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PolyMet NorthMet Geology and Resource Background, August 2006 (Revised January 2007)

PolyMet Project Description Support Document
ER03

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PolyMet NorthMet Project
Geology and Resources Background

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1 INTRODUCTION

1.1 SECTION OVERVIEW

This Report reviews available geologic data and centers on:

- the project drilling data compilation, history, quality, format, and description;
- regional geology and project geologic description;
- controls on mineralization;
- metallurgical bulk metallurgical sample collection history;
- project topography and basemap;
- project geophysical data;
- background to resource estimation.

1.2 LOCATION

The NorthMet deposit (Dunka Road project of US Steel) is located eight miles due east of the PolyMet plant site (Figure 1). The approximate location for the mine area in various coordinate systems is:

- Minnesota State Plane feet, north zone, NAD83, 2,903,650E, 738,350N;
- UTM, NAD83, zone 15, 577,500E, 5,274,500N;
- Latitude-Longitude is Latitude 47º 36’ north, Longitude 91º 58’ west;
- Public Land Survey location of the RGGS lease area is Sections 1, 2, 3, 9, 10, 11, and 12 of T59N, R13W (Figure 1);
- The mine site is near the intersection of USGS 1:24,000 Allen, Babbitt, Babbitt Southwest, and Isaac lake quadrangle maps;
- NAVD 88 is used as the vertical datum.

1.3 PROJECT GEOLOGICAL SUMMARY

NorthMet, located in the Partridge River intrusion of the Duluth Complex, is a large, disseminated sulfide deposit in heterogeneous troctolitic rocks associated with the 1,100 million year old Mid-Continent rift. Metals of interest are copper, nickel, cobalt, platinum, palladium, and gold. The majority of the metals are concentrated in four sulfide minerals: chalcopyrite, cubanite, pentlandite, and pyrrhotite, with platinum, palladium and gold also found in bismuthides, tellurides, and alloys.

The deposit consists of seven igneous stratigraphic units dipping to the southeast.

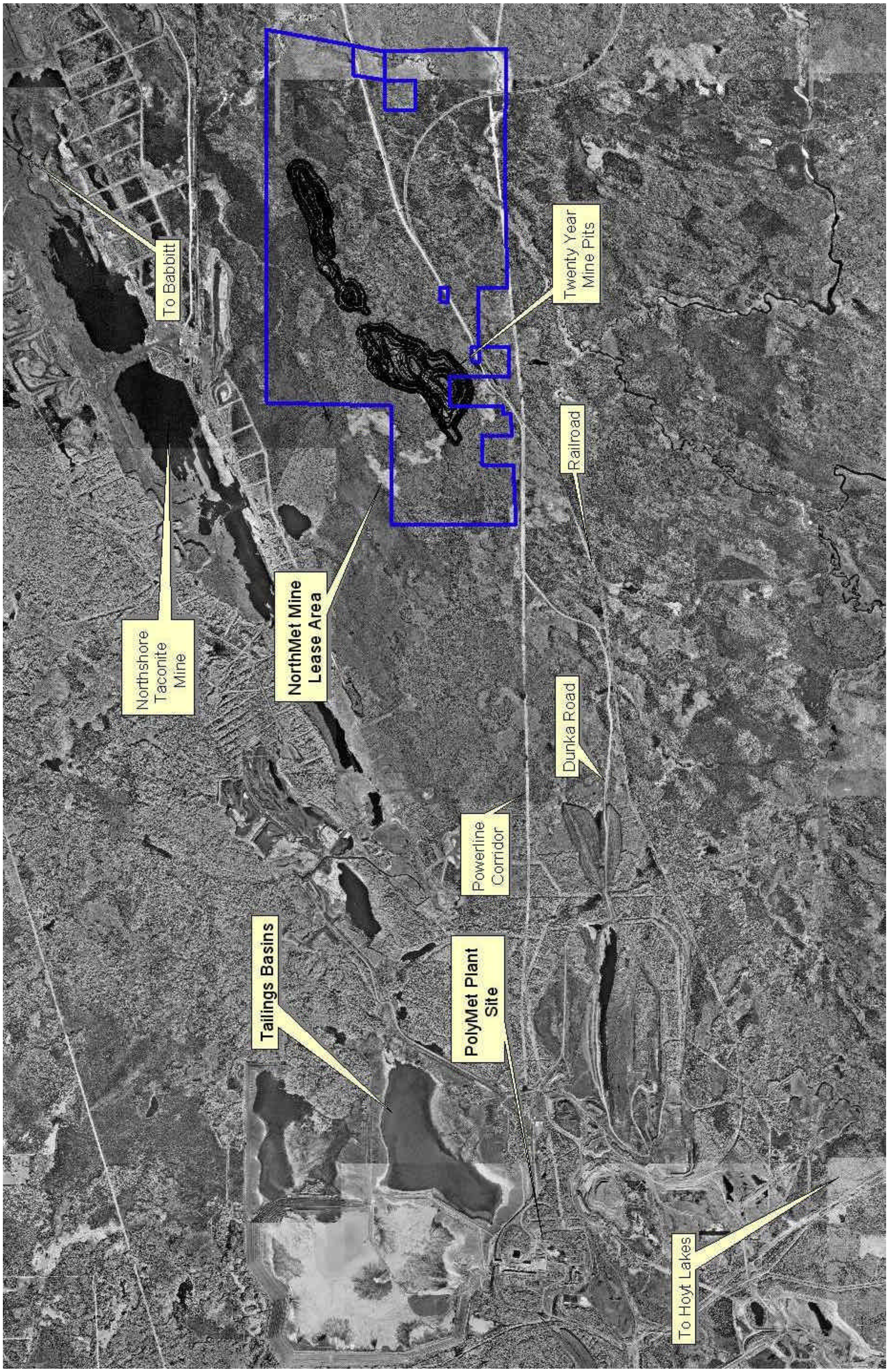

Figure 1 Overview of PolyMet NorthMet project, mine to plant site

NorthMet is one of eleven large copper-nickel-PGE deposits along the northern margin of the Complex (PGE: platinum, palladium, gold). All of these share grossly similar geologic settings to NorthMet–disseminated sulfides with minor local massive sulfides in heterogeneous rocks forming the basal unit of the Duluth Complex along the contact with older rocks.

These deposits occur in two sub-intrusions of the Complex: NorthMet, Wetlegs, Wyman Creek, and Babbitt are in the Partridge River intrusion; and Serpentine, Dunka Pit, Birch Lake, Maturi, Maturi Extension, Spruce Road, and South Filson Creek are in the South Kawishiwi intrusion to the northeast.

The deposit is on the southern flank of the Mesabi Iron Range, which is host to six large taconite mines, the closest of which is less than two miles north of the planned NorthMet pits.

The following estimate (Table 1) by Dr. Phillip Hellman of Hellman & Schofield (Sydney, Australia), in July, 2006, gives <u>a measured and indicated resource</u> (above 500 foot elevation, i.e., to about 1,100 feet below surface) of approximately 498 million short tons at a 0.1% copper cut-off or 295 million short tons at a 0.2% copper cut-off, resulting in the following grades. Assumed metal prices in modeling are shown at right of table:

Table 1 Summary of July 2006 resource estimates (above 500ft. elevation)

Metal:	Grade at 0.1% copper cut-off	Grade at 0.2% copper cut-off	Assumed metal price (USD):
Copper	0.25%	0.33%	$1.25/lb
Nickel	0.08%	0.09%	$5.60/lb
Cobalt	70 ppm	75 ppm	$15.25/lb
Platinum	59 ppb	77 ppb	$800/oz
Palladium	215 ppb	285 ppb	$210/oz
Gold	31 ppb	39 ppb	$400/oz

2 PROJECT EXPLORATION HISTORY

2.1 INTRODUCTION

There have been three major drilling programs since 1969, re-sampling for PGE began in 1989, three PolyMet joint ventures were pursued and dissolved in the 1990's, processing technology was developed in the late 1990's, the former LTV Steel Mining Company concentrator was optioned in 2003, and the metallurgical process was refined in 2005-2006.

2.2 EXPLORATION HISTORY

United States Steel (USS) began core drilling at NorthMet (as the Dunka Road project) in 1969. Drilling targeted a conductor that turned out to be in the footwall metasedimentary rocks, but the first drill hole hit massive sulfide in the Duluth Complex. Drilling continued over five years for 112 holes with 133,716 feet of intercept. The working assumption was to mine the deposit from underground, sampling was limited to the most continuous zones with strong visible copper-nickel mineralization, only about 2,200 samples representing about 22,000 feet were taken. USS assayed only for copper, nickel, sulfur, and iron. Platinum Group Element (PGE, in this case platinum, palladium, and gold) presence was known from sampling on concentrates, but the economics of PGE recovery were apparently not pursued. Project work stopped while apparently incomplete and was not restarted.

USS did not do much follow-up, but kept their land ownership, core, pulps, coarse rejects, and records for the project. In the mid 1980's the Minnesota Department of Natural Resources (MDNR) began sampling various historic drill core intervals in the Duluth Complex for PGE and got some good, but localized results. In 1989 Fleck Resources (Fleck) leased the Dunka Road property from USS and began a program of re-assaying USS pulps and coarse rejects with a much more extensive multi-element suite, as well as adding in some new samples from existing core through cooperative work with the Natural Resources Research Institute (NRRI), associated with the University of Minnesota Duluth. The results were very positive in showing elevated PGE values in the deposit and confirming the previous copper-nickel assays.

Fleck partnered with NERCO in 1991 for some bulk sample work, mine plans, environmental reviews etc., done through Fluor Daniel Wright, but the partnership was eventually dissolved. In 1995 Fleck joined with Argosy Mining Corp. (Argosy) to do more work on the project, again with no major progress towards production.

In June 1998, Fleck became PolyMet and focused their resources on Dunka Road, which was renamed NorthMet. Without partners, except for a brief venture with North Mining (North), PolyMet drilled and sampled 87 holes in 1998-2001, and sent two large bulk metallurgical samples to Lakefield Laboratories in Lake filed Ontario for development and refinement of the PlatSol process and began some environmental background work.

In the summer of 2000, North was taken over by Rio Tinto. The joint venture agreement was terminated by PolyMet upon consideration that NorthMet appeared to be a low priority to Rio Tinto. The main concern was that other partnership opportunities might be missed during the time that Rio Tinto assessed and prioritized the ongoing North projects. However, much of the North funding was already in place and was used to partially finance the 2001 pre-feasibility study.

After release of the pre-feasibility study (2001), a brief hiatus, and a major re-evaluation of how the project should proceed, PolyMet became active again in 2003 with new management and a new development plan.

This plan involves integrating the former LTV Steel Mining Company iron ore concentration plant with new facilities for processing of the NorthMet copper-nickel-PGE concentrates through a hydrometallurgical method at rate of 32,000 short tons of ore per day to produce copper metal and various hydroxide and concentrate products of nickel-cobalt-PGE.

Geologic work towards this end began in 2004 and first focused on a careful and total re-compilation of the historic NorthMet project drill hole related data. This effort organized and verified all drilling metadata, location, downhole survey, lithology, and assay data, and cataloged all paper (and digital) records for the project. Of note is that this resulted in an increase in the number of acceptable assays from 12,000 to around 17,200 and an improved geologic picture from careful consolidation of existing records.

This work was used as background for a revised resource estimate in January 2005 and planning of a drill program for 2005. The 2005 program entailed drilling and sampling 109 holes (77,000 feet), collection of a forty ton metallurgical bulk sample for pilot scale testwork, geotechnical drilling, in-fill sampling of previously drilled core, and extensive collection of waste characterization data. The 2005 drilling program added 13,450 multi-element assay records to the existing database. A PolyMet report covers the details of historic drilling and assaying (Patelke & Geerts, 2006).

Table 2 gives a summary of exploration drilling for the project.

Table 2 Summary of NorthMet Project drilling to date.

Period:	Company:	Type of Drilling:	Number of Holes:	Total Feet:
1969-1974	US Steel	Core	112	133,716
1991	NERCO	Core	2	842
1998-2000	PolyMet	Reverse Circulation (RC)	52	24,650
1999-2000	PolyMet	Core	32	22,156
2000	PolyMet	RC deepened with Core Tail	3	2,696
2005	PolyMet	Core	109	77,166
Totals for Project:			310	261,226

3 REGIONAL GEOLOGY

3.1 SUMMARY

This section covers regional geology context, Duluth Complex geology, and geology of the Partridge River intrusion.

3.2 REGIONAL GEOLOGY

Two broad age groups dominate rocks with mineral potential in northeastern Minnesota: Archean and Proterozoic (Figure 2).

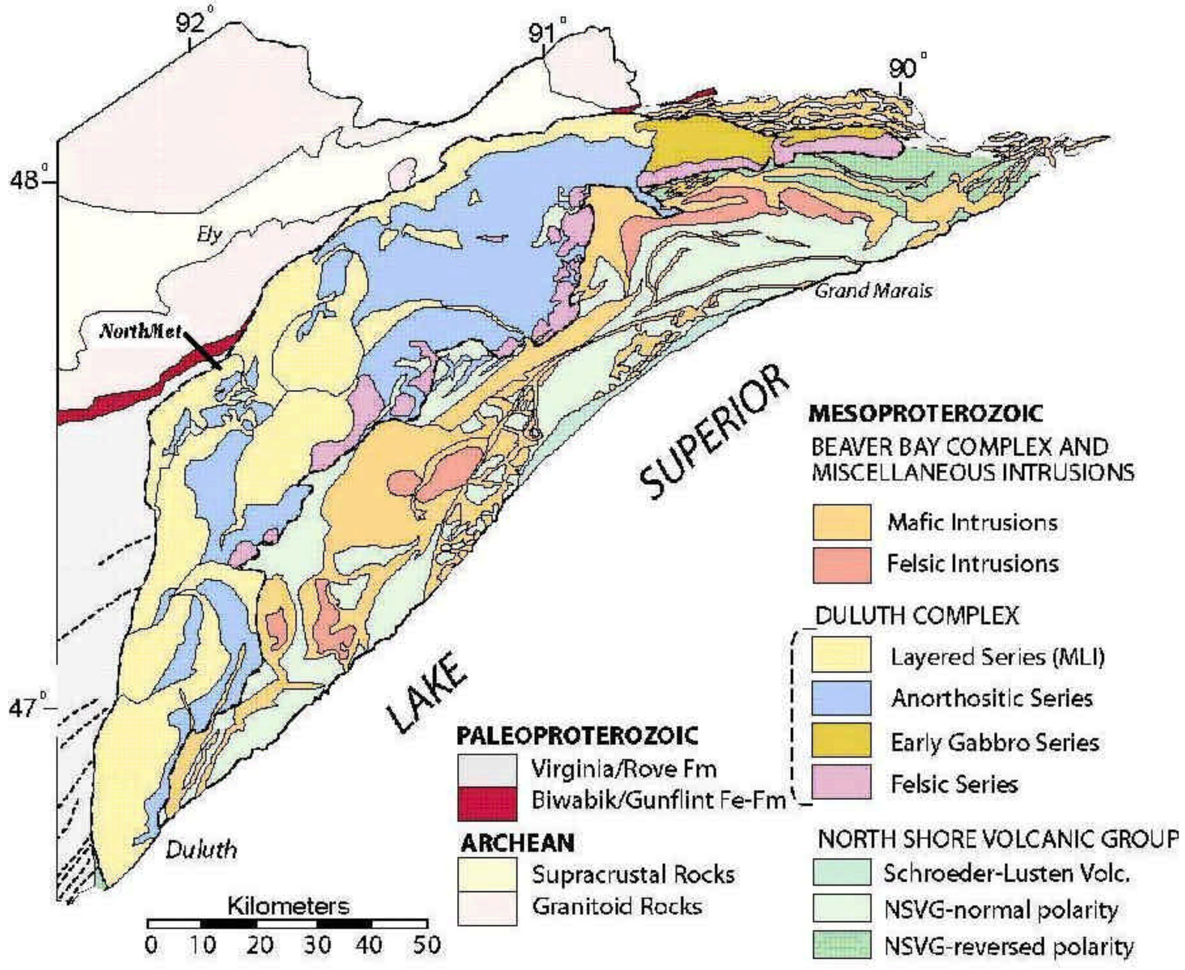

Figure 2 Bedrock Geology of Northeast Minnesota (from Miller et al., 2001)

3.2.1 Archean Rocks

Archean rocks represent possible hosts for lode gold, Volcanogenic Massive Sulfide (VMS), PGE, and diamond prospects. Historically, numerous iron ore mines operated in this terrane. North of the PolyMet site is extensive and underexplored terrane of exposed Archean rock, similar to that in Ontario (Wawa and Quetico subprovinces). This terrane is comprised of roughly east-west striking granite-greenstone belts. These rocks form the basement at the NorthMet site.

3.2.2 Proterozoic Rocks

Proterozoic rocks of interest in northern Minnesota include the Animikian Basin (Paleoproterozoic, 1.8 billion years old) sedimentary rocks (in the NorthMet area these are, oldest to youngest, the Pokegama Quartzite, Biwabik Iron Formation, and the Virginia Formation) and the Keweenawan-aged (Mesoproterozoic, 1.1 billion years old) igneous and sedimentary rocks.

Of the three Paleoproterozoic sedimentary formations that form the footwall at NorthMet, only the Virginia Formation (comprised of turbidites and graywackes that are locally sulfide-bearing) contacts the Duluth Complex igneous rocks.

3.2.3 Duluth Complex

The Mesoproterozoic rocks include the Duluth Complex, a large, composite, tholeiitic mafic intrusion that was emplaced into comagmatic flood basalts of the North Shore Volcanic Group. Other units of the Keweenawan system include the Beaver Bay Complex, and associated minor intrusions. These rocks are all part of the Mid-continent rift igneous system, an arcuate structure starting in Kansas, trending north to Lake Superior, following the Lake Superior basin, and then curving south towards mid-Ohio (Figure 3). Outcrop of rift related rocks is limited to the St. Croix River Valley in eastern Minnesota and the Lake Superior region. The history and mineral potential of the Duluth Complex and associated rocks is well covered in Miller et al., 2002.

Rocks of the Complex are varied and include troctolitic, anorthositic, gabbroic, granodioritic, and granitic intrusive bodies. Generally, these rocks are troctolitic / gabbroic and divided into an Anorthositic Series, Troctolitic Series (Taylor, 1964), and a late Felsic Series (Weiblen and Morey, 1980). Initially, rocks of the Anorthositic Series were inferred, on the basis of abundant field evidence, to have been emplaced early in the evolution of the Complex. However, high-resolution U-Pb isotopic age dates indicate that the Troctolitic and Anorthositic Series have indistinguishable crystallization ages of about 1,099 million years (Miller, 1992; Paces and Miller, 1993). The Felsic series is volumetrically minor and has so far been unimportant in economic potential.

Emplacement of the Complex occurred during an episode of extensional tectonism that produced the Mid-Continent Rift System. Weiblen and Morey (1980) present a half-graben model for the overall emplacement style (Figure 4). They envision a step-and-riser configuration of the basal contact, due to steep, southeast-dipping, northeast-trending normal faults. According to the model, magma was injected into fault-bounded voids, formed during rifting, to produce multiple smaller intrusions that collectively comprise the Complex. They also suggest that these northeast-trending faults may be offset by a series of northwest-trending strike-slip (transform) faults. Some studies suggest that the grades of Cu-Ni±PGE mineralization often increases in close proximity to fault zones and other structural features within the Complex. Inferred footwall faults at NorthMet display this step-and-riser geometry.

