:* Diabase *Hand Sample Description:* Dark grey-white, medium-grained to coarse-grained sub-ophitic diabase. Plagioclase and pyroxene form a sub-ophitic texture. A spherical fracture pattern is also present. Chalcopyrite (fine grained) is disseminated throughout the sample and is associated with minor disseminated magnetite. *Thin Section Description:* Distinction of minerals in this thin section is difficult because of the high degree of sericitization and alteration. Sericitization of plagioclase and pyroxene ranges from 30 to 70% and is pervasive throughout the sample. Serpentinized olivine is anhedral and fine grained. Fractures were observed to be filled with either serpentine or olivine. Radial pumpellyite occurs as clusters and is disseminated in sample. Chlorite alteration is also common in this sample. Magnetite has a dendritic habit in places; pyrolusite and ilmenite occur in association with the magnetite.

MM-020 - Copper Bar dike

Mineralogy, Grain Size and Modal Percent (%)	Description
Magnetite medium grained (10%) Ilmenite fine grained (5%) Pyrolusite fine to medium grained (5%) Chalcopyrite fine grained (3%) Bornite fine grained (5%) Covellite fine grained (2%) Chalcocite fine grained (2%) Quartz medium grained (8%) Plagioclase medium to coarse grained (30%) Microcline fine to medium grained (10%) Biotite fine to medium grained (8%) Hornblende fine to medium grained (7%) Chlorite fine grained (5%)	*Rock Type:* Diabase *Hand Sample Description:* Dark grey-white, medium- to coarse-grained sub-ophitic diabase. This samples differs from the others in that it is moderately magnetic and has a coarser grain size. Magnetite is associated with minor fine-grained chalcopyrite and other sulphide minerals. Large plagioclase laths (1 to 2 mm) form a sub-ophitic texture with pyroxene and magnetite. *Thin Section Description:* Microcline and sanidine occur as subhedral and inequigranular grains intergrown with pyroxene, with all forming the sub-ophitic texture. Granophyric texture partially affects the albite laths. Chalcopyrite, bornite, chalcocite, and covellite occur in association with one another, and are disseminated throughout the sample. Magnetite occurs as dendrites and overprints the primary mineralogy composed of plagioclase and pyroxene. It also occurs partly pseudomorphed into pyrolusite. Ilmenite is also present in the magnetite. Sericite alteration and chlorite occur pervasively throughout the sample. Hematite filled fractures crosscut most of the sample.

MM-021 - Stuart Location dike

Mineralogy, Grain Size and Modal Percent (%)	Description
Pyrrhotite coarse grained (30%) Chalcopyrite medium grained (10%) Magnetite fine grained (5%) Hematite fine grained (5%) Sphalerite fine grained (10%) Pentlandite fine grained (5%) Pyroxene fine grained (10%) Plagioclase fine to coarse grained (15%) Quartz fine grained (5%) Biotite fine grained (3%) Chlorite fine grained (2%)	*Rock Type*: Diabase *Hand Sample Description*: Bronzy-yellow (weathered) and grey (fresh), fine- to medium-grained rock with massive brecciated sulphides in a sub-ophitic matrix. Mineralization of massive pyrrhotite and chalcopyrite dominate this sample. Weathered surface of sample is heavily rusted with approximately 1 cm of build-up on the surface. Matrix of pyroxene and plagioclase is predominantly fine grained. *Thin Section Description*: Sample is dominated by coarse-grained pyrrhotite. Chalcopyrite and hematite fill brecciated fractures in the pyrrhotite. Chalcopyrite appears to have been part of an initial deformation and was subsequently fractured in a secondary event. Minor magnetite is disseminated with sphalerite throughout the sample. Pyroxene, plagioclase and quartz have undergone major grain size reduction and are now mostly fine grained with only plagioclase remaining as medium- to coarse-grained crystals. Larger plagioclase grains are intergrown with pyroxene throughout. Some parts of the pyrrhotite grains appear to have pentlandite exsolution lamellae in cross-polarized light.

MM-022 - Stuart Location dike

Mineralogy, Grain Size and Modal Percent (%)	Description
Ilmenite medium grained (5%) Chalcopyrite fine to medium grained (10%) Pyrrhotite fine grained (5%) Magnetite fine to medium grained (10%) Hematite fine grained (5%) Plagioclase medium grained (30%) Pyroxene medium grained (15%) Biotite fine grained (10) Pumpellyite fine grained (3%) Olivine fine grained (7%)	*Rock Type:* Diabase *Hand Sample Description:* Dark grey-white fine- to medium-grained, sub-ophitic diabase. 30% plagioclase, 15% pyroxene with sericitization in hand sample appearing as light brown alteration. Sample is moderately magnetic which differs from the Copper Bar dike samples. Mineralization occurs as medium-grained blebs with magnetite and ilmenite and chalcopyrite. Hematite is pervasive through sample, following fractures through the sample. *Thin Section Description*: Plagioclase and pyroxene form sub-ophitic texture. Plagioclase is inequigranular and subhedral. Bands of fine-grained olivine are slightly serpentinized. Magnetite and ilmenite blebs dominate the mineralization with highly deformed chalcopyrite disseminated throughout sample. Magnetite and ilmenite occur interchangeably in blebs