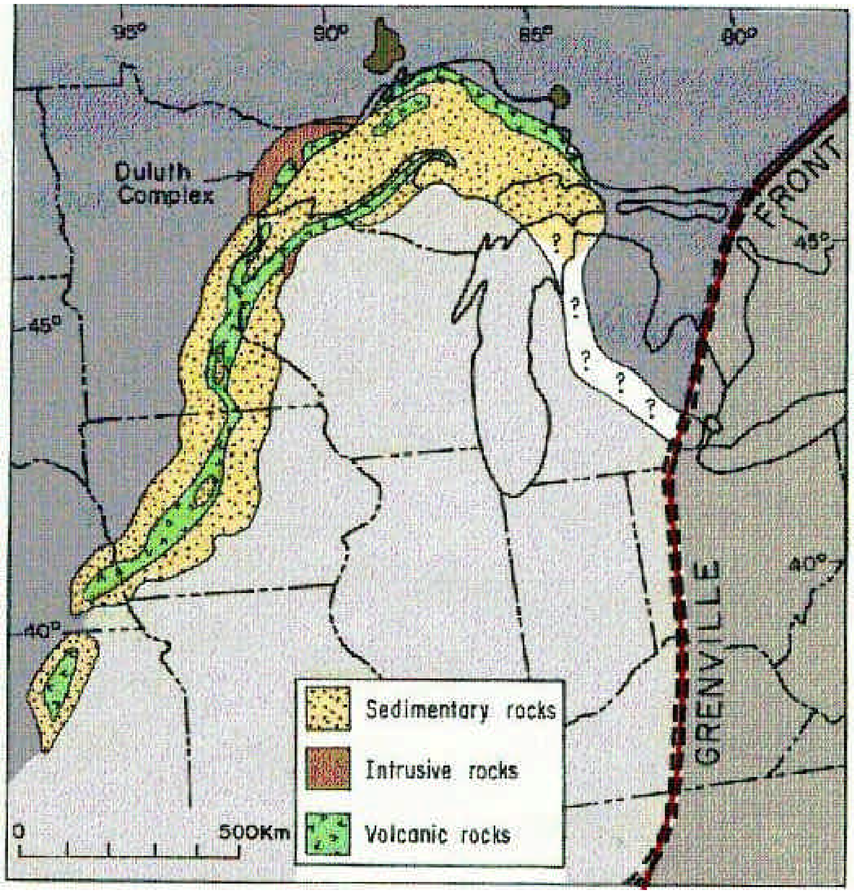

Figure 3 Plan view of Mid-Continent Rift (from Miller, 2001)

Green (1983), however, points out that observable geologic relations are inconsistent with models that imply the presence of a topographic rift valley or graben at the surface at any time during rifting.

Eleven, large, copper-nickel-PGE deposits are hosted in the Complex in the area of NorthMet. All of these share grossly similar geologic settings to NorthMet–disseminated sulfides with minor local massive sulfides in the heterogeneous rocks forming the basal unit of the Duluth Complex along the contact with older rocks.

These deposits occur in two of the largest and oldest of the sub-intrusions of the Complex: NorthMet, Wetlegs, Wyman Creek, and Babbitt (MinnAMAX or Mesaba) are in the Partridge River intrusion (PRI); and Serpentine, Dunka Pit, Birch Lake, Maturi, Maturi Extension, Spruce Road, and South Filson Creek are in South Kawishiwi intrusion (SKI) (Figure 5).

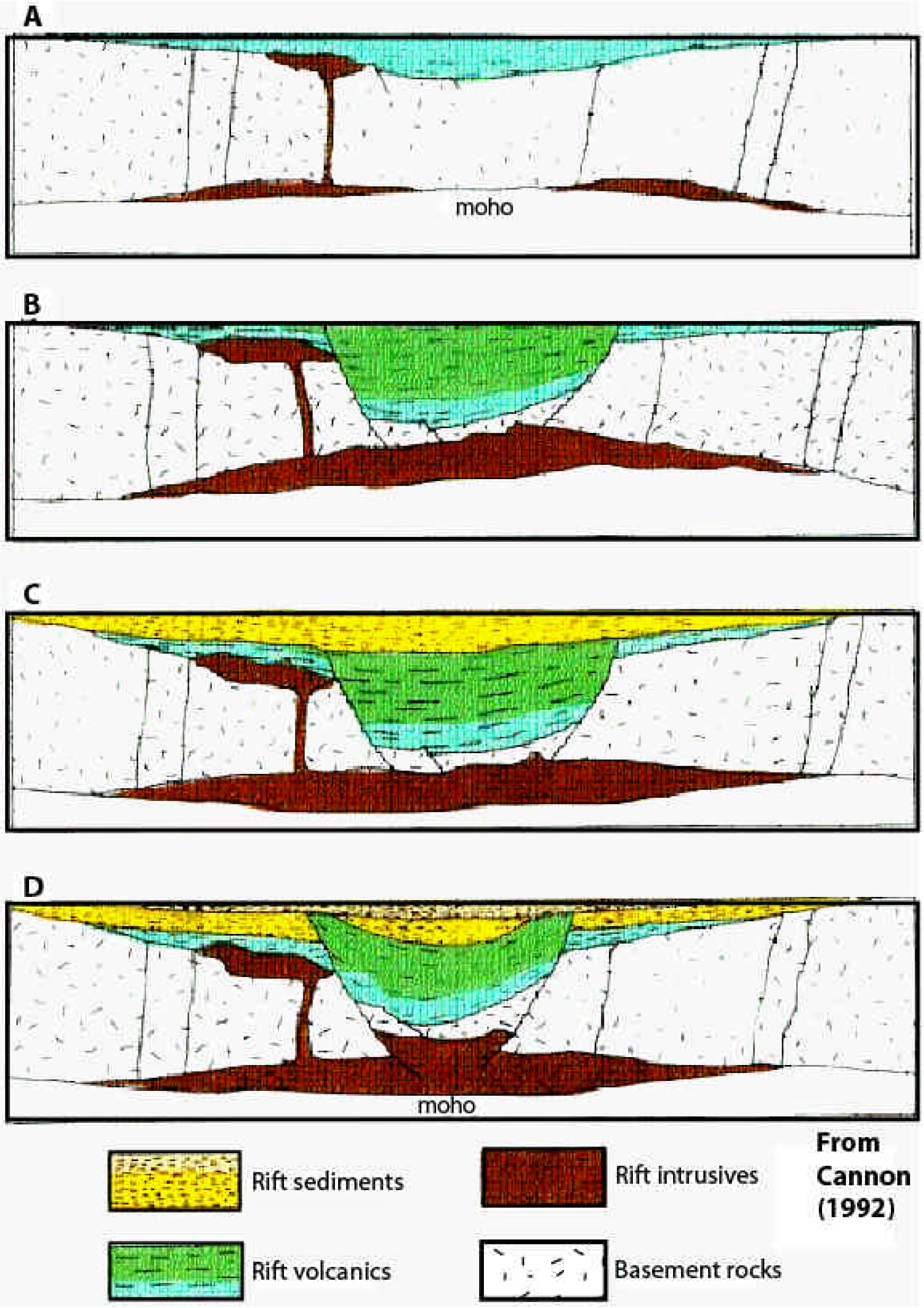

Figure 4 Cross-section showing Mid-Continent Rift development

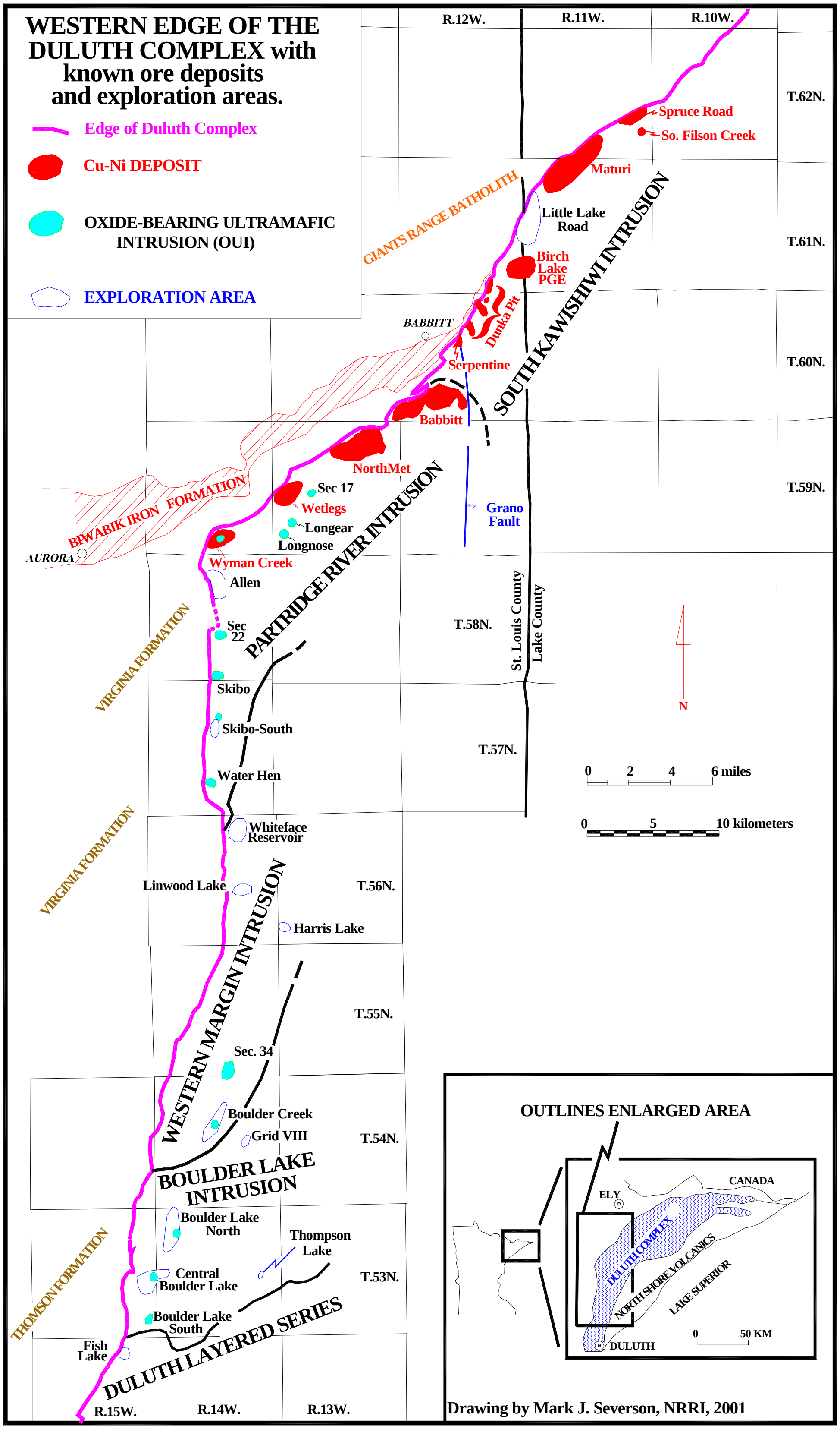

Figure 5 Intrusions and ore deposits of the Western Margin of the Duluth Complex

3.2.4 Partridge River Intrusion

The Partridge River intrusion (PRI), host to the NorthMet Deposit, has been extensively drilled (over 1,100 drill holes). The PRI rocks are divided into at least eight separate and distinct rock units in drill core (Units 1-8, Severson and Hauck, 1990). Drill holes within the NorthMet Deposit intersect seven of these rock units (Units 1-7; Figures 6, 7). The units are composed primarily of troctolitic anorthosite to augite troctolite, medium- to coarse-grained, light gray to dark gray, and in lesser amounts, gabbroic anorthosite to olivine gabbro. At NorthMet igneous rocks directly overlie Virginia Formation, elsewhere in the PRI they are locally in contact with the Biwabik Iron Formation.

This basic igneous stratigraphy (see next section) is present in hundreds of drill holes along a 15-mile strike length. Definition of the stratigraphy has provided a framework by which mineralized zones, containing elevated values of Cu-Ni and precious metals, can be traced and correlated.

In the NorthMet area the base of the Complex is in relatively sharp (locally gradational over a few feet) contact with Lower Proterozoic metasediments of the Virginia Formation (argillite and graywacke sequence). The underlying iron-formation is seen in longer NorthMet drill holes and outcrops in the Peter Mitchell Mine of Northshore Mining Company, less than two miles north of the deposit. The contact between the Virginia Formation and the Biwabik Iron Formation is consistently sharp and well defined on the eastern Mesabi Range.

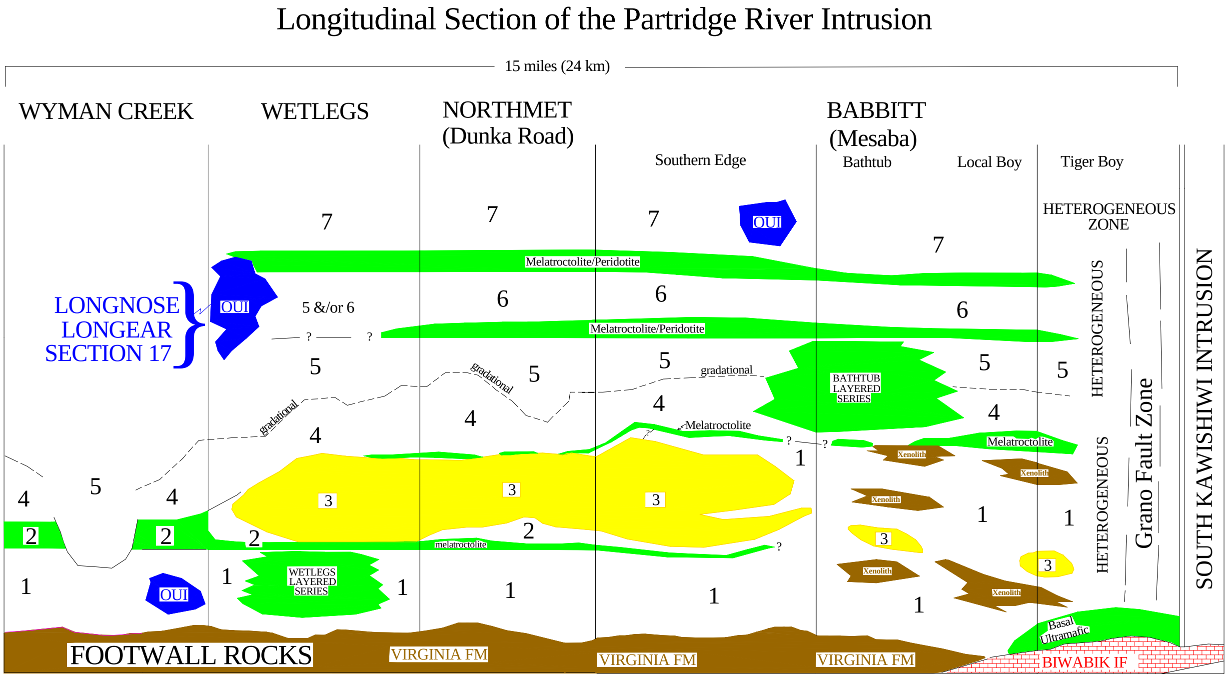

Figure 6 Longitudinal section of Partridge River intrusion showing igneous and footwall units. Ultramafics and Unit 3 form major markers at NorthMet (Severson, 2002)

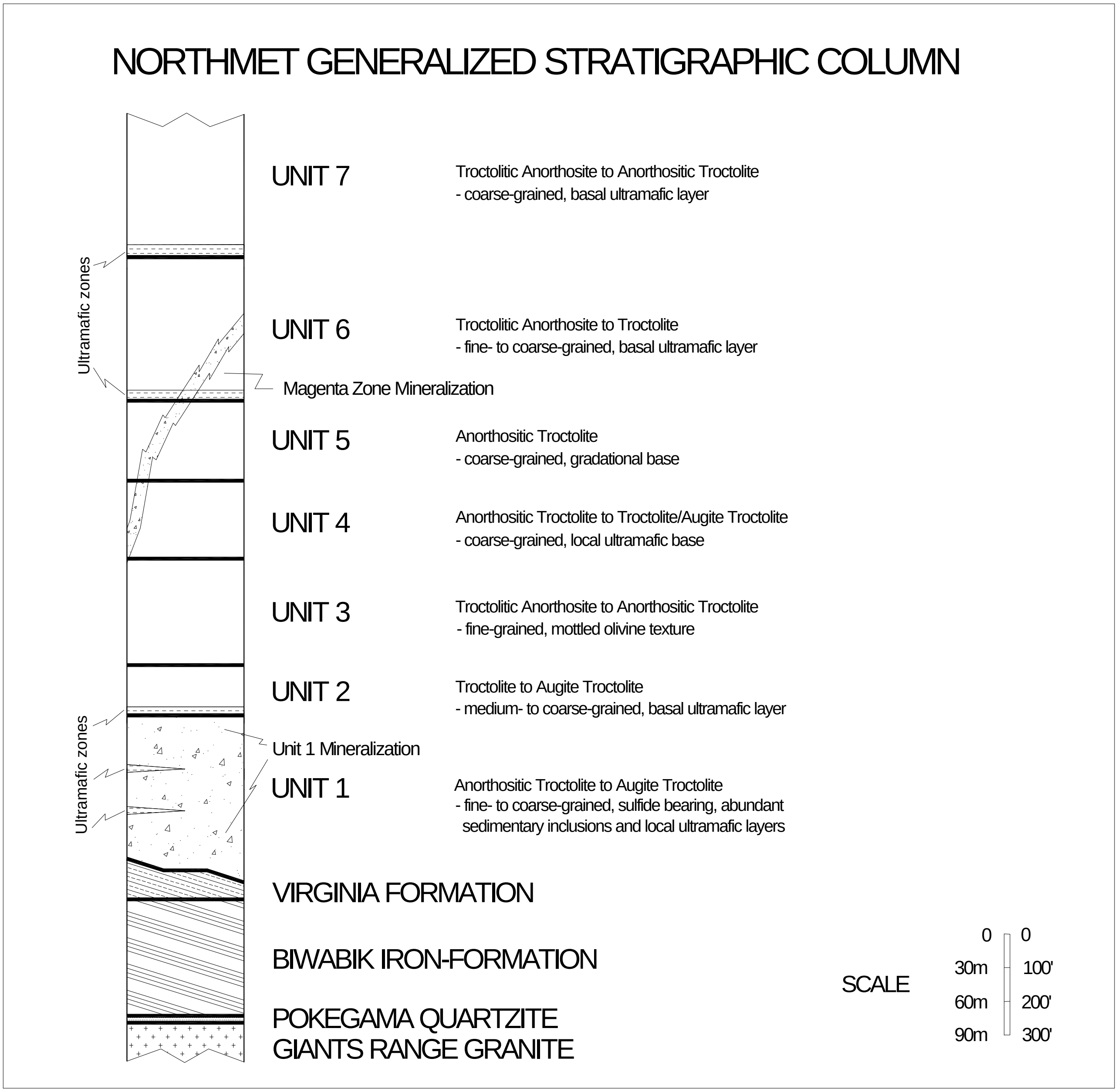

Figure 7 Generalized stratigraphic column for NorthMet Units (after Geerts, 1994)

4 GEOLOGY OF THE NORTHMET DEPOSIT

4.1 INTRODUCTION

NorthMet consists of seven igneous units that dip southeast, with most economic sulfide mineralization in the lowermost unit (Unit 1). The following is a summarized description of the geology of the deposit, based on observations from drill core and limited outcrop mapping.

4.2 QUATERNARY GEOLOGY

In general the Quaternary geology of the region is a thin (0-30 ft., but locally thicker) blanket of glacial deposits including till, lacustrine materials, and outwash. Low spots are usually peat bog or open wetland. Topography is subdued and drainage is poor.

Site specific geologic studies of the drift have not been done, though a series of geophysical soundings were carried out in 2006 to better define drift thickness outside the area to be mined (Ikola, 2006).

Lehr and Hobbs (1992) mapped the area as part of the Wampus Lake Moraine. Minnesota Geologic Survey map 164 (Jennings and Reynolds, 2005, includes GIS database) catagorizes all drift materials as Rainy Lobe till and re-sedimented glacial deposits, overlain locally by post glacial peat.

Test pits for preliminary PolyMet engineering studies and informal observations of sumps and other small excavations bear this out. Most areas consist of unsorted sand / silt / clay with cobbles and boulders. Boulders on surface can be greater than 10 feet in size and there may be a boulder lag horizon just below the ground surface in some areas.

As measured from drill holes, thickness of the drift ranges from 0 to 50 feet (mostly less than 20 feet) and averages about 12 feet. The 2006 geophysical soundings measured thicknesses up to 60 feet past the western margins of the drilled area.

4.3 STRUCTURAL GEOLOGY

The general structure of the NorthMet deposit, as defined by bedding trends in the Biwabik Iron Formation (BIF) and Virginia Formation, is dominated by an overall dip ranging from 15-25° to the southeast, striking about N56°E. Dips in the seven igneous units are grossly similar, but dips of the mineralized zone are up to 60° in the east pit area. Dips in both the Animikian and the Duluth Complex rocks can be attributed to crustal loading, associated with the input of large volumes of magma originating from the Mid-continent Rift System (Sims and Morey, 1972).

At least 14 faults have been proposed across the NorthMet Deposit (Figure 8). Unfortunately, not enough evidence has been established through drilling to indicate with certainty the exact location of major offsets or faulting within the igneous rock units or the footwall rocks (Figure 9). This definition difficulty is compounded by the fact that over time the fault representations have been extended vertically from ground surface to footwall, though many were originally thought to only show offset in the footwall, or were based solely on limited outcrop evidence.

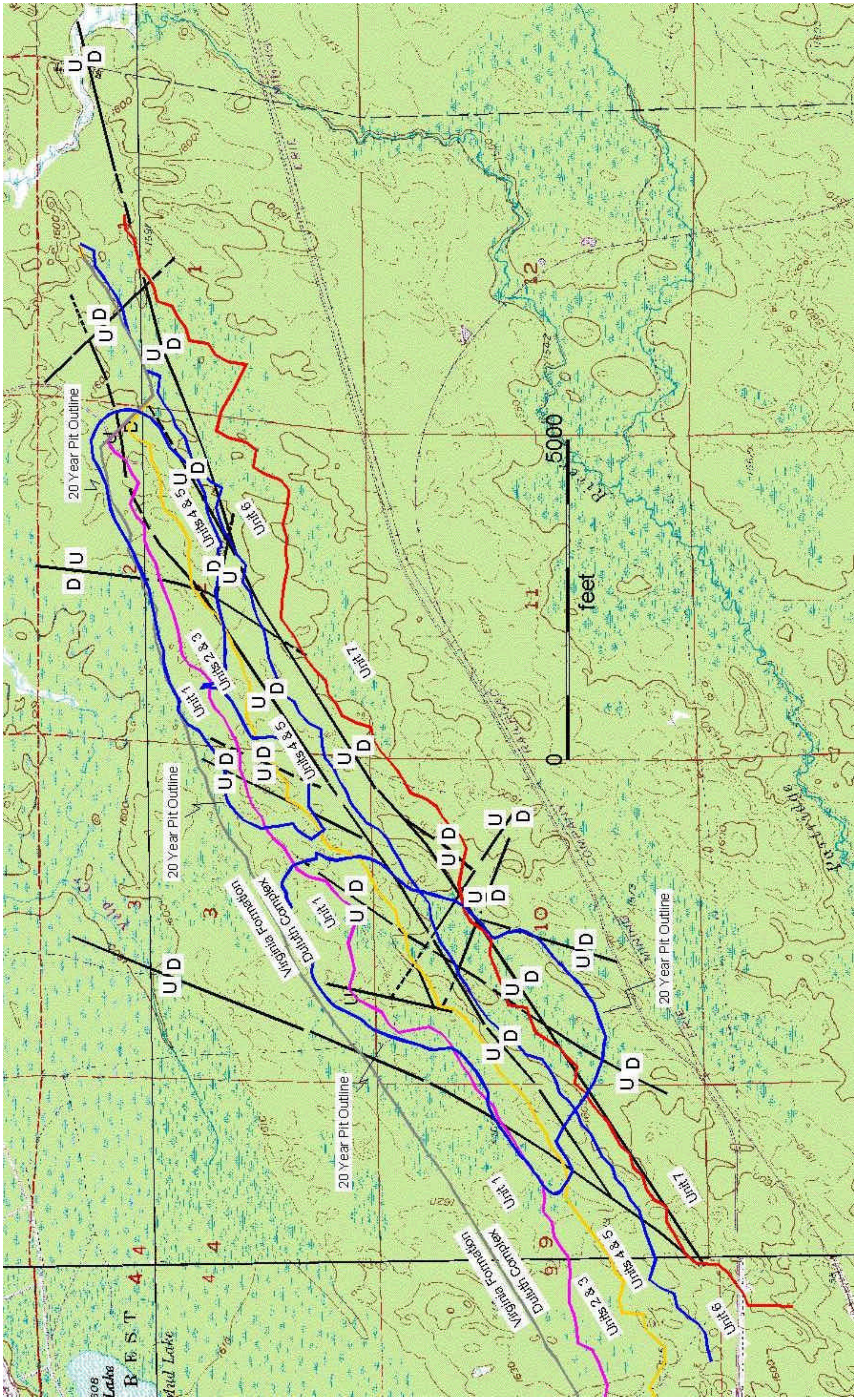

Figure 8 Plan view of faults, unit boundaries, and 20 year mine pits on USGS topographic base

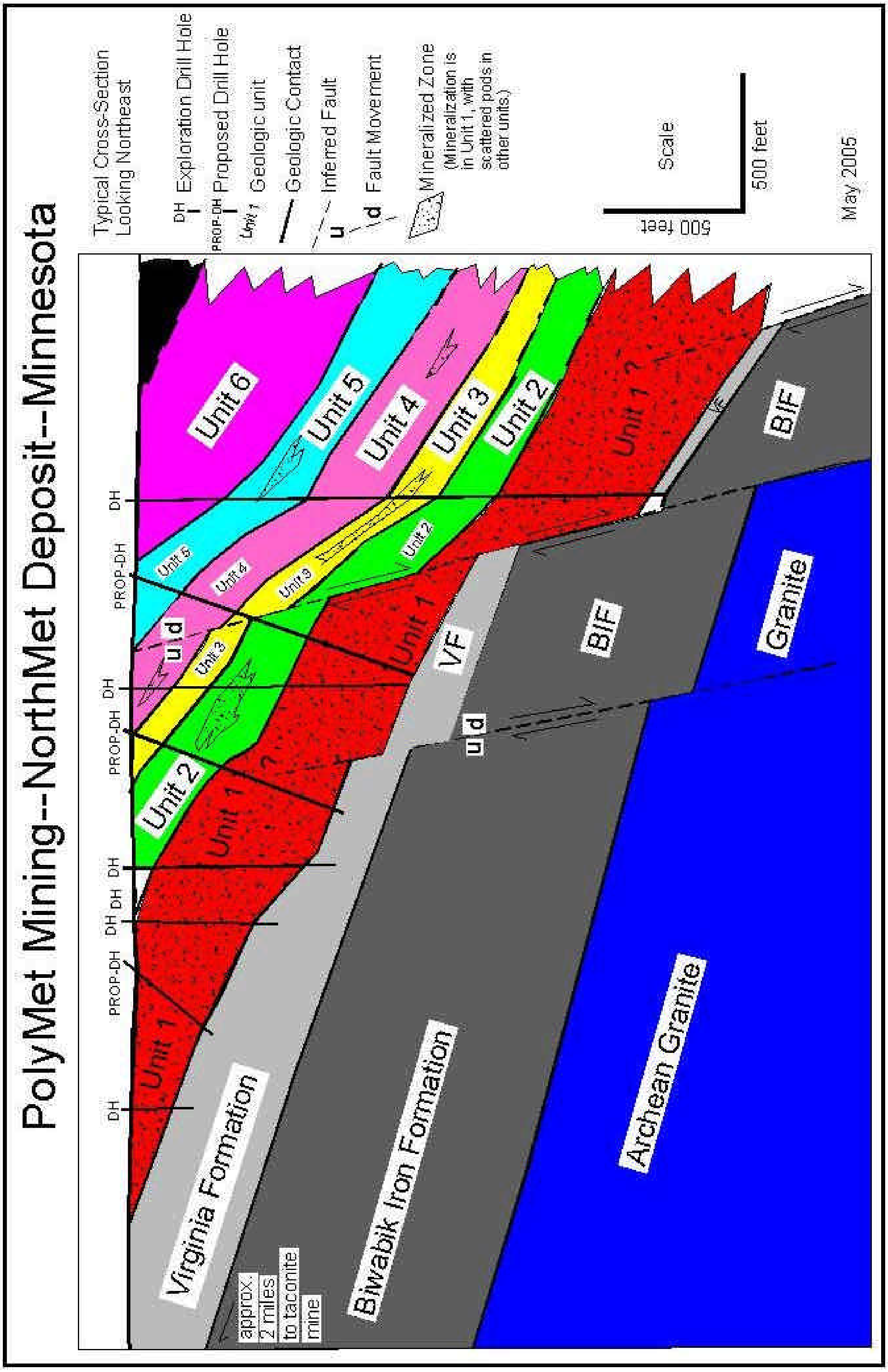

Figure 9 NorthMet generalized cross-section, note faults “dying out” in igneous rocks

Clearly however, offset or faulting exists, at least within the footwall rocks, due to substantial offsets in the BIF (assuming an average 20° dip) as evidenced between drill holes portrayed in cross-sections. Many of these same offsets can be correlated in adjacent cross-sections. Fault zones are apparent in drill core and show up as brecciated intervals (up to several feet thick), including gouge mineralization (clay, calcite, quartz, etc.), slickensides on serpentinized fracture faces, and/or severely broken (rubble) core. However, the exact location of all faults/offsets at the NorthMet Deposit on a hole to hole basis has only been approximated, due to the sparse structural information as so far provided by drilling. Extensive angle drilling in 2005 (93 of 109 holes) brought no great clarity to this issue (virtually all previous drilling was vertical). The current geological model and working cross-sections are therefore constructed with minimal faulting influence, especially within the igneous rock units of the Partridge River intrusion, until more evidence clarifies this issue.

4.4 LOGGING AND MAPPING UNITS

A summary of the general stratigraphy of the NorthMet Deposit is outlined below. Rock units and formations are listed in descending order, as would be observed from top to bottom in drill hole. NorthMet units are labeled as Units 1 through 7, bottom to top. Unit 3 is the oldest, the intrusion sequence of the other units is not clear.

The broad picture is of a regular stratigraphy of troctolitic to anorthositic rock units, dipping southeast at 20° to 25°, with basal ultramafic units commonly defining the boundaries of these units. The basal ultramafic zones tend to have diffuse tops, sharp bases, and are commonly serpentinized and foliated (See Figure 6 & 7 above). Geologists have generally picked the unit boundaries at the base of these ultramafics though there are local exceptions. Economic sulfide mineralization is ubiquitous in the basal igneous unit (Unit 1) and is locally present, but restricted, in the upper units.

4.5 ROCK TYPE AND UNIT CLASSIFICATION

Igneous rock types in the Complex are classified at NorthMet by visually estimating the modal percentages of plagioclase, olivine, and pyroxene, using a rock classification scheme (Figure 10) modified from Phinney (1972). Due to subtle changes in the percentages of these minerals, a variation in the defined rock types within the rock units may be present from interval to interval or hole to hole. This is especially true for Unit 1. Table 3 gives the mineral chemistry of common minerals at NorthMet.

Unit definitions are based on: overall texture of a rocktype package; mineralogy; sulfide content; and context with respect to bounding surfaces (i.e., ultramafic horizons, oxide-rich horizons). Unit definitions are not always immediately clear in logging, but usually clarified when drill holes are plotted on cross-sections. In other words, to correctly identify a particular stratigraphic unit, the context of the units directly above and below must also be considered.

Based on drill hole logging, the generalized rock type distribution at NorthMet is about 83% troctolitic, 6% anorthositic, 4% ultramafic, 4% sedimentary inclusions, 2% noritic and gabbroic rocks, and the rest as pegmatites, breccia, basalt inclusions, and others.

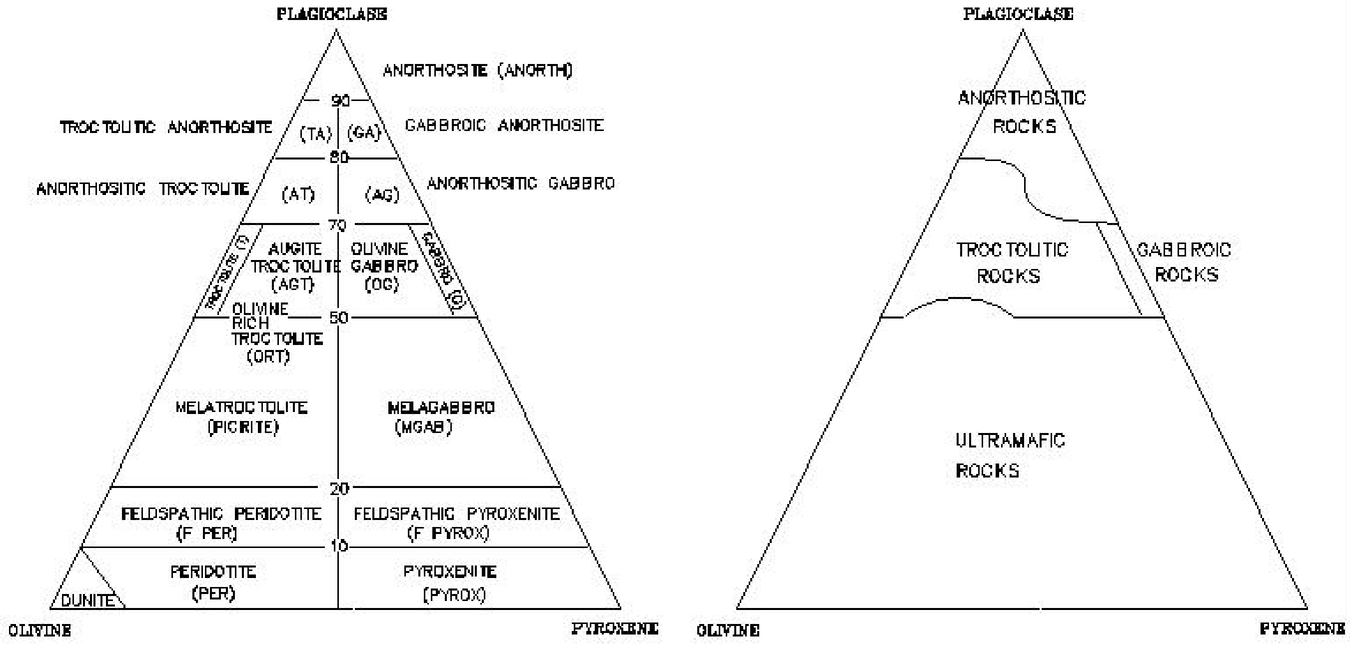

Figure 10 Modified Phinney (1972) diagram for rock type classification

4.6 UNIT DEFINITIONS AND DESCRIPTIONS

4.6.1 Unit 7

Unit 7 is the uppermost unit intersected in drill holes at the NorthMet Deposit. It consists predominantly of homogeneous, coarse-grained anorthositic troctolite and troctolitic anorthosite, characterized by a continuous basal ultramafic subunit that averages 20 ft. thick. The ultramafic consists of fine- to medium-grained melatroctolite to peridotite and minor dunite. The average thickness of Unit 7 is unknown due to erosion removing the upper parts.

4.6.2 Unit 6

Very similar to Unit 7, Unit 6 is composed of homogeneous, fine- to coarse-grained, troctolitic anorthosite to troctolite. It averages 400 ft. thick and has a continuous basal ultramafic subunit that averages 15 ft. thick. Overall, sulfide mineralization is generally minimal, although a number of drill holes in the southwestern portion of the NorthMet Deposit contain significant sulfides and associated elevated PGEs (Geerts 1991, 1994). Sulfides within Unit 6 generally occur as disseminated chalcopyrite/cubanite with minimal pyrrhotite. This mineralized occurrence, the “Magenta Zone”, transitions into Units 4, and 5, and is discussed in greater detail below.

4.6.3 Unit 5

Unit 5 exhibits an average thickness of 250 ft. and is composed primarily of homogeneous, equigranular-textured, coarse-grained anorthositic troctolite. Anorthositic troctolite is the predominant rock type, but can locally grade into troctolite and augite troctolite towards the base of the unit. The lower contact of Unit 5 is gradational and lacks any ultramafic subunit, therefore the transition into Unit 4 is a somewhat arbitrary pick. Due to the ambiguity of this contact, thicknesses of both units vary dramatically. However, when Units 5 and 4 are combined, the thickness is fairly consistent deposit-wide.

4.6.4 Unit 4

Being somewhat more mafic than Unit 5, Unit 4 is characterized by homogeneous, coarse-grained, ophitic augite troctolite with some anorthosite troctolitic. Unit 4 averages about 250 ft. thick. At its base, Unit 4 may contain a local thin (usually no more than 6 inch) ultramafic layer or oxide-rich zone. The lower contact with Unit 3 is generally sharp.

4.6.5 Unit 3

Unit 3 is used as the major “marker bed” in determining stratigraphic position in the PRI. It is composed of fine- to medium-grained, poikilitic and/or ophitic, troctolitic anorthosite to anorthositic troctolite. Characteristic poikilitic olivine gives the rock an overall mottled appearance. On average Unit 3 is 300 ft. thick. The lower contact of Unit 3 can be disrupted, with multiple “false starts” into typical Unit 2 homogenous rocks, only to go back to mottled Unit 3 with depth. This sequence is common in drill holes in the southwestern portion of the deposit and can span for many tens of feet along core before finally settling into “definitive” Unit 2. As with Units 4 and 5, the thickness of Units 2 and 3 tend to be highly variable, whereas if combined into one unit, it is more consistent deposit-wide (though not as consistent as Units 4 & 5).

Unit 3 can contain both footwall metasedimentary (Virginia Formation) and hanging wall metabasalt inclusions, which seems to indicate its earliest emplacement within the intrusive sequence of the deposit. This is exemplified by the fact that few sedimentary inclusions are found above Unit 3 and few basalt inclusions are found below it, as if Unit 3 was initially intruded between these units and eventually acted as barrier between them as later units were emplaced.

4.6.6 Unit 2

Unit 2 is characterized by homogeneous, medium- to coarse-grained troctolite and augite troctolite with a consistent basal ultramafic subunit. The continuity of the basal ultramafic subunit, in addition to the relatively uniform grain size and homogeneity of the troctolite, makes this unit distinguishable from Units 1 and 3. Unit 2 has an average thickness of 100 ft. The ultramafic subunit at the base of Unit 2 is the lowermost continuous basal ultramafic horizon at the NorthMet Deposit, averages 25 ft. thick, and is composed of melatroctolite to peridotite and minor dunite.

In some ways the characteristics of Unit 2 and how it fits into the stratigraphy are ambiguous, it can be interpreted as the lower part of Unit 3, the upper part of Unit 1, or a separate unit. Based on continuity of the ultramafic boundary it seems to be a lower, more mafic, counterpart to Unit 3 or a separate unit. However, even though Unit 2 has been historically described as barren, in the western part of the deposit it appears to have mineralization grossly continuous with that at the top of Unit 1. The general lack of footwall inclusions would argue against Unit 2 being older than Unit 1.

4.6.7 Unit 1

Of the seven igneous rock units represented within the NorthMet Deposit, Unit 1 is the only unit that contains significant deposit-wide sulfide mineralization. Sulfides occur primarily as disseminated interstitial grains between a dominant silicate framework and are chalcopyrite > pyrrhotite > cubanite >pentlandite. Unit 1 is also the most complex unit, with internal ultramafic subunits, increasing and decreasing quantities of mineralization, complex textural relations and varying grain sizes, and abundant sedimentary inclusions. It averages 450 ft. thick, but is locally 1,000 feet thick and is characterized lithologically by fine- to coarse-grained heterogeneous rock ranging from anorthositic troctolite (more abundant in the upper half of Unit 1) to augite troctolite with lesser amounts of gabbro-norite and norite (becoming increasingly more abundant towards the basal contact) and numerous sedimentary inclusions. By far the dominant rock type in Unit 1 is medium-grained ophitic augite troctolite, but the textures can vary wildly. Two internal ultramafic subunits occur in drill holes in the southwest, and have an average thickness of 10 ft.

4.6.8 Footwall: Animikie Group and Archean Rocks

The footwall rocks of the NorthMet Deposit consist of Paleoproterozoic sedimentary rocks of the Animikie Group. These rocks are represented by the following three formations, listed from youngest to oldest: the Virginia Formation, the Biwabik Iron Formation, and the Pokegama Quartzite. They are largely underlain by Archean granite of the Giants Range Batholith, but there are Archean basalts and metasediments mapped in outcrop near the project area. The Duluth Complex is only in contact with the Virginia Formation at the NorthMet site.

Intrusion of the Complex metamorphosed the Virginia. Non-metamorphosed Virginia Formation (as found to the north of the site) consists of a thinly-bedded sequence of argillite and graywacke, with lesser amounts of siltstone, carbonaceous-sulfidic argillite/mudstone, cherty-limey layers, and possibly some tuffaceous material. However, in proximity to the Duluth Complex, the grade of metamorphism (and associated local deformation) progressively increases, and several metamorphic varieties and textures are superimposed on the original sedimentary package at an angle to the original stratigraphy. At least four distinctive Virginia Formation varieties are present at NorthMet and informally referred to as: Cordieritic Metasediments; Disrupted Unit; Recrystallized Unit; and Graphitic Argillite (often with pyrrhotite laminae). These subunits are fully described in Severson, 1999.

Two large-scale changes were made to the interpretation of footwall geometry based on the 2005 drilling at NorthMet. 1970's USS drill hole 26054 in the west part of the deposit intersected and was terminated in 124 feet of Virginia Formation inclusion. Previously this had been interpreted as in-situ footwall rock. Drill hole 05-420C penetrated below this inclusion, demonstrating that it was an inclusion, not intact footwall. This had the effect of lowering the Virginia Formation-Unit 1 contact by 600 feet in this area. Further drilling in this area generally showed Virginia Formation intercepts hundreds of feet below where expected, based on earlier working cross-sections. This increased the resource at depth.

At the east end of the property, south of the proposed east pit, in an area that had been previously poorly drilled (one hole), eleven new drill holes intercepted norite-rich Virginia Formation parallel to the southern wall proposed pit. This "ramp" of unassimilated or partially assimilated Virginia Formation locally raised the footwall by 800 feet compared to what had been expected from cross-sections prior to drilling.

4.6.9 Inclusions

Two broad populations of inclusions occur at NorthMet: hanging wall metabasalts (Keweenawan) and footwall metasedimentary rocks. Basalts are fine-grained, generally gabbroic, with no apparent relation to any mineralization. Footwall inclusions may carry substantial sulfide (pyrrhotite) and often appear to contribute to the local sulfur content. Footwall inclusions are all Virginia Formation, no iron-formation, Pokegama Quartzite, or older granitic rock has been recognized as an inclusion at NorthMet.

Sedimentary inclusions make up about 4% of the logged rocktypes, and basalt inclusions sum to less than 1% of the drilling footage.

Generally, hanging wall inclusions are restricted to Unit 3 and the units above, while footwall inclusions are most abundant in Unit 1. This zoned distribution of inclusions indicates that one possible scenario for order of intrusion is that Unit 3 intruded first, created space between the basalt and the Virginia Formation, then portions of the hanging wall basalts collapsed into the Unit 3, but for some reason Unit 3 was not able to dissagregate or assimilate much of the footwall rock (due to temperature, viscosity of magma or ductility of the footwall). Unit 1 however, intruded between Unit 3 and the footwall and was able to assimilate large portions of the footwall and thus contaminate itself with both sulfur and silica. In this scenario Unit 2 is intruded after Unit 1, between Units 1 and 3, as Unit 2 has limited footwall inclusions. Unit 3's intrusion would have separated the footwall and Unit 1 from later Units 4 through 7, which never reacted with the footwall at the NorthMet site. Therefore, any footwall inclusions seen in Units 4 through 7 (and probably those seen in Unit 2) can be interpreted as being carried in from some other part of the magmatic system. Note that basalt overlies and is in direct contact with the Virginia Formation at the Wetlegs deposit to the west of NorthMet, implying that the starting conditions for this chain of events are plausible.

4.6.10 Other Igneous Units

Quadrangle scale outcrop mapping indicates that other igneous stratigraphic units are present above Unit 7. These units are similar to Units 6 and 7 in that they consist of homogeneous-textured troctolitic rocks with basal ultramafic members. Because they have not been intersected in drill holes at NorthMet, the units above Unit 7 are not discussed in this report.

There are minor, unmineralized, pre-Complex sills in both the Virginia Formation and Biwabik Iron Formation at NorthMet. In neither case is there any apparent relation to Duluth Complex mineralization. Early sills in the Virginia probably metamorphosed the Virginia, forming a zone that resisted assimilation during later intrusion of the Complex– hence leading to the thin “rind” of metamorphosed Virginia on top of the BIF seen in the deeper downdip drill holes at NorthMet.

4.6.11 Alteration and Fracturing

The vast majority of rock within the NorthMet Deposit is unaltered. Types of alteration most commonly observed in NorthMet rocks are serpentinization / chloritization of olivine, sericitization and saussuritization of plagioclase, and uralitization of pyroxenes. Most alteration is related to close proximity of fractures and/or joints that cross-cut the troctolitic rocks. Likewise, on a microscopic level the center of alteration is focused around microfractures. This pattern suggests that both fracturing and accompanying alteration of the rock occur as a result of the migration of late-stage deuteric fluids during the cooling phase. As would be expected in a magmatic deposit of this type, the vast majority of sulfide mineralization is independent of alteration.

4.7 SILICATE MINERALOGY - PETROGRAPHY

As part of PolyMet's environmental review process, a number of mineralogical studies were conducted for waste rock and tailings management purposes. The rock characterization involved the selection of a representative suite of rock types that would be moved or exposed during mining. A total of 91 samples were selected from drill core intervals ranging from 5 to 20 feet in length. These samples represent the most common rock types that would be encountered in the NorthMet pits and include all seven igneous stratigraphic units (with a wide range of sulfur and metal values), as well as, footwall rocks and inclusions. Petrographic observations were recorded from polished thin-sections of each of the intervals, including; mineral identification, estimated modal percents, crystal shape/grain size/textural characteristics, and textural relationships between the dominant silicate framework and oxide/sulfide mineralogy.

Petrography showed few if any differences between the silicate mineralogy and their textural relationships, as applied to specific rock types and stratigraphic units. The information from this exercise is comparable with results achieved by Geerts (1991, 1994), Severson (1991) and others.

4.8 SILICATE MINERALOGY AND CHEMISTRY - MICROPROBE

In conjunction with the petrography of waste characterization samples, microprobe analyses were performed to accurately determine the chemistry of silicate, oxide, and sulfide mineralogy. The analyses were performed in February 2006 by McSwiggen & Associates - Micro Analytical Services in St. Anthony, MN, using a JEOL 8600 Electron Microprobe. A subset of 24 polished thin-sections were selected, representing the most common rock types, with a wide range of sulfur and metal values, and representatives from all stratigraphic units. Analyses were conducted on three separate grains within each section (i.e. totaling ~72 analyses for each mineral), including: plagioclase, olivine, pyroxene (mostly clinopyroxene, but also some orthopyroxene), and biotite. The silicate analysis included the three most abundant ore metals, including: nickel, copper, and cobalt. Oxide minerals included both ilmenite and magnetite. The same procedure was done for chalcopyrite, pyrrhotite, cubanite and pentlandite, and for minor bornite, pyrite, and sphalerite.

Similar to the petrographic findings, there was little compositional difference between silicates with respect to stratigraphic unit designation. These tests confirmed prior conclusions about the general homogeneity of the silicate mineral chemistry.

The average anorthite (An) content of plagioclase was slightly higher in anorthositic rocks versus typical troctolites. As expected, metal content within the silicate mineralogy was low. No significant differences were found in the average metal contents of plagioclase. Slightly higher values of NiO were detected in cumulus olivines of olivine-rich nonreactive (less than 0.05% sulfur in assays) rocks, which would be expected of an early cumulus phase. The reverse of this was true for pyroxenes and biotite in more plagioclase-rich rocks, which had slightly higher averages of NiO, due to the fact that they are later intercumulus phases. Biotite was found to also have slightly higher averages of NiO when present within ultramafic rocks.

Microprobe data for silicate, sulfide, and oxide minerals are in Appendix 1 (each mineral averaged by major geologic unit) and Appendix 2 (average value for each mineral for each major rocktype in each major geological unit).

4.9 NICKEL IN SILICATES (LAB ASSAY NICKEL VS. RECOVERABLE NICKEL)

It has been characteristic of NorthMet and other Duluth Complex deposits to show lower nickel recoveries in process test work than would be expected from laboratory assays on drill core. Generally there is a loss of about 25-35% of the nickel compared to drill core assays when concentrating sulfides. From previous work, it is known that small amounts of unrecoverable nickel occur as a magnesium-iron-nickel silicate [$(Mg,Fe,Ni)_2 SiO_4$] that is tied up in the mineral olivine, which is one of three significant gangue minerals that occur across the NorthMet deposit. Testwork has shown that most of the very small amount of nickel contained in silicates would not be recovered during the autoclaving process proposed.

For example, mineralogical studies show that approximately 25% to 35% of the rock in NorthMet is composed of olivine. Previous microprobe study, plus work by PolyMet in 2006, has shown an average of <u>about</u> 0.10% nickel in olivine. The approximate nickel grade of the PolyMet metallurgical bulk samples is 0.10%. Because the average nickel in the olivine is the same as the average nickel in the bulk samples, the unrecoverable nickel in the olivine would be expected to reduce nickel recovery by the amount of olivine in the bulk sample - 25% to 35%. Nickel recoveries on the six PolyMet metallurgical bulk samples have ranged from 69% to 77%. This is in line with an approximate 25% to 35% loss of nickel to silicate.

4.10 ECONOMIC MINERALIZATION

The majority of economic mineralization (copper, nickel, cobalt, platinum, palladium, and gold) at NorthMet occurs in the basal Unit 1, with copper and nickel in chalcopyrite, cubanite, and pentlandite, all in the presence of pyrrhotite. Cobalt is contained in sulfides. Platinum, palladium, and gold, while showing good correlation with sulfur and the other metals, are also in a variety of tellurides, bismuthides, and alloys, as well as associated with the major and minor sulfides.

There is a smaller zone of economic mineralization at the western end of the property in the upper units, known as the “Magenta Zone.” This zone is generally copper and PGE-rich (sulfur-poor relative to metals) and of moderate grade.

The minerals of interest from a waste characterization perspective are the same as above, but pyrrhotite is expected to be the main mineral affecting water quality in regards to waste rock, though the traces of chalcopyrite, cubanite and pentlandite will require study for waste rock storage. Trace pyrite and pyrrhotite are the main sulfide minerals found in the tailings.

Table 3 Mineral formulas for the common minerals at NorthMet

SILICATES	GENERALIZED FORMULA	ABUNDANCE
Plagioclase (calcic feldspar, ~An 60)	$Na_{0.4}CaO_{0.6}Al_{1.6}Si_{2.4}O_8$	45-75%
Olivine	$(Mg, Fe)_2SiO_4$	20-40%
Clinopyroxene (augite)	$(Ca, Na)(Mg, Fe, Al)(Si, Al)O_6$	5-15%
Orthopyroxene	$(Mg, Fe)SiO_3$	0-2%
Biotite	$K(Mg, Fe)_3(AlSi_3O_{10})(OH)_2$	0-2%
Potassium feldspar	$KAlSi_3O_8$	0-1%
Apatite	$Ca_5(PO_4)_3(F,Cl,OH)$	trace to 1%
Amphibole (hornblende)	$(Ca, Na)_2\text{-}3(Mg, Fe, Al)_5\ Si_6(SiAl)_2O_{2}2(OH)_2$	trace to 1%
Chlorite	$(Mg, Fe)_3\ (Si, Al)_4\ O_{10}(OH)_2\ (Mg, Fe)_3\ (OH)_4$	trace to 1%
Serpentine	$Mg_2, Si_2O_5(OH)_4$	trace to 1%
Sausserite		trace to 1%
SULFIDES		
Chalcopyrite	$CuFeS_2$	0-3%
Cubanite	$CuFe_2S_3$	0-3%
Pentlandite	$(Fe, Ni)_9S_8$	0-1%
Pyrrhotite	$Fe_{1-X}S$	0-5%
	(Note that the sum of the disseminated sulfide minerals is rarely greater than about 5%, and that proportions can vary greatly over short distances at all scales)	
OXIDES		
Ilmenite	$FeTiO_3$	0.5-3%
Magnetite	Fe_3O_4	0-1%

For all Duluth Complex deposits (except South Filson Creek and the NorthMet Magenta zone) the major control(s) on mineralization, in an exploration sense, are: proximity to the footwall and heterogeneous troctolitic host rocks. Common, but possibly secondary, characteristics are: ilmenite greater than magnetite and nearby ultramafic horizons.

Most sulfide mineralization at NorthMet is of an igneous source, some is locally modified by sulfur derived from footwall metasedimentary rocks (Virginia Formation). Minor veins and other cross-cutting relations indicate some movement of sulfides within the deposit, but there is no evidence for large scale relocation of sulfides, nor any macroscopic evidence for any hydrothermal event that may have remobilized PGE's or sulfides.

Virtually all sulfide mineralization at NorthMet moved in with magmatic pulses, and metal enrichment of the magma happened in a deeper chamber. Therefore, the main controls on the location of mineralization within the deposit become the specific magmatic pulse or pulses making up the individual units. While textures in Unit 1 are described as heterogeneous, there is also a broad homogeneity in regards to mineral occurrence, mineral chemistry, whole rock and REE chemistry, and gross rock type that all reinforce the view of a large system of magma pulses replenishing the resident magma at the NorthMet site.

The exception to this is that some sulfur, particularly in Unit 1, was derived from assimilation of footwall rocks. The main effect of this assimilation has been to dilute the sulfide grade with additional pyrrhotite in Unit 1, rather than this sulfur scavenging base metals from the magma.

Microprobe data for silicate, sulfide, and oxide minerals are in Appendix 1 (each mineral averaged by major geologic unit) and Appendix 2 (average value for each mineral for each major rocktype in each major geological unit).

Resource modeling treats the NorthMet deposit as five separate domains:

- Virginia Formation footwall rocks;
- a domain including the upper, higher grade parts of Unit 1, locally merged with the higher grade zones at the base of Unit 2;
- the remainder (lower part) of Unit 1;
- the Magenta zone in Units 4, 5, & 6 in the western part of the deposit;
- and the remaining, less mineralized, parts of Units 2 through 7.

Unit 1 is mineralized throughout the deposit area, with other units (2 through 7) showing some economic mineralization in the western and central parts of the deposit, but essentially no continuous zones in the east. There is no known economic mineralization in the footwall rocks. Deposit wide, Unit 1 has the highest grades near its top.

Though grades vary, Unit 1 is also mineralized to the east of the deposit, down-dip (south) to depths of at least 2,500 feet, and past the limits of expected pit development in the west. The development of waste rock stockpiles over these areas is not expected to encumber any material that could reasonably be classed as ore because the upper units are barren and the Unit 1 mineralization is from 1,700 to over 2,500 feet below ground surface.

For modeling purposes, Unit 1 is bounded by both “hard” and “soft” geologic surfaces. A “hard” boundary is one where the interpolation of drill hole data into the block model does not cross geological surfaces, a soft boundary is one where interpolation crosses geological boundaries. The top of Unit 1 (i.e., the ultramafic at the base of Unit 2) is a soft boundary for mineralization estimation as the mineralized domain model crosses from Unit 1 into Unit 2. The base of Unit 1, where it contacts the Virginia Formation, is a hard boundary for estimation and metals values, with virtually all sulfide in the Virginia Formation below as pyrrhotite. No data from Unit 1 is used in estimating grades in the Virginia Formation, or vice versa.

In the up-dip, west half of the deposit there is an arbitrary and diffuse geologic boundary within Unit 1 that vanishes to the east. This is roughly equal to the top of a petrological contamination zone where large quantities of the footwall metasedimentary rocks have been assimilated. This zone is informally called the “front” or “norite zone” by PolyMet geologists. Precious metals values drop off in this zone and pyrrhotite becomes the dominant sulfide. Moderate copper values may persist below this line, but this is essentially a lower physical limit to combined polymetallic grades above the likely project cut-offs.

In the center of the deposit the highest, near surface, Unit 1 grades transition into the middle of the unit, while in the east, mineralization is strong and vertically persistent throughout the unit.

The top of the merged Unit 1 and Unit 2 mineralized domain (domain 1) forms a hard boundary that, combined with the bedrock ledge (depth to bedrock) surface, forms the bottom and top estimation boundaries for the upper units (exclusive of the “Magenta Zone”, which is internal to this domain).

There is no conclusive relation between specific Unit 1 specific rock type and presence or grade of mineralization except that noritic rocks are generally of lower grade.

Units 2 and 3: These units are treated as one unit in the geologic model, with PolyMet geologists considering them as a single package grading from an ultramafic base to an anorthositic top for modelling purposes. The thickness of the package stays relatively constant, though the thickness of the two individual units varies, primarily due to Unit 2 locally thinning.

While generally barren, Unit 2 has mineralization at its base in the western half of the deposit. These zones may not be strictly equivalent to Unit 1 type mineralization. Copper and nickel values are lower, as is pyrrhotite, but behavior of other metals is inconsistent, with PGE (Pt + Pd +Au) content varying locally relative to grades at the top of Unit 1. Above the basal zone of Unit 2 it is usually barren, medium-grained, and homogenous in texture. Average PGE in Unit 2 is slightly above that of Unit 1, however sampling density is not equal nor as well distributed as sampling in Unit 1.

Unit 3 shows two zones of mineralization in the west, one in the middle of the unit and one near the top. Both of these seem somewhat discontinuous and are of moderate grade relative to Unit 1 material.

Units 4 and 5 are also modeled as a geologic package. There is no compelling geologic reason to fully separate these units, the boundary between them being an arbitrary pick based on overall changes in texture from homogenous to heterogeneous, grain size, and plagioclase content, but without a well defined bounding horizon. The top boundary of Unit 5 is the basal ultramafic of Unit 6, which is an unused hard boundary in modelling. The bottom boundary of Unit 4 is a discontinuous ultramafic horizon. There are also discontinuous oxide-rich zones along the contact between Units 3 and 4.

Metals and sulfur grades in Unit 4 are proportional to Unit 1, but consistently lower. Unit 4 has few high copper or sulfur assay intervals. There is some near surface mineralization, modelled as a part of the Magenta Zone, described below for Units 5 and 6. Otherwise there is only low grade, discontinuous material at the unit base.

Unit 6 and Unit 7: These units are very similar in nature. Both are homogenous anorthositic troctolites with well defined ultramafic bases. No top for Unit 7 has been seen in drill hole.

Units 5 and 6 host one or more zones of mineralization, which appear continuous (and appear to transition into Unit 4), that are modeled as the Magenta Zone. Unit 6 material was described by Geerts (1994) as the “Magenta Horizon” when originally found in six drill holes. Further drilling has extended these copper rich, sulfur poor zones (of moderate overall grade) into more than thirty drill holes in Units 4, 5, and 6. The zone seems to transition across the ultramafic base of Unit 6 and into Units 4 and 5, which is problematic if the emplacement model of these units representing individual pulses of magma is correct. There is no gross evidence for this mineralization being hydrothermal, which could cross boundaries, but would presumably alter large masses of rock. Most likely the proximity and apparent continuity of mineralization in Units 4, 5, and 6 is coincidental.

Nevertheless, the Units 4, 5, and 6 mineralization does appear to cross stratigraphy. In the down-dip center area of the deposit, where drilling and sampling are widely spaced, there is a poorly defined 2,000 foot (strike length) zone of this mineralization in Unit 6, based on just a few drill holes. There is a barren gap of about 3,500 feet along strike to the west, where mineralization occurs in the top of Unit 5 and middle of Unit 6 (Magenta Zone), which becomes more continuous in Unit 6 and starts to transition into the middle of Unit 5. This zone is about 3,800 feet in strike length. Overall it appears grades and continuity are better in Unit 5 than in Unit 6 for this zone. This zone crosses geology, continues into Unit 4 near surface, and daylights near the Unit 3-Unit 4 contact.

Unit 7 has a few good assay intercepts, but no apparent continuity for sulfides. Only 11% of the drilling footage in this unit has been sampled (88 samples).

Table 4. Average values for assays by unit after removal of the less than 0.05% copper intervals (drill core samples). Unsampled zones not accounted for here.

	Cu%	Ni%	S%	Pt+Pd+Au ppb	Co ppm	Cu+Ni%	Cu/Ni	Cu/S	Total percent of unit sampled	Average sample length
Unit 1	0.3	0.09	0.83	349	76	0.39	3.35	0.43	90	5.3
Unit 2	0.2	0.07	0.39	365	73	0.27	2.74	0.61	80	5.6
Unit 3	0.19	0.05	0.5	286	62	0.25	3.19	0.53	71	7.2
Unit 4	0.21	0.06	0.58	269	66	0.28	3.40	0.44	51	7.6
Unit 5	0.27	0.07	0.54	398	65	0.35	3.64	0.54	41	7.8
Unit 6	0.33	0.08	0.48	532	69	0.41	3.74	0.69	27	7.2
Unit 7	0.2	0.06	0.32	330	83	0.26	3.60	0.72	11	8.4

Values in Table 4 are calculated after removing samples with less than 0.05% copper. Samples removed are generally those collected for waste characterization purposes, many well outside the expected mining area, and these low values can somewhat obscure the ore chemistry / mineralogy relations in the “ore.” Ratios are calculated on all raw data, not on the copper-nickel-sulfur values shown here.

Some items to keep in mind when reviewing Table 4 are:

- Because the deposit dips to the south, a smaller percentage of the upper units than the lower units intersect the mine area. Many USS holes in the southern part of the deposit have not been sampled in their entirety, whereas sampling in the mine area is essentially complete;

- Percent of unit sampled in Table 4 roughly equates to a minimum percent Mineralized;

- Average sample length reflects a higher proportion of 10 foot samples taken for waste characterization in the upper units;

- Decreasing sulfur values and increasing copper:sulfur ratios reflect the diminishing amounts of pyrrhotite found measuring upward through the stratigraphy from a chalcopyrite-cubanite and pyrrhotite regime as found in Unit 1 to a chalcopyrite dominant regime in the upper units;

- The low copper:nickel ratio in Unit 2 is probably a function of sampling being concentrated in the basal ultramafic zone, which represents a large portion of Unit 2, where a higher portion of nickel is in olivine rather than indicative of unit mineralization chemistry.

Also consider these deposit wide items:

- East end of deposit: low grades above Unit 1;

- Center of deposit: Unit 1 grades are best at depth;

- West end of deposit: Magenta Zones in Units 4-5 and in Unit 6 model as one, but maybe geologically distinct. Mineralization present, but poor over much of base of Unit 1;

- No lateral or vertical zonation has been recognized in sulfide or silicate mineral Chemistry;

- Gatehouse (North Mining) did report some geochemical cyclicity in unit 1, but this has not been revisited with the larger data set;

- Poor assay grades in the noritic rocks are related to footwall assimilation and contamination, otherwise there is little connection between grades and specific rock type. About 83% of the igneous rocks at NorthMet are troctolites, 6% anorthositic rocks, 4% ultramafic rocks, and 4% footwall inclusions. The remainder are norites, gabbros, and other;

- Within Unit 1 copper:sulfur ratio tends to be highest at top, then diminishes with depth, following the pattern of PGE's;

- The upper units have higher copper:sulfur ratios than Unit 1 (i.e., more chalcopyrite rich), but lower overall copper values;

- Ratio of PGE to copper is lowest in Unit 1, but Unit 1 has greatest quantities of both;

- Chalcopyrite is the dominant sulfide in the upper units regardless of total sulfur content;

- Copper grades above the likely cut-off grades are higher in the east;

- The association of PGE and ultramafic rocks remains to be tested with the full data set. Elsewhere in the Complex it has been seen that the PGE values are commonly near, but not necessarily in, the ultramafic horizons.

Table 5 Simple correlation ® table for economic metals and sulfur

	Cu%	Ni%	S%	Pt ppb	Pd ppb	Au ppb	Pt+Pd+Au	Co ppm	Zn ppm
Cu%	1.000								
Ni%	0.860	1.000							
S%	0.541	0.572	1.000						
Pt ppb	0.568	0.508	0.195	1.000					
Pd ppb	0.750	0.635	0.292	0.673	1.000				
Au ppb	0.591	0.472	0.250	0.482	0.699	1.000			
Pt+Pd+Au	0.760	0.645	0.292	0.778	0.983	0.755	1.000		
Co ppm	0.544	0.704	0.621	0.217	0.281	0.241	0.288	1.000	
Zn ppm	-0.021	-0.004	0.286	-0.041	-0.037	-0.017	-0.039	0.093	1

The simple correlation table above (Table 5, number of samples=19,516) shows the strong relation of copper, nickel, and palladium, and a somewhat surprising relation of cobalt to sulfur.

- Zinc's low factor is probably related to its multiple origins as either magmatic or derived from assimilation of footwall rock, hence representing two populations of data.

- The sulfur vs. metal correlation is probably greatly affected by iron, the presence of which is not shown here, but is in excess in all rocks.

4.11 SULFIDE (ORE) MINERAL PROPORTIONS

Various metallurgical test programs have been conducted on NorthMet ores since the 1970's. Reported sulfide mineral proportions have not been consistent between these tests. Table 6 shows well characterized sulfide mineral proportions for waste rock from studies done by PolyMet in 2006 and results from various previous studies.

Sulfide mineralogy within the NorthMet Deposit has been described in detail through petrographic observations and microprobe analysis. Approximately 95-98% of all sulfide mineralization consists of 4 predominant species, in decreasing order of abundance: chalcopyrite (cp) > pyrrhotite (po) > cubanite (cb) > pentlandite (pn). In general, Po:Cp&Cb ratios increase towards the basal contact or in proximity to sedimentary inclusions. Likewise, Cp:Cb ratios increase with increased distance away from the footwall rocks. In core logging, chalcopyrite is often not distinguished from cubanite.

Table 6 Sulfide Average Percentage (recalculated to 100 % Sulfide)

	Chalcopyrite %	Cubanite%	Cp:Cb	Pyrrhotite%	Pentlandite%
Metallurgical Studies:					
SGS Lakefield 1991 (NERCO L1)	44	12	4:1	2	9
SGS Lakefield 1991 (NERCO H1)	36	18	2:1	3	8
SGS Lakefield 2000 (PolyMet Conc.)	32	14	2:1	27	7
SGS Lakefield 2005 (Comp. 1)	37	9	4:1	38	16
SGS Lakefield 2005 (Comp. 2)	42	7	6:1	36	15
SGS Lakefield 2005 (Comp. 3)	36	7	5:1	41	16
Independent Studies:					
Geerts 1994 (Unit 1 – Ore)	54	15	4:1	21	3
PolyMet Waste Rock Study 2006:					
Unit 6	76	6	12:1	5	4
Unit 5	55	3	17:1	17	5
Unit 4	41	5	8:1	32	16
Unit 3	48	6	9:1	35	5
Unit 2	52	13	4:1	24	9
Unit 1	39	7	6:1	44	9

The results show a fairly wide range of values, which may not be totally representative of the deposit as a whole. It is important to note that these discrepancies may be the results of differences in composites, mixed intervals from multiple units including both waste rock and ore, or variations in petrography or laboratory procedures. Some of the composite samples submitted for metallurgical studies were prepared from relatively limited representative core (NERCO samples from 2 drill hole locations), while others were prepared from multiple locations evenly distributed across the deposit. Also, some of the composites contain some sulfide mineralization from stratigraphic units other than Unit 1.

4.12 WHOLE ROCK GEOCHEMISTRY

As a part of the PolyMet waste characterization program, whole rock analyses were conducted on the specific samples used in humidity cell testing. Appendix 3 gives the data averaged by rocktype within unit. Appendix 4 gives the detail for each of the humidity cell samples. These are the same samples used for the microprobe work given in Appendices 1 and 2.

The whole rock analyses show the overall homogeneity of the rock mass, with the major oxides varying by only a few percent for the igneous rocks and only the “ultramafics” showing a consistently distinct chemical difference (lower silica, higher magnesium). As would be expected, the anorthositic rocks show relatively higher silica, aluminum, and calcium, reflecting increased plagioclase content. Sample selection for the humidity cell work was based not only on rock type and unit, but also sulfur and metals content. Rock types and units expected to make up the majority of the of the material sent to stockpiles and tailings were tested, hence not every minor rock type in every unit was tested. Those not tested are variants or subsets of those tested.

5 DRILLING HISTORY

5.1 INTRODUCTION

In the history of the NorthMet Project there have been a total of three broad exploratory drilling campaigns up through the end of 2005, conducted by United States Steel (USS, 1969-1974) and PolyMet Mining Inc. (Reverse Circulation or "RC" drilling and core drilling in 1998-2000 & two phases of core drilling in 2005), plus two (actually two pairs of twins) holes by NERCO Minerals Company in 1991. This drilling encompasses 261,227 feet over 310 holes as of May 2006. Over 30,700 acceptable assays have been taken from this drilling (182,651 feet assayed). Figure 11 shows collar locations for all drill holes on and around the projected mine site. Table 7 gives a breakdown of years, footages, and number of assays for all project drilling.

There is also over 3,400 feet of hydrogeology drilling done in 2005, and 26,000 feet of drilling in "stratigraphic holes" (drilling by other companies not done as part of the NorthMet project) at the periphery of the project. No assays are in use from these holes.

Approximately 89.5% of Unit 1 and about 57% of the upper units have been sampled across the deposit. The sampled percentages are higher in the anticipated area of mining.

Sampling in Unit 1 (the main mineralized zone) is now mostly continuous through the zone for all generations of drilling. The PolyMet RC and core holes have continuous sample through the upper waste zones (which do have some intercepts of economic mineralization). Work in 2005 essentially completed the sampling of historic USS core within the area likely to be mined. This broad sampling limits the possibility of location bias in the sample set.

Resource consultant Dr. Phillip Hellman (Hellman, 2005) compared assays from RC drilling with those from nearby core drilling and found no significant bias between the sample sets.

5.2 USS CORE DRILLING (1969-1974)

USS drilled a total of 112 holes over 133,716 feet in the deposit area between 1969 and 1974. A few of these only penetrate Virginia Formation and intercept Biwabik Iron Formation, one hole goes to the Archean granite basement rocks in the mine area, and five go to granite to the north of the mine area. PolyMet uses the Virginia Formation holes for stratigraphic control, with some assays from the Virginia Formation in use. A few holes pass through Virginia Formation then penetrate an "undercut" of Duluth Complex rock, generally considered to be a local embayment from the bulk of the Complex and not sill-like in nature. These holes may or may not re-enter the Virginia Formation below the Complex.

USS assayed about 2,200 intervals with (mostly) 10 foot samples. All but 14 holes were vertical, and the angled holes more or less referenced grid north (~325°) and ranged from 40° to 60° in dip. Acids tests were done for the angled holes, but no other downhole records have been found.

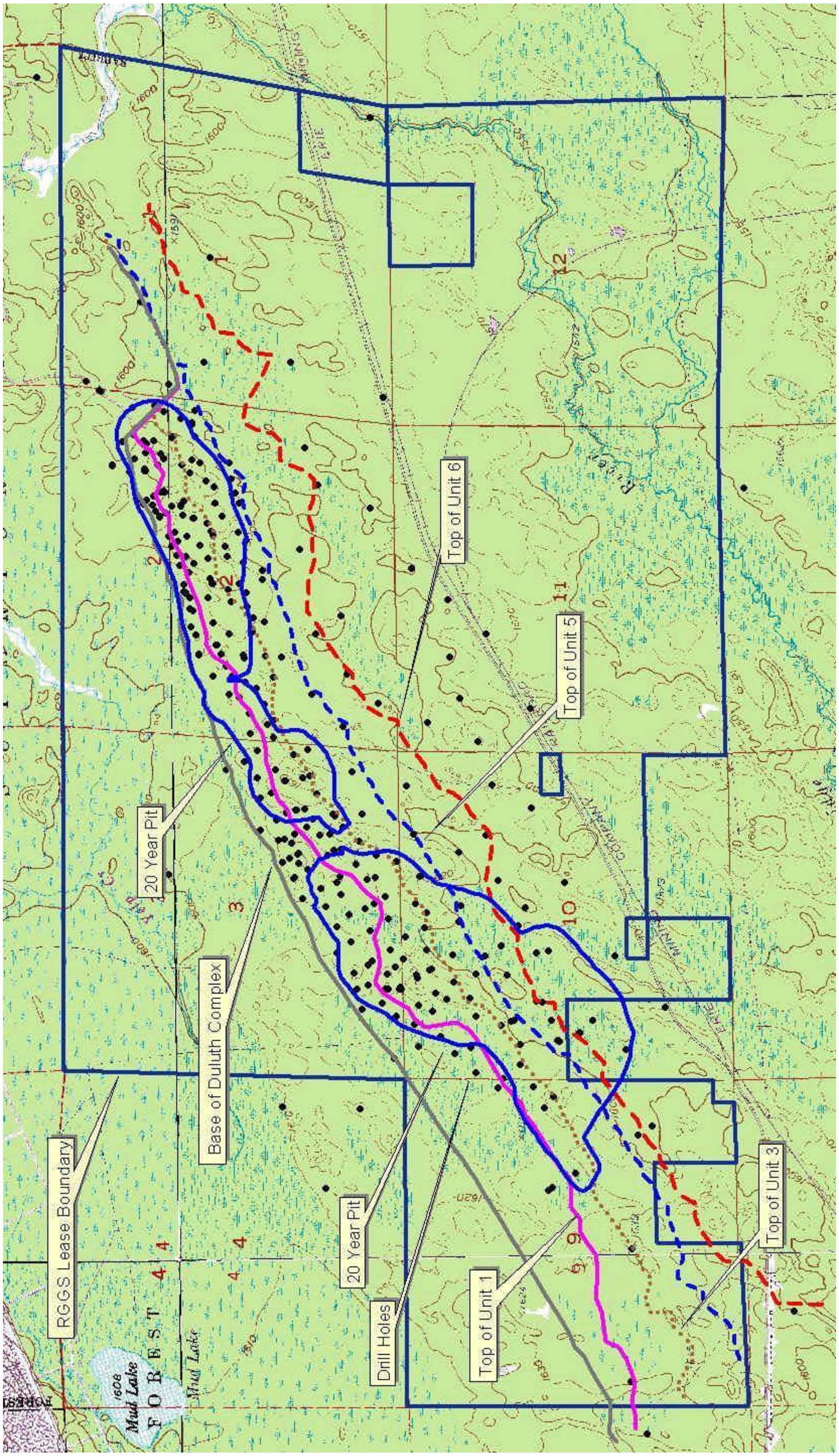

Figure 11 NorthMet drill holes, contacts, lease area, and 20 year pit outlines

Table 7. Total drilling and assaying for NorthMet project

Company	Drilling years	Assaying years	Number of drill holes	Total footage for group	Number of assay intervals used in “accepted values” tables	Assayed footage used in final database	Assay Laboratories
US Steel	1969-1974	1969-1974, 1989-1991, 1999-2001, 2005-2006	112	133,716	9,475	56,525	USS, ACME, ALS-Chemex
NERCO	1991	1991	2 (4)	842	165	822	ACME
PolyMet reverse circulation drilling	1998-2000	1998-2000	52	24,650	4,765	23,767	ACME
PolyMet core drilling	1999-2000	2000-2001, few in 2005	32	22,156	4,058	20,727	ALS-Chemex
PolyMet RC drilling deepened with AQ core tail	2000	2000	3	2,696	524	2,610	ALS-Chemex
PolyMet core drilling	2005	2005-2006	109	77,166	11,656	71,896	ALS-Chemex
Totals for exploration drilling			310	261,226	30,643	176,347	
US Steel stratigraphic holes	1970's?	none	6	9,647	none	none	
INCO	1956	none	3	2,015	none	none	
Humble Oil / Exxon	1968-1969	none	3	9,912	none	none	
Bear Creek / AMAX	1967-1977	none	11	8,893	none	none	
PolyMet / Barr Engineering (hydrologic testing)	2005	none	21	3,459	none	none	

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USS geologists logged the holes, and sampled those parts with “better” visible mineralization, amounting to about one-sixth of the total USS drilling. Their sampling goal was development of an underground resource, rather than open pit, hence only the most continuous higher grade zones were sampled. PolyMet has since sampled virtually all available USS core in the area of anticipated mining, as well as some outlying areas. Many deep holes remain to be sampled in their entirety. Property wide, over 50% of the Duluth Complex intercept in the USS holes has been sampled.

The original USS drilling was assayed at their own laboratories in Minnesota. The later re-assaying of pulps and coarse reject, and work on previously unsampled USS core, has been done by ACME and later by ALS-Chemex.

Virtually all of the USS core from this program exists and is available for further sampling. USS “skeletonized” the upper, (apparently) unmineralized parts of seventeen holes after assaying, with only a foot kept for each five or ten foot unsampled run.

5.3 NERCO DRILLING (1991)

In 1991 two sites were drilled for metallurgical holes by NERCO (in partnership with Fleck Resources Ltd.- precursor to PolyMet), which twinned USS holes 26086 (east end) and 26101 (west end), and were subsequently labeled 26086A and 26101A (Pancoast, 1991). At each site a BQ size (1 7/16") and PQ size (3 11/32") hole was drilled. The two BQ holes were split and assayed at 5 foot intervals from bedrock intercept to end-of-hole. The core from the PQ holes was shipped directly to Lakefield Laboratories for compositing and testing on the assumption that the assays would match those in the BQ holes.

All assays for the NERCO drilling (165) were done by ACME Analytical Laboratories Ltd., Vancouver, B.C. (ACME).

5.4 POLYMET RC DRILLING (1998-2000)

PolyMet used an experienced local contractor to carry out reverse circulation drilling in 1998 through 2000. This drilling program started out with new holes being drilled near USS core holes for comparison between drilling methods, followed by in-fill drilling in the east pit area, then an expansion of drilling into the less drilled central part of the deposit. Material from all these holes was used for metallurgical testwork. This was all 6 inch RC, with two 1/16 samples taken from each 5 foot run for both archive and assay. The initial assaying was done by ACME, with Chemex check assays. PolyMet has archive logging sample from all RC drilling. MDNR may have 1/16 samples from this drilling in their warehouse in Hibbing. The other pulps and coarse rejects are thought to be lost.

Three RC holes (99-304BC, 99-305BC, and 99-310BC) were re-entered and deepened with AQ core.

5.5 POLYMET CORE DRILLING (1999-2000)

Core drilling was done at the end of the RC program mostly as in-fill drilling with a small component of exploration / expansion of the area previously drilled by PolyMet (32 core holes for 22,156 feet). All of these core holes were drilled by IDEA International using Hagby drills, at first as BTW size (19 holes) then using NTW size (13 holes). All holes were vertical.

5.6 POLYMET CORE DRILLING (2005)

PolyMet's 2005 drill program covered 109 holes for 77,165 feet. These included fifteen 4 inch diameter holes for metallurgical sample (6,974 feet) drilled by Boart-Longyear of Salt Lake City in February-March 2005.

In 2005 IDEA drilled twelve PQ sized holes (3.3 inch) for 6,897 feet, mostly used for bulk sample material, but with a few holes intended as in-fill. The PQ holes were also all drilled in February-March of 2005.

IDEA also drilled fifty-two NTW sized holes (2.2 inch) for 41,403 feet, and thirty NQ2 sized holes (2.0 inch) for 21,892 feet. The "N" size core was drilled in February-March and September-December of 2005.

About 11,650 multi-element assays were collected from the 2005 drilling program. Another 1,790 assays were performed on USS and older PolyMet core. All assaying was by ALS-Chemex.

Of the 109 holes drilled in 2005, 93 were angled. Sixteen NQ2 sized holes were drilled and marked as oriented core, ten to the south and six to the north, at varying dips, for geotechnical assessment across the deposit. These holes targeted expected positions of pit walls as defined by Whittle pit shells developed by mining consultants AMDAD and available in January 2005.

PolyMet's 2005 metallurgical drilling targeted nearby USS or previous PolyMet holes to minimize the risk of lost time for non-productive drilling and yet recover material from across the deposit–much of this drilling phase accessed areas only available in winter to large drill rigs such as used here. Set-up and move times also contributed to a need to get results on every hole.

5.7 SAMPLE RECOVERY

5.7.1 RC Sample Recovery

PolyMet has found no definitive record assessing nor quantifying recovery for the RC (Reverse Circulation) drilling. PolyMet does have a partial list of sample weights from the preparation laboratory. Based on this, and written comments from Gatehouse of North Mining, it is estimated that sample recovery was greater than 85% for the RC drilling.

It is believed that because North Mining did not make reference to RC recovery in their due diligence and feasibility study scoping reviews, and because North was on site at the time of this drilling, there was no issue or concern about RC recovery.

5.7.2 Core Recovery

Core recovery as recorded by USS was upwards of 99% on about 12,000 intervals. PolyMet (1999-2000) recorded recovery on about 2,400 intervals averaging about 97%, with over 94% of the intervals showing 90% or greater recovery. In 2005 PolyMet's calculation was for an average core recovery of 100.2%, with about 97% of the intervals (n~7,075) showing recovery of greater than 90%.

Zones of poor core recovery are rare in the Duluth Complex. There is seldom a deeply weathered zone at the bedrock ledge intercept, though often the first few feet of many holes will show horizontal fracturing and moderate weathering. Most drill core would be described as fresh, with more minor alteration than weathering.

5.8 STRATIGRAPHIC DRILL HOLES

Six US Steel iron ore holes to the north of the deposit, eleven Bear Creek / AMAX holes from the Babbitt Deposit to the east, three Humble Oil / Exxon holes to the south, and to the west three INCO holes, and one Bear Creek hole, are all used for gross stratigraphic control. No assays from these stratigraphic holes are in the PolyMet database.

There are two water wells included in the data base, WW-1 and WW-2. In January-February 2005 these were drilled near RC holes (now sealed) that were used as wells in prior drilling campaigns. WW-1 did not produce much water and is capped and WW-2 produced and was used throughout the 2005 drill program.

There are twenty-one holes drilled under the supervision of Barr Engineering for hydrogeological studies carried in the database to keep a record of their locations, and because they (mostly) hit bedrock and provide a "depth to ledge" data point for engineering studies. These are all air rotary or "Rotosonic" holes.

6 ASSAY HISTORY

6.1 INTRODUCTION

There are eight generations of sample preparation and analyses that contribute to the overall project assay database:

1) Original USS core sampling, by USS, 1969-1974;
2) Re-assaying of USS pulps and rejects, selection by Fleck and NRRI, 1989-1991;
3) Sampling of previously unsampled USS core, sample selection by Fleck and NRRI in 1989-1991;
4) Sampling of two NERCO drill holes in 1991;
5) Sampling of RC cuttings by PolyMet in 1998-2000;
6) Sampling of PolyMet core in 2000;
7) Sampling of previously unsampled USS core (sample selection work done by NRRI, done in two phases) in 1999-2001.
8) Sampling of PolyMet core from 2005 drilling, as well as continued sampling of previously unsampled USS core in 2005-2006.

Employees of PolyMet (or Fleck Resources) have been either directly involved in or supervised all sample selection since the original USS sampling. Sample cutting and preparation of core for shipping has been done by direct PolyMet employees or contract employees. Reverse circulation sampling was done by, or in cooperation with, PolyMet employees and drilling contractor employees.

The USS core has been stored, either at the original company warehouse in Virginia, Minnesota during drilling, or more recently at the Coleraine Minerals Research Laboratory (now a part of the University of Minnesota). Core has been secured in dry, well sorted, locked buildings within a fenced area that is locked at night. The NERCO BQ size core is also stored at this facility.

The 1998-2000 PolyMet core and RC reference samples were stored in the PolyMet warehouse in Aurora, Minnesota during drilling and pre-feasibility. These were moved to a warehouse in Mountain Iron, Minnesota from 2002 until 2004. They were then moved to a warehouse at the current PolyMet field office site in Hoyt Lakes. Access has been limited to PolyMet employees.

PolyMet core from 2005 has been processed on site by PolyMet employees and is kept in a locked building at the Hoyt Lakes site.

No sieve tests are available for historical work. Sieve tests were performed by ALS-Chemex for samples from the 2005 drilling program.

PolyMet has historical fee schedules for ACME and Chemex, these detail methods and detection limits over time. Also available is some of the original sample submission paperwork back to 1989.

6.2 USS CORE SAMPLING, BY USS, 1969-1974

USS used two internal laboratories. The Applied Research Laboratory (ARL) in Coleraine Minnesota is now owned by the Natural Resources Research Institute, University of

Minnesota Duluth and known as CMRL-NRRI. The other laboratory used in the 1970's was "MinnTac Ore Operations" (MOO). At the time of drilling by USS, these laboratories were primarily responsible for analysis of samples representing upwards of 50 million tons a year of Minnesota iron ore, as well as USS worldwide exploration analyses.

Analytical methods at these USS laboratories is uncertain. Whilst standards were developed and used (as evidenced by documents in PolyMet files), it is not thought the standards were inserted into the sample stream in a blind manner. It is likely that these were used for calibration or spot checks. The standards description indicates that some material had been sent to "MOO" for their work on this core. There is every indication that the sampling and analytical work performed by USS was thorough, professional, of a high standard, and reliable.

Core was split by USS using a manual core splitter. Samples submitted for assay were half core.

Gatehouse (2000a), as part of the North Mining due diligence, summarizes the US Steel sampling and assaying as follows:

> *USX 'BX' diameter drilling and 10' intervals (late 60s-70s) was sampled using anvil splitting and prepared and analysed by the central USX laboratory. Sample rejects were kept as –6# and –20# material produced by gyratory and rolls crushers respectively. The precise techniques are not available but given the era, the style of analyses done at that time, and nature of the company it is highly probable that total Cu and Ni assays were produced using AAS. No Au or PGMs were analysed. No quality control has been found for this work*

USS "skeletonized" seventeen holes, some in the planned PolyMet mine area, after the initial sampling of visibly mineralized zones. Generally USS kept half core for the parts that had been sampled, but kept only one foot of core to represent every 5 or 10 foot interval of the unsampled portions. Hence, sample that would have been useful for data confidence is not available for these holes. PolyMet has a complete inventory of the skeletonized holes.

6.3 RE-ASSAYING OF USS PULPS AND REJECTS, BY FLECK AND NRRI, 1989-1991

The re-assaying of USS pulps and sampling of previously unsampled core completed in 1989-1991 was sponsored by Fleck Resources and partially involved co-operative work with the NRRI in Duluth. A large number of pulps and coarse rejects from the original USS drilling were re-assayed for copper, nickel, PGE, and a full suite of other elements. The NRRI's contribution was the selection and sampling (and re-logging) of previously unsampled core. This was the first large scale testing for PGE done on the NorthMet project.

About 2,600 of these analyses are in the current PolyMet database. All of this analytical work was done at ACME by aqua regia with ICP-ES for copper and nickel, with Au, Pt, Pd by PbO collection fire assay/AAS finish. There is uncertainty about the level of property specific standards used at ACME, though it is certain that they used some duplicates and their own internal standards. There is overall agreement between the ACME assays done on pulps and rejects and the original USS work. Sample preparation for all this work is thought to have been done by ACME.

6.4 SAMPLING OF PREVIOUSLY UNSAMPLED USS CORE, BY FLECK AND NRRI IN 1989-1991

This set includes USS virgin core samples (limited number) taken by Mark Severson for his 1988 and 1990 NRRI reports on the “unmineralized” parts of the Partridge River intrusion. These were processed at CMRL for Cu-Ni-S assays, and at Bondar-Clegg (Vancouver B.C.) for other elements.

Also included in this group are USS core samples where Steve Geerts took virgin core sample for his 1991 NRRI report and 1994 thesis work. These were processed at ACME.

6.5 SAMPLING OF TWO NERCO DRILL HOLES IN 1991

NERCO drilled two holes and took about 165 assays. Sample selection was done at the NERCO field office in Babbitt, samples were shipped to a customs broker in the state of Washington, and all preparation and analytical work was done at ACME in Vancouver (Pancoast, 1991). .

6.6 ARGOSY-SAMPLING OF USS COARSE REJECT 1995

There is some evidence that Argosy (joint venture partner in 1995) did some sampling of coarse reject for composites used for metallurgical work, but no evidence of re-assay for individual previously sampled intervals or new sampling of drill core has been found.

6.7 SAMPLING OF RC CUTTINGS BY POLYMET IN 1998-2000

There are 5,324 analyses from the RC drilling in the PolyMet database. The 1998 RC drilling program started with all analyses being sent to ACME and check assays going to Chemex. RC sample collection involved a 1/16(?) sample representing each five foot run. These were sent to Lerch Brothers of Hibbing Minnesota, for preparation, then sent to ACME for analysis.

Part of the way through the RC program, PolyMet switched laboratories, and sent the samples to Chemex, with ACME undertaking check assays. Analytical methods were aqua regia digestion, fire assay for PGE, and ICP-AES for other elements. LECO furnace sulfur was run on nearly every sample.

Gatehouse (2000) summarized the sampling and assaying of the RC samples for North Mining during their due diligence on the project:

> *6” hole RC drilling conducted by PolyMet in 1998 had assay samples over 5’ taken at the rig using a 1/16 split creating (10-15lb) samples. This initially was were [sic] sent to Lerch Bros in Hibbing where preparation consisted of jaw and gyratory crushing of entire sample followed by riffle splitting (0.5lb) for final pulping. Assaying was done by Acme using the same techniques as above. One in ten samples had pulps sent to Chemex in Vancouver for check assaying using the same Fire Assay technique and similar (notionally stronger) aqua regia ICP technique for Co Ni Cu and other elements.*

6.8 SAMPLING OF POLYMET CORE IN 2000

The 1999-2000 PolyMet core drilling was all assayed by ALS-Chemex. An ICP matrix problem was discovered (April 2000) on some nickel and cobalt assays causing a low bias (precious metals were not affected). The method was rectified by changing the nickel and cobalt standards to more closely match the project matrix, and the affected samples were re-assayed. Sample preparation was done at Chemex, though some may have been done at Lerch Brothers in Hibbing—various original Chemex laboratory certificates show both “received as pulp” and give grind directions. ACME ran the check assays on these samples.

Samples were generally five feet in length, with some adjustments to avoid crossing geologic boundaries. Analyses were aqua regia digestion with fire assay for PGE and ICP-AES for other elements. LECO furnace sulfur was run on most intervals. During this program property specific standards and quartzite blanks were inserted into the sample stream.

6.9 SAMPLING OF PREVIOUSLY UNSAMPLED USS CORE (BY NRRI) IN 1999-2001

Samples (collected by Severson et al., 2000 and Patelke, 2001) of previously unsampled USS core were assayed by ALS-Chemex. Most samples were sawn at the Coleraine laboratory by University of Minnesota employees. At various times samples were prepared at the NRRI Coleraine laboratory, Lerch Brothers, and probably by ALS-Chemex.

Samples were generally five feet in length, with some adjustments to avoid crossing geologic boundaries. Analyses were aqua regia digestion with fire assay for PGE and ICP-AES for other elements. LECO furnace sulfur was run on most intervals. During this program property specific standards and quartzite blanks were inserted into the sample stream.

This work was intended to supplement and in-fill the database, primarily in the Unit 1 mineralized zone as well as to provide some geochemical data for waste characterization.

6.10 SAMPLING OF POLYMET CORE, 2005, CONTINUED SAMPLING OF USS CORE IN 2005-2006

For the 2005 drilling program (2005 and early 2006 assaying) all analyses were done by ALS-Chemex, but with varying preparation at PolyMet in regards to core cutting (depending on core size, see below) to ease handling during bulk sample compilation. Chain of custody protocols were established which required ALS-Chemex to collect all samples at the PolyMet site in Hoyt Lakes and take them directly to the ALS-Chemex preparation laboratory in Thunder Bay, Ontario.

For all core, after core retrieval, washing, logging, photographing, and selection of intervals to be sampled (sampling all of certain zones, parts of others) the core was cut so that a portion could be sent for assay.

For the NQ2 and NTW size core, a normal ½ core was sent for assay. Generally this was a five foot sample in Unit 1 or where there was visible (economic) mineralization, and ten foot samples in most other cases.

For 4 inch and PQ sized core, intended for the 2005 metallurgical sample, assay samples were taken by the core box rather than the usual method of sampling based on run block footages or geologic intercepts. The goal was to minimize handling and re-packaging, therefore minimizing the risk of mislabeling or other errors. By sampling by boxes, when the assay data was returned from the laboratory, PolyMet was able to easily choose boxes to send as the sample for the pilot plant, without having to repackage those parts of boxes that might have been of lower grade.

The 4 inch diameter and PQ cores had 1/4 of the core cut and removed as two adjacent 1/8 pie slices along its length. One 1/8 slice was sent to the assay laboratory, one 1/8 slice was re-boxed at PolyMet as a “save” or geological reference sample. All boxes have the run blocks and sample tags inside, with the sample numbers written on the outside of the box. An individual sample interval of the 4 inch or PQ core for the 2005 bulk sample was one box in length and was intact core pieces with a 1/4 slice removed. Assayed sample of too low a grade to contribute to the bulk sample was kept at the PolyMet project site in Minnesota.

Where two 4 inch or PQ holes were drilled at the same site and the upper portion appeared to pass through unmineralized rock only, that upper interval was sampled in only one of the two holes.

Where core field duplicates were done on the large diameter core, two 1/8 slices were used, with a third 1/8 sample cut and kept for archive. This varies from the practice of two 1/4 cores on the BQ (USS), NQ2, and NTW core sent out in 2005-2006.

In 2005 and 2006 PolyMet essentially completed sampling of existing USS core in the area likely to be mined, and completely sampled a number of holes from bottom to top that had minimal previous sampling in the down-dip area of the deposit. Future mine planning may require more sampling of historic cores at the periphery of the currently planned pits.

PolyMet greatly expanded the overall geochemistry data set during the 2005 drill program, the majority of the approximately 400 standards submitted were also tested by an aqua regia digestion and for LECO furnace sulfur to get better reference data on the performance of (and differences among) these methods. About 1,300 aqua regia digestions were run on core samples that were also assayed by four acid methods, about 700 of these had whole rock analysis, and 250 of those had Rare Earth Element analyses. Most of these samples were also tested for specific gravity / density and LECO furnace sulfur.

6.11 POLYMET ASSAY METHODS 2005-2006

6.11.1 ICP

Two assay methods were used. All samples were subjected to four acid (“total”) digestion (HF-HNO_3-$HClO_4$ digestion with HCl leach and ICP-AES for 27 elements, ALS-Chemex code ME-ICP61), in addition, about 1 in 10 samples was analyzed by an aqua regia (“partial” digestion, ALS-Chemex code ME-ICP41) method for 34 elements for comparison with older data and any data generated during metallurgical testing.

6.11.2 PGE

PGE (platinum, palladium, gold) were analyzed by fire assay with a ICP-AES finish on 30 gram samples, this was ALS-Chemex code.”PGM-ICP23.”

6.11.3 Four Acid Digestion vs. Aqua Regia Digestion

In the 2005-2006 sampling program PolyMet switched from historic Aqua regia digestion to a four acid method. Previous comparisons had shown that the Aqua regia method had probably understated the copper and nickel contents by a small amount (about 5%), but more importantly the four acid method is expected to give a more complete digestion and therefore better results in assessment of standards.

For copper and nickel the change in digestion method has shown no significant change in copper and a very slight increase in nickel, based on about 275 standards where both methods were used. No factoring is being used to convert any project metals values.

6.11.4 LECO Furnace Sulfur vs. ICP Sulfur

Prior to the 2005-2006 sampling PolyMet had about 14,800 samples where both ICP sulfur (aqua regia digestion) and LECO furnace sulfur had been analyzed. In the 2005-2006 sampling program the LECO test was done on about 1 in 8 samples (including most standards). Because of the switch to four acid (total) digestion, a factor based on the relation of the four acid ICP sulfur to the LECO method needed to be established for modeling and environmental purposes. Analytical Solutions Ltd. of Toronto calculated this factor with another review done by SRK of Vancouver. Essentially, for sulfur values below 2.0% the 4 acid digestion ICP value can be used, and for values above 2.0% the four acid ICP value should be multiplied by 1.08 to arrive at a value consistent with expected LECO method values.

7 ASSAY QUALITY CONTROL

7.1 INTRODUCTION

This section reviews assay quality control for historic drilling programs and details the more recent programs.

7.2 USS QUALITY CONTROL (1969-1974)

The documented extent of the USS quality control is minimal. Some standards were created and used, but more likely for laboratory calibration rather than ongoing insertion into the sample stream. USS records for work done at CMRL in the 1970's are still stored at the laboratory. PolyMet has no record of anyone associated with the project making a full investigation into these records. Less than 200 USS samples are used in the current database and therefore the issue of historic assay quality control is not material.

Where checks have been done comparing USS assays with others (ACME, Chemex) the results have been in agreement.

7.3 FLECK-NRRI QUALITY CONTROL (1989-1993)

Records are limited and it appears that during this period of sampling Fleck relied on the laboratories internal quality control and checks of USS copper-nickel grades against ACME grades. Some standards (i.e., purchased standard reference materials) may have been inserted by the NRRI in this phase of sampling.

7.4 POLYMET QUALITY CONTROL (1999-2001)

7.4.1 Standards, Duplicates, and Blanks

In February 2000, Cone Geochemical (in conjunction with Hazen Research) prepared three standards under the direction of consulting geochemist Kenneth Lovstrom. These were prepared from PolyMet RC cuttings (detailed sample source unknown). Standards were pulverized at Hazen to 90% passing 200 mesh in a porcelain ball mill, then returned to Minnesota. Standards were used at an insertion rate of 1 in every 20 samples.

Blanks consisted of purchased “chicken grit” (New Ulm Quartzite) inserted into the sample stream at 1 in 20 samples. Blanks were measured out at the time of sampling.

Duplicates seem to have been a split from crushed rock at the laboratory, not duplicate core pieces, and were done every 10 samples.

7.4.2 Assessment

Compiled, detailed records of the assessment of the performance of standards, duplicates, and blanks from the 1999-2001 sampling have not been found. Because this program was successful at detecting problems at Chemex it is assumed that those records existed and are still with the consulting geologist or the successors to North Mining.

7.4.3 Check Sampling

When ACME was the main laboratory, check samples were submitted to Chemex, this was reversed at a later time. PolyMet used these check samples in 2004-2005 in assessing quality of data, and Gatehouse also assessed this data in his due diligence memos for North in 2000. Significant differences between laboratories were not found.

7.5 POLYMET QUALITY CONTROL 2005-2006

In the 2005 program, careful attention was placed on quality control and record keeping. Three property specific standards were created from coarse rejects of USS samples, blanks were created from iron-formation, field duplicates were done from core, coarse reject duplicates were run at the laboratory, and pulp duplicates were also done by ALS-Chemex. No check assays were done through other laboratories as ALS-Chemex performance was determined to be reliable relative to the “round robin” expected values calculated by Analytical Solutions Ltd. (ASL) of Toronto.

PolyMet used 63 coarse-reject USS samples, weighing from five to seven pounds each, to create three property specific standards in 2004. Seven samples were first sent to determine if the material had deteriorated in storage. Assays on these original seven samples matched their previous values. Coarse reject was then collected to make the property specific standards. The 2004 assay results on these standards are also consistent with results based on original USS assays of drill core. The 2004 ALS-Chemex results are shown in Table 8 with the calculated values for each "composite". Values are based on twenty samples of each standard with 4-acid assays completed in 2004. The USS results are slightly understated relative to the 2004 ALS-Chemex values.

Table 8 Standards: ALS-Chemex 2004 assays compared with older USS assays

	Cu %	Ni %	S %
Standard 1 expected value based on 1969 to 1974 USS assays	0.18	0.08	1.04
Standard 1 assayed value-2004 - Chemex	0.20	0.11	1.08
Standard 2 expected value based on 1969 to 1974 USS assays	0.36	0.14	0.88
Standard 2 assayed value-2004 – Chemex	0.37	0.15	0.82
Standard 3 expected value based on 1969 to 1974 USS assays	0.55	0.18	1.17
Standard 3 assayed value-2004 – Chemex	0.57	0.21	1.04

Approximately every twelfth sample submitted to ALS-Chemex in 2005 was a standard, blank, or field duplicate. The low, medium, and high grade standards were distributed as best as possible to match the expectation of grade in the surrounding samples. Chemex ran a crusher duplicate every 20 samples, and a pulp re-run every 10-12 samples.

7.6 STANDARDS

7.6.1 Preparation

Standards preparation was done at CDN Labs of Delta, British Columbia. The three standards were prepared separately and in an identical manner. The sample was ground to 200 mesh, screened and the oversize ground. The +200 fraction was bagged and ultimately returned to PolyMet. The -200 fraction was mechanically mixed for 72 hours. Twenty samples of each were cut from the standard and sent to ALS-Chemex in North Vancouver for assay. Homogeneity was approved by both PolyMet and resource consultant Dr. Phillip Hellman, the standards were then bagged in lots of approximately 110 g. in tin-top kraft paper bags and shipped to back PolyMet for further testing and use

7.7 COARSE BLANKS

The blank material used was “Biwabik Iron Formation”, which is quartz, magnetite, hematite, iron carbonate and minor iron silicates. Material was 2 inch crush, taken from the crushed rock pile on site at the former LTV Steel Mining Company mine in Hoyt Lakes Minnesota. This was clean sample originally crushed for road-bed and rail-bed fill. Sample was moved by loader to the PolyMet core preparation facility and once there was handled only with plastic tools. Each sample was weighed to approximate a typical weight of submitted core sample, and samples were shipped in the type of same containers as all core samples.

Investigation of an alternate blank material from an operating Duluth Complex dimension stone quarry showed erratic copper values and was not used.

7.8 DUPLICATES

7.8.1 Field Duplicates

Field duplicates were 1/4 core for BQ, NQ2, and NTW size core and 1/8 samples for PQ and 4 inch core.

7.8.2 Laboratory Duplicates

Chemex performed two duplication steps in the 2005-2006 work, crusher duplicates and pulps.

7.9 CHAIN OF CUSTODY

Because all samples for the 2005 program were picked up at the PolyMet core facility in Hoyt Lakes by ALS-Chemex, with pulps then transported to Vancouver according to ALS-Chemex standard practices (air freight), and all coarse reject returned directly to PolyMet by ALS-Chemex, there are no chain of custody issues for this phase of work. All 2005 core has been kept in a locked PolyMet facility at the Hoyt Lakes site.

7.10 LABORATORY AUDITS

Richard Patelke of PolyMet visited the ALS-Chemex preparation laboratory in Thunder Bay during the time PolyMet samples were being processed in May of 2005. This was an informal review based on a checklist supplied by an outside consultant. No issues were noted, and all work observed was being done in accordance with the contract.

7.11 OTHER ISSUES

During a site visit in September 2005, Pincock, Allen, and Holt (PAH) expressed concern about two issues: that not enough mineralogic work had been done on the deposit, and that there existed a possibility for cross-contamination of samples in the core cutting process.

The first item was simply a misunderstanding about the availability and compilation of data. The second item was reviewed by PolyMet geologists and no evidence was found for any contamination.

8 DRILLING DATABASE

8.1 INTRODUCTION

This section covers the drilling database.

8.2 DATABASE CONTENT-MODELING DATA

The drill data explanations listed here refer to what PolyMet considers to be “accepted values.” Most geological and resource modeling computer programs do not easily allow multiple entries for the same drill core interval for the same type of data in the same data table. For example, it is not practical to repeat an interval in the same data table using assays from multiple laboratories. In our final drilling and modeling database we include data extracted from more complete files, held primarily in Microsoft Excel format.

The PolyMet data sets, as summarized below, can be used in any mine modeling software package to assemble a complete picture of the PolyMet assay and geology database. The supporting digital and paper records are archived at PolyMet in Hoyt Lakes.

PolyMet currently uses “Gemcom for Windows” as our modeling and data handing program, H&S uses “TechBase” for block modeling, and AMDAD uses SURPAC for mine design. Data tables are moved as Excel or comma delimited files, and graphics as AutoCAD or ASCII string files, as needed.

Table 9 Summary of geology database(s) content

Parameter:	Comment:
Total number of drill holes	310 USS, NERCO, and PolyMet exploration holes, 47 other
Total footage	261,227 feet for exploration, 29,827 feet for other
Type of drilling USS, NERCO, PolyMet	255 core, 52 RC, 3 mixed
Total number angled holes	107 USS, NERCO, and PolyMet
Total number oriented core holes	16, all in 2005
Total number multi-element assay records in database	30,638
Standards, blanks, core duplicates	2005 program: 409 standards, 406 blanks, 396 core duplicates
Total number whole rock analyses	938 in 2005 program, plus uncompiled historical work
Total number REE analyses	323 in 2005 program, plus uncompiled historical work
Total number lithologic intervals	24,953
Total number RQD measurements	9,769
Total number core recovery records	23,250
Total number of Specific Gravity / Density measurements	4,650 plus duplicates
Total number thin-sections examined	182 in 2006, plus uncompiled historical work
Total microprobe work	1,000s in 2006, plus uncompiled historical work

8.3 DATA TABLES-SHORT DESCRIPTIONS

These descriptions are of the broad data in each database table, and the sources of that data. Figure 12 gives a representation of the table relationships in Gemcom.

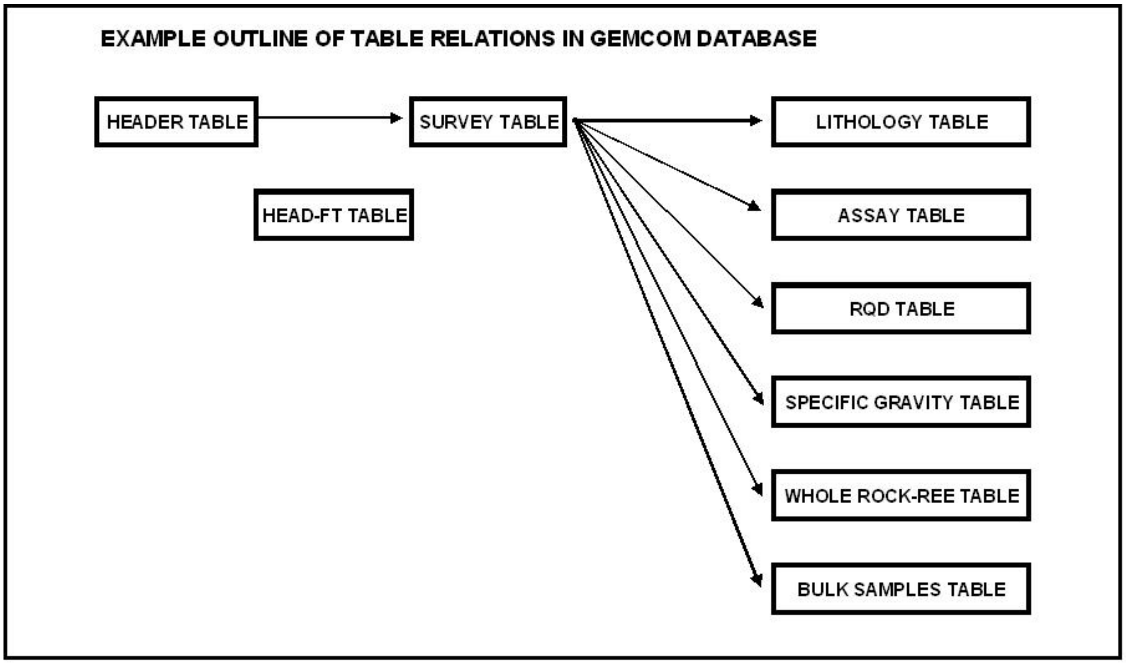

Figure 12 Generalized database relationships for PolyMet drilling data

8.3.1 Header Table

The header table contains all data that applies to the entire hole, such as location, geologist, company, and date drilled. Generally it is tied by the software to the other tables using the drill hole number and downhole footage as the key field(s).

8.3.2 Drill Hole Location Mapping

In 2005 PolyMet used handheld GPS units to check the location of every drill hole that could be located in the field. This data was checked against data from USS, previously contracted surveying and mapping, and digital topographic maps currently in use to reconcile all locations to a common data set PolyMet deems to be correct.

8.3.3 Data Sources

Data sources for the header table include geologic logs, assays sheets, drillers reports, older mapping recovered from the RGGS files, MGS and NRRI reports, and checks against current mapping.

8.3.4 Downhole Survey Table

USS did no downhole surveying of vertical holes, but did do did acid-dip tests on angled holes. The NERCO holes were not surveyed. The PolyMet RC and core holes done in 1998-2000 were surveyed using gyroscopic methods (specific tool unknown). In the 2005 drilling, none of the 4 inch holes were surveyed, some of the PQ holes were surveyed, and all of the NQ2 and NTW sized holes were surveyed. All surveys in 2005 were done using a “Flexit” SmartTool multi-shot system supplied by IDEA International.

8.3.5 Assay Table

Assay data is extracted from two files, one representing all drilling and sampling up to 2005, a second with all drilling from 2005 and sampling in 2005-2006. Each of these master files contains extensive quality control data (standards, blanks, duplicates, check samples, etc.) which have been reviewed and used in deciding which actual assays are to be used.

The assay data table represents the accepted values for 30,643 intervals across the deposit. Besides metals values the data file includes NSR, NMV, interval classification for waste rock characterization, laboratory information, assay method, hole size and type (core or RC), basic rocktype and unit data, and sampling date.

8.3.6 Lithology Table

The lithology data table is a subset of the full lithologic data set derived from logging. Not all data in all logs is included here though the intervals, unit definitions, rocktype and metadata are all complete and accurate.

8.3.7 Specific Gravity / Density Table

Specific gravity is another data set with multiple entries for common intervals, it is treated much the same as assay data where a “best” value is chosen to represent a particular interval–in this case where intervals have been tested by various specific gravity / density methods and a single value must be chosen. The average specific gravity value for the deposit is 2.95. It appears that density is more a function of local rocktype than sulfide grade (with exceptions) and hence no strong relation between grade and density has been defined.

8.3.8 RQD Table

The RQD data was compiled from work done by PolyMet in 1999-2000 and the 2005 drilling. RQD was not done on the four inch and PQ large diameter core drilled in 2005, but was done on all other core, as well as where PolyMet sampled previously unsampled (and therefore unbroken) USS BQ core. Historic USS RQD data has not been found. The average RQD value for the deposit is 94%.

8.4 OTHER DRILL HOLE RELATED DATA

Besides the basic drill hole files developed for modeling the deposit (header, survey, lithology, and assays) numerous other files of either subsets of, or other drill hole specific data, are available from PolyMet. These include:

8.4.1 Bulk sample data table

This data table identifies the intervals used for specific bulk metallurgical samples from 1998 through 2006.

8.4.2 Oriented Core Geotechnical Data

Under the direction of Marc Rougier of Golder Associates (Toronto), PolyMet drilled 16 oriented core holes in 2005. These were all NQ2 size (2 inch) holes drilled by IDEA International of Virginia, Minnesota. Orientation was with the “EasyMark” tool, which uses a wax pencil and a spring loaded device to match the broken core surface and hence mark the down facing side of the core.

Geotechnical logging on these holes consisted of measuring the angles of all fractures as well as classifying their surface attributes. This data has been entered as needed to accommodate use for geotechnical reporting.

8.4.3 Polished Section / Thin Section / Polished Thin Section Inventory

There is an inventory of over 350 thin-sections taken over the years by academic and company geologists for petrography and available for use.

8.4.4 Aqua Regia Data (2005-2006)

The 2005 drilling program represented a switch in assay methods for PolyMet from aqua regia to a four acid digestion. About 1,840 samples (including standards) in the 2005 program were also run with aqua regia digestions to establish a comparison if needed.

8.4.5 Whole Rock Data

PolyMet has compiled samples for whole rock done by the company as well as by others into a “from-to” format amenable to loading into mine modeling software if needed. The 2005 whole rock analyses were performed by ALS-Chemex using ICP-AES (method code ME-ICP06, and FeO by Fe-VOL05).

8.4.6 Rare Earth Element (REE) Data

PolyMet has compiled samples for REE done by the company in 2005-2006 into a “from-to” format amenable to loading into mine modeling software if needed. There are about 320 samples in this data set from the 2005 drilling. This was done using ALS-Chemex method code ME-MS82.

Note that for the 2005 sampling, most of those samples that were analyzed for REE had whole rock, assay by both aqua regia and four acid digestion, as well as specific gravity determination by ALS-Chemex and PolyMet. About 250 samples had this complete treatment.

9 BULK SAMPLES

9.1 INTRODUCTION

There have been at least three large bulk metallurgical samples taken by USS and four by PolyMet, plus others from smaller drill core composites. The following is a brief summary of sample history. The results of metallurgical tests on all these samples are covered in USS and SGS Lakefield (Lakefield) reports. See Table 10 for a summary of these bulk samples.

9.2 USS BULK SAMPLES

USS took at least three bulk samples from the deposit. USS also took a few small trench samples (locations unknown) and processed some drill core composites from the site. These samples are recorded in the material receiving books at Coleraine Minerals Research Laboratory (CMRL, formerly the USS minerals processing laboratory). Details about these additional smaller samples have not been pursued. No records indicate that any blast hole sampling was done by USS prior to collecting their bulk samples.

9.2.1 USS Bulk Sample Number 1

USS Bulk No. 1 was taken from a surface excavation at drill hole 26058 during September 1970. It is certain that this sample was taken, but no documentation has been found for site selection reasoning or metallurgical testing. The site location was near the center of NW 1/4, Section 10, T59N, R13W. The original pit geometry is unknown. The copper-nickel grade for the interval from 8 to 20 feet in DDH 26058 is 0.88% copper and 0.14% nickel. USS had no assays for the next 500 feet. The first core interval (8-20 feet) is sulfide bearing whereas the interval 20-524 feet is not visibly sulfide-bearing and was not assayed until 2001 by PolyMet.

9.2.2 USS Bulk Sample Number 2

Bulk sample No.2 was the first of two samples USS recovered in 1971 from a second location (site of USS bulk samples number 2 and 3). This pit was positioned directly above (north of) the updip projection of drill hole 26105. This hole (drilled and assayed in 1971) was angled to the north to penetrate the footwall near the northeast corner of the deposit. This pit location assumed that the best interval in the hole, 0.77% copper and 0.28% nickel, at 22-32 feet, would follow a dipping horizon and be intersected in a pit near the surface. This was a reasonable assumption. Drill hole 26112 just down dip (south to southeast) shows similar assays at about the same level above the footwall.

A 300 ton sample was taken for Bulk No. 2. However, this sample did not return the grade expected, with the low head grade blamed on presence of footwall rock. Core logging shows numerous inclusions of Virginia Formation in heterogeneous olivine-gabbro to augite-troctolite in this area. The footwall rock referenced by USS was probably inclusions, not *in situ* Virginia Formation.

9.2.3 USS Bulk Sample Number 3

USS Bulk sample No. 3 is from the same site as USS Bulk No. 2. This was taken at the south (stratigraphically higher) edge of the sample pit in an attempt to move up-section from the footwall related contamination. This second sample weighed about 20 tons. Bulk No. 3 did improve the head grade.

The USS memo and other documents referring this pit do not mention any drilling or sampling prior to collecting the bulk sample. Only core hole DDH 26105 is mentioned and thus it is not known if any blasthole assay studies were performed.

USS concluded that: *"Pilot-plant tests on three test pit samples of copper-nickel sulfides from the Duluth Gabbro deposit have confirmed that 83 to 89 percent of the total copper and 72 to 85 percent of the sulfide nickel can be recovered in a cleaned bulk sulfide concentrate containing 20 percent copper and 4.5 percent nickel. Mineral liberation requires grinding to about 75 percent minus 200 mesh and consumes about 23 net kwhr per short ton. Differential flotation of the bulk sulfide concentrate to make separate copper and nickel concentrates was unsatisfactory, as a clean separation was not achieved. A selective flotation scheme, wherein only copper sulfides were floated in the first step and previously-depressed nickel sulfides were floated in the second step, showed good selectivity and high metal recovery in bench-scale tests but pilot plant results were erratic because of difficulty encountered in control of critical parameters, notably pH of the pulp at various stages of flotation."*

USS felt that more work would be needed for actual cost estimation, but that this work established that concentration at the deposit would be economically feasible. Further test work was pending a decision to pursue mining the deposit, and was never done.

9.3 NERCO BULK SAMPLE (LARGE DIAMETER DRILL CORES)

In 1991, NERCO took samples from two large diameter (PQ or 3.3 inch) drill cores (holes 26086A and 26101A, twinning USS holes 26086 and 26101). Drill hole 26086A was in the northeast corner of the deposit, and 26101A near the northern contact in the western one third of the deposit. These holes were themselves first twinned by smaller core holes for assay and submission of samples to landowners and the state.

The smaller diameter NERCO cores are stored with other USS NorthMet drill cores at CMRL. Both holes ended short of the length of the originals (26086A at 522 feet vs. 574 feet in 26086, and 320 feet in 26101A vs. 655 feet in 26101).

Two composites were initially created at Lakefield, a lower composite graded 0.42 percent copper and 0.14 percent nickel; a higher one had grades of 0.71 percent copper and 0.20 percent nickel. Further tests created three more sub-composites. Both selective and bulk concentrates were made. The concentrates from these samples were used to test "Cuprex Metal Extraction Process" or CMEP (a ferric chloride leaching solvent extraction-electrowinnowing process) for extraction of copper and nickel with by-product cobalt, platinum group metals, gold, silver, and ilmenite.

9.4 ARGOSY

Records available in the PolyMet files indicate that one or more small bulk samples were composited from -6 and -20 mesh coarse reject from the original USS drilling by Argosy. Flotation tests were carried out on these samples at Lakefield.

9.5 POLYMET BULK SAMPLES

9.5.1 PolyMet Pilot Plant 1998

A 26 ton bulk sample was created by PolyMet from the first 14 RC holes drilled in 1998. Metallurgical testing was done at Lakefield in December, 1998. The purpose of this program was to produce bulk concentrate as a final metals recovery method was still under study at the time. This was done in runs of four, seven, and forty-two hours. Pyrrhotite recovery (and therefore total sulfur) was purposefully minimized in this test run. The hydrometallurgical work was done on this concentrate in 1999.

9.5.2 PolyMet Pilot Plant 2000

The 2000 bulk sample produced 839 kg of concentrate from 33.5 tonnes (37.25 short tons) of sample from forty RC drill holes. This sample focused on total sulfur recovery to maximize metals return to concentrate and eliminate sulfur in the tailings.

9.5.3 PolyMet Variability Testing

In 2000, twenty RC drilling samples from across the 1998-2000 drilling area (center and northeast parts of the deposit) were submitted to Lakefield for variability testing. The samples were processed through various bench scale tests, (flotation and metals recovery, head and tailings assay, sulfide nickel vs. silicate nickel, and variations in reagents) to ascertain if spatial differences in ore treatability existed.

9.5.4 PolyMet Pilot Plant 2005-Three Composites

In 2005 PolyMet created a 40 ton bulk sample from fresh large diameter core (PQ size or 3.3 inch, and 4 inch size core). The drilling for these bulk sample holes targeted zones of known mineralization near existing, but widespread, holes across the property. This plan minimized the risk of drilling non-productive holes. The main reason for this concern was wintertime site access–many locations on site are only accessible when the ground is frozen and spring time thaw can be unexpected and rapid.

This drilling project targeted a grade of 0.40% copper, which is the average grade of the Unit 1 drill core intervals above the US $7.42 NSR economic cut-off in use at that time. This goal was met, with lower grade intervals available to dilute the sample if needed. About forty tons of 0.40% copper material were available for compositing. The US $7.42 NSR was selected as representing a reasonable cut-off value and to facilitate comparison with earlier work using the same cut-off value.

This sample was mostly comprised of Unit 1 material, but contained material from the Magenta Zone as well as the other units.

In May and June 2005, it was decided, with input from Bateman Engineering, to create three separate bulk samples: ten tons of 0.30% copper, twenty tons of 0.35 copper, and ten tons of 0.40% copper. These samples were processed at Lakefield in 2005.

Because large diameter holes were drilled in expected pit areas, were generally shallow, and by definition represented the mining area, no further location or rock unit criteria where applied in developing the bulk sample.

9.5.5 PolyMet 2006-Two Composites

In spring 2006, a set bulk samples were created from coarse-reject material from the 2005 drilling. The goal for this project was to make two samples, one for start-up and conditioning of the pilot plant, one for actual process testing. The targeted grade for each was 0.35% copper. The start-up sample was calculated to weigh 4.16 tons, the main ore sample 4.94 tons. These samples were processed at Lakefield in 2006.

One sample was created with material all mapped as being within the ten year mining envelope based on preliminary pit designs received from AMDAD in December 2005. As such it only included geologic units 1 through 5. This composite used all available NQ2 and NTW coarse reject from within this pit shell.

The other sample was composited from material from across the rest of the deposit, exclusive of the ten year east pit. Units 1 through 7 were included in this sample.

Both samples were deemed by PolyMet to be representative of the deposit, and by selecting from virtually all material available, there is little question that these composites represent the deposit as a whole.

Table 10. Large metallurgical samples collected at NorthMet

Bulk Sample:	Year	Tons	Location of sample
USS Bulk sample pit No. 1	1971	Unknown, but small	Pit in center of property
USS Bulk sample pit No. 2	1971	300	Pit at east end of property
USS Bulk sample pit No. 3	1971	20	Pit at east end of property
NERCO PQ drill core	1991	Est at 4.5 tons or less by drill core size	One PQ drill hole from each end of property
Argosy Mining	1995	Unknown, but small	Composited from USS coarse rejects
PolyMet RC drill cuttings	1998	26	One composite, mostly from what is now considered east part of 10 year pits
PolyMet RC drill cuttings	2000	33	One composite, mostly from what is now considered east part of 10 year pits
PolyMet 4 inch and PQ core	2005	10.5, 21.5, and 10.7	Three composites from within ten year pits across property
PolyMet coarse reject	2006	4.2 and 4.94	One composite from 10 year east pit, one from 20 year pit across property

9.6 REPRESENTIVITY OF BULK SAMPLES

The NorthMet bulk samples taken prior to 1998 were for very general process testing. Available evidence would indicate that there was no intention that the samples would fully represent the deposit. The samples since 1998 have all been comprised of material from within or immediately adjacent to the pits as the pit designs were understood at the time.

PolyMet believes these samples to be representative of the ore body as a whole. Dr. Phillip Hellman of H&S investigated the representivity of the 2005 samples (about 42.7 tons split to 10.5, 21.5, and 10.7 ton composites averaging 0.30%, 0.35%, and 0.40% copper) and concluded that within the bounds of geologic and pit design knowledge at the time of sampling, the sample was appropriate.

Variability testing of 20 samples from the 1999 and 2000 reverse circulation drilling taken across what would now be considered the central and eastern pits shows metals correlated with sulfur. No are discernable differences related to location.

Bulk sample and bench testing show sulfide recovery to concentrate to be independent of grade.

Petrology studies over time have shown little, if any, relation between rock type and grade at NorthMet. Because the deposit rock types are rather limited in their silicate and sulfide mineralogy it can be assumed that the ore body (and therefore tailings) will be homogenous over time, as will the rock stored in stockpiles. This is borne out in the mine planning and scheduling by the narrow range of chemistry seen in the block model data for both the paying (Cu, Ni, Co, Pt, Pd, Au) and non-paying elements (i.e., Zn, Pb, Mo, etc). These metal grades are all dependent on the amount of sulfur in the rock.

10 TOPOGRAPHY AND BASEMAP

10.1 INTRODUCTION AND DATA SOURCES

This section reports the nature and source of mapping data in use for the project. All mine site mapping data in use for the NorthMet project comes from:

- records obtained from USS and RGGS (USS successor mineral rights owner);
- air photo topographic work done in 1999;
- surveying by PolyMet or contractors;
- and publicly available GIS data.

Plant site mapping comes from work contracted by Cliffs-Erie following the shutdown of LTV Steel Mining Company.

10.2 NORTHMET GRID DEFINITIONS

10.2.1 Local Grid System

There is a local mapping grid laid out on the ground at the project mine site. It approximates the original USS grid (of which there may have been two varying by a fraction of a degree). Line cutting and surveying were done in 1999 by Northern Lights Surveying (formerly in Biwabik, now in Virginia, Minnesota).

For digital cross-sections, PolyMet uses an approximation of the USS grid. This digital grid was laid out in 2004 or earlier. The baseline runs at an azimuth of N56.06°E (approximately the strike of the deposit). Computerized cross-sections are on one-hundred foot spacings at right angles and parallel to this baseline.

10.2.2 State Plane Coordinate System

Because drill data is in feet, PolyMet used NAD83 “Minnesota State Plane North” as the primary coordinate system at the mine site and in all data handling. USS used NAD27 for their original mapping. The vertical datum currently used is NAVD88.

10.2.3 UTM Coordinate System

PolyMet geologists used UTM (Zone 15, NAD83) for temporary drill hole locations and other field mapping instances where a portable GPS was used. Data conversion between coordinate systems are done in “Corpscon for Windows” (U.S. Army Corps of Engineers program) or AutoCAD Map 2000.

10.3 AIR PHOTO TOPOGRAPHY

10.3.1 Survey Control

Survey control for the mine site air photo was done in 1999 by Northern Lights Surveying. Their initial task was to tie in existing data, locate drill holes, define and cut a grid, and develop control points for air photo topographic mapping. Northern Lights has done additional control work since then.

10.3.2 1999 Aero-Metric Topographic Mapping

Aero-Metric of Sheboygan, Wisconsin, produced the 2 foot contour map currently in use for the project mine site. This was done through a contract with environmental engineering consultants Foth and Van Dyke on behalf of PolyMet, in the fall of 1999.

11 RESOURCE ESTIMATION

11.1 INTRODUCTION

This section reviews some aspects of the NorthMet resource estimation. It is derived from proprietary reports from consultants to PolyMet in 2005-2006. It primarily covers the estimation of metals of value (Cu, Ni, Co, Pt, Pd, and Au, S is also covered).

Elements with potential to impact the water quality objectives in rock stockpiles or tailings were modeled following the same general methods, with the exception that the application of conservatism was reversed. In modeling economic metals best practice guidelines indicate that when choices are made the estimation method should always be that which would understate the grade if reasonable. In modeling elements as a data input for the assessment of potential water quality, all choices were those which would overstate the values to some extent.

11.2 DATA AND INTERPRETATIONS

Digital drilling data was supplied by PolyMet in the form of Microsoft Excel spreadsheets. These replace previous data and are based on the previously recompiled database with additions from the 2005 drilling and 2005-2006 sampling programs.

An elevation model was constructed using two foot contours extracted from AutoCAD by PolyMet (“pmettopo.xyz”).

The geology model in use was created by PolyMet in February, 2006, using logging and assaying data from the 2005 program to supersede the previous model. Most detail work was directly done in Gemcom by Richard Patelke at PolyMet with reference to working paper cross-sections and other drawings. All geologic surfaces honor drill hole unit intercept points.

A surface defining the base of till was modeled using drill intercept data and outcrop polygon data draped over the topography. The tops of Duluth Complex Units 1 through 7, 20 (Virginia Formation), and 30 (Biwabik Iron-Formation) were created as line work, then each merged with the bedrock ledge surface and the original drill hole intercept points, then meshed to form a TIN surface. Figure 13 illustrates a typical cross-section showing modeled tops of Units 1-7, 20, and 30. Intervals coded as Unit 1 are shown together with grade estimates within blocks that are classified as Unit 1 blocks. The scale is shown by easting and northings (the section is non-orthogonal).

In the geologic model units 2 & 3 are modelled as a single package, as are units 4 & 5.

11.3 COMPOSITES

Composited intervals with no assays were assigned zero (or low) grades for metals values for resource estimation on the assumption that these intervals were visually identified as having no mineralization. In many cases this was an unjustifiably conservative approach because some assays had been excluded from the database by PolyMet on the basis of overly stringent quality control criteria. This resulted in scattered intervals within mineralization having missing assays.

Drill hole assays were composited to 10 foot lengths within their appropriate lithological units, prior to grade estimation. Units 1 – 7 are within the Duluth Complex, Unit 10 is the glacial till, and Unit 21 is minor Unit 20 material occurring as rafts within the Duluth Complex (generally within Unit 1). No values were assigned to the Biwabik Iron-Formation

Units 1 to 7 are the main units of economic interest. These are within the Duluth Complex and are illustrated in plan view in Figure 14 and in sectional view in Figures 15.

11.4 CORELATION

Correlation coefficients (Spearmans) for Cu:Ni, Cu:Co; Cu:Pd and Co:Ni are high (0.93, 0.52, 0.85 & 0.68, respectively). Cu:Au is also high at 0.86. These high correlations indicate the geochemical coherence of the target elements within the controlling mineralization domains.

11.5 VARIOGRAPHY AND MODELLING

Variography was completed for Cu, Ni, Co, Pt, Pd, Au, and S. Grades for these were estimated by Ordinary Kriging. Details of variogram models were provided in Hellman & Schofield (2005) and examples of modeled variograms (for Cu) are given in Figure 16 and Figure 17.

Check estimates for Cu and Ni were completed using Inverse Distance Squared weighting. All estimates were completed by Dr. P. L. Hellman of H&S.

A Net Metal Value (“NMV”, previously referred to as net smelter return, “NSR”) value for each block was calculated using assumed metal prices of: $1.25/lb Cu, $5.60/lb Ni, $15.25/lb Co, $400/oz Au, $800/oz Pt and $210/oz Pd.

Densities were modelled using inverse distance weighting within appropriate geological units. Modelled values from Measured, Indicated and Inferred blocks are summarized in Table 11. Un-estimated blocks were assigned the average density of the rock unit.

Table 11. Summary of modelled density measurements

Unit	SG
1	2.98
3	2.92
5	2.89
6	2.88
7	2.95
20	2.80
21	2.84

Details of the block model are given in Table. 12 The base of the block model is at 500 feet elevation (see Figure 13).

Table 12 Summary of Block Model Limits

Lower-left X coord:	2896178	Column size	100	Number	202
Lower-left Y coord:	728887	Row size	100	Number	60
Top Z coord:	1610	Level size	20	Number	56
Baseline azimuth: 56.06					

Four confidence categories were assigned to the estimate blocks on the basis of proximity to drill hole data. Table 11-3 summarizes the search parameters and data requirements for the various confidence categories.

Variography was completed for the two mineralized domains as well as the rest of the data within the Duluth Complex and the underlying Unit 20 (Virginia Formation).

Estimation search strategies and resulting confidence categories are summarized in Table 13 (data refer to 10 ft composites). The fourth search was used to ensure that no blocks remained un-estimated for an indication of potential mineralization in areas of low drilling density and also for environmental considerations. Categories 1, 2 & 3 equate to Measured, Indicated and Inferred categories, respectively.

Table 13. Search parameters (distances in feet)

Category	Search 146° (ft)	Search 056° (ft)	Search Z (ft)	Min Data	Max Data
1	200	300	30	10	24
2	300	450	45	8	24
3	400	600	60	8	24
4	6000	8000	1200	4	24

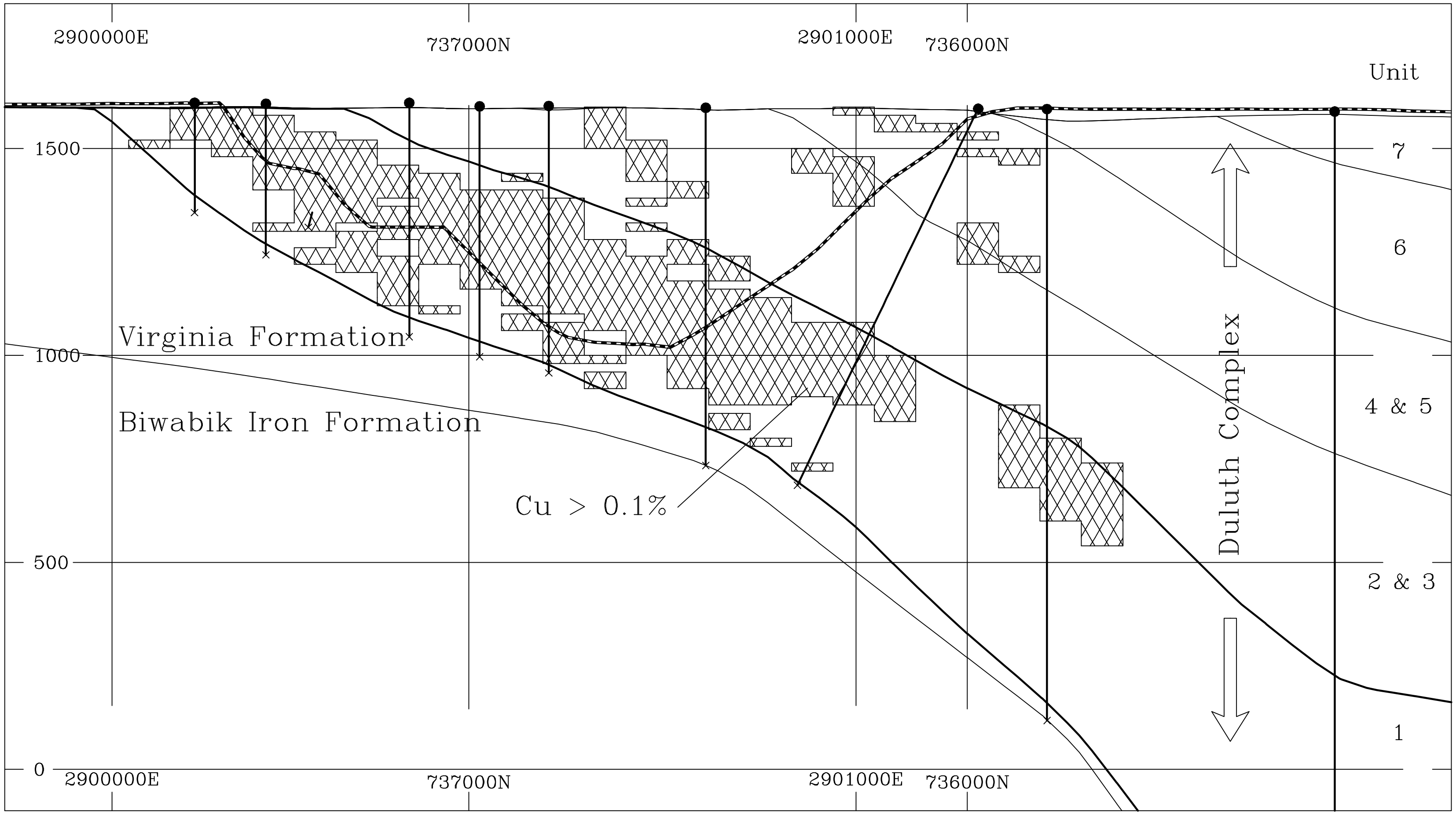

Figure 13. Typical cross-section with modelled lithological surfaces and Cu mineralization (preliminary optimum pit also shown as is traces of drill holes)

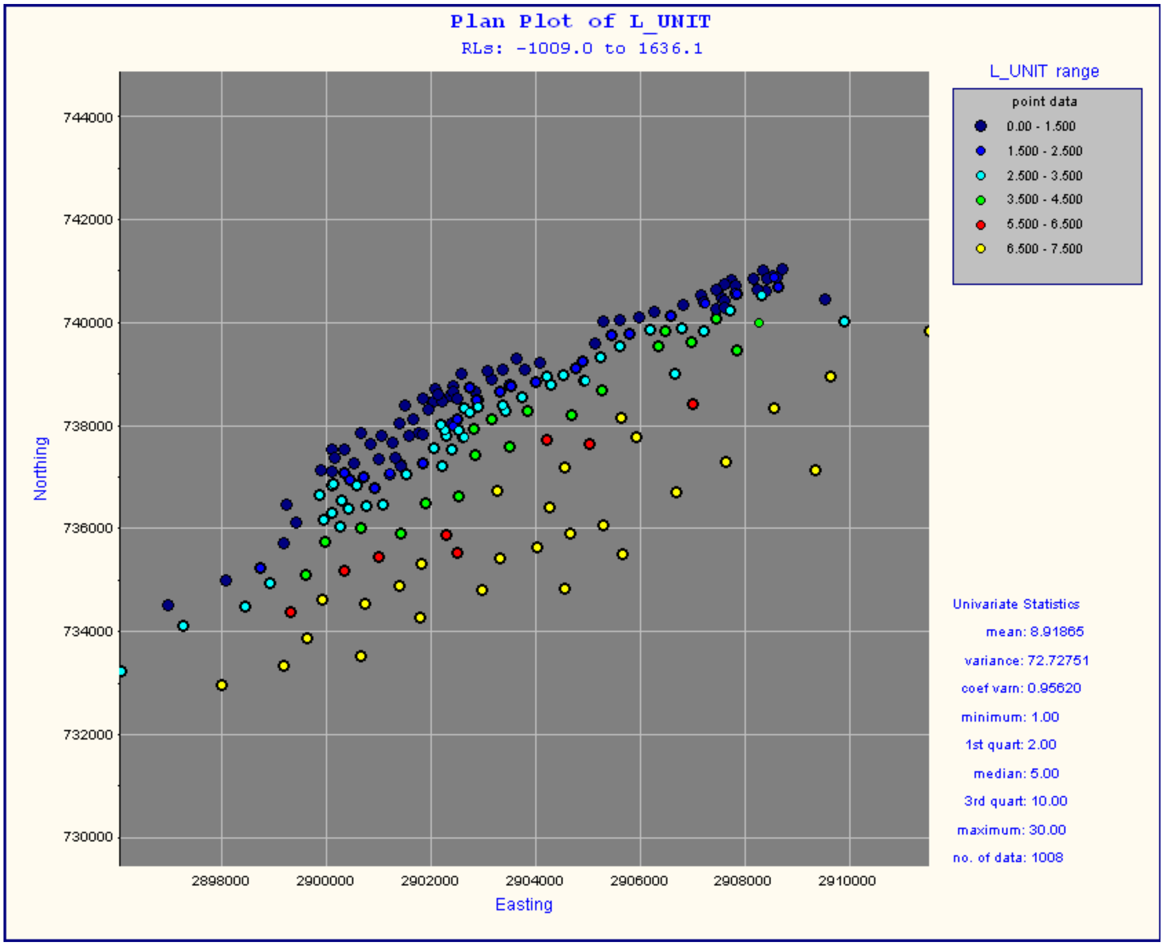

Figure 14. Plan view of Units 1 – 7 drill collar geology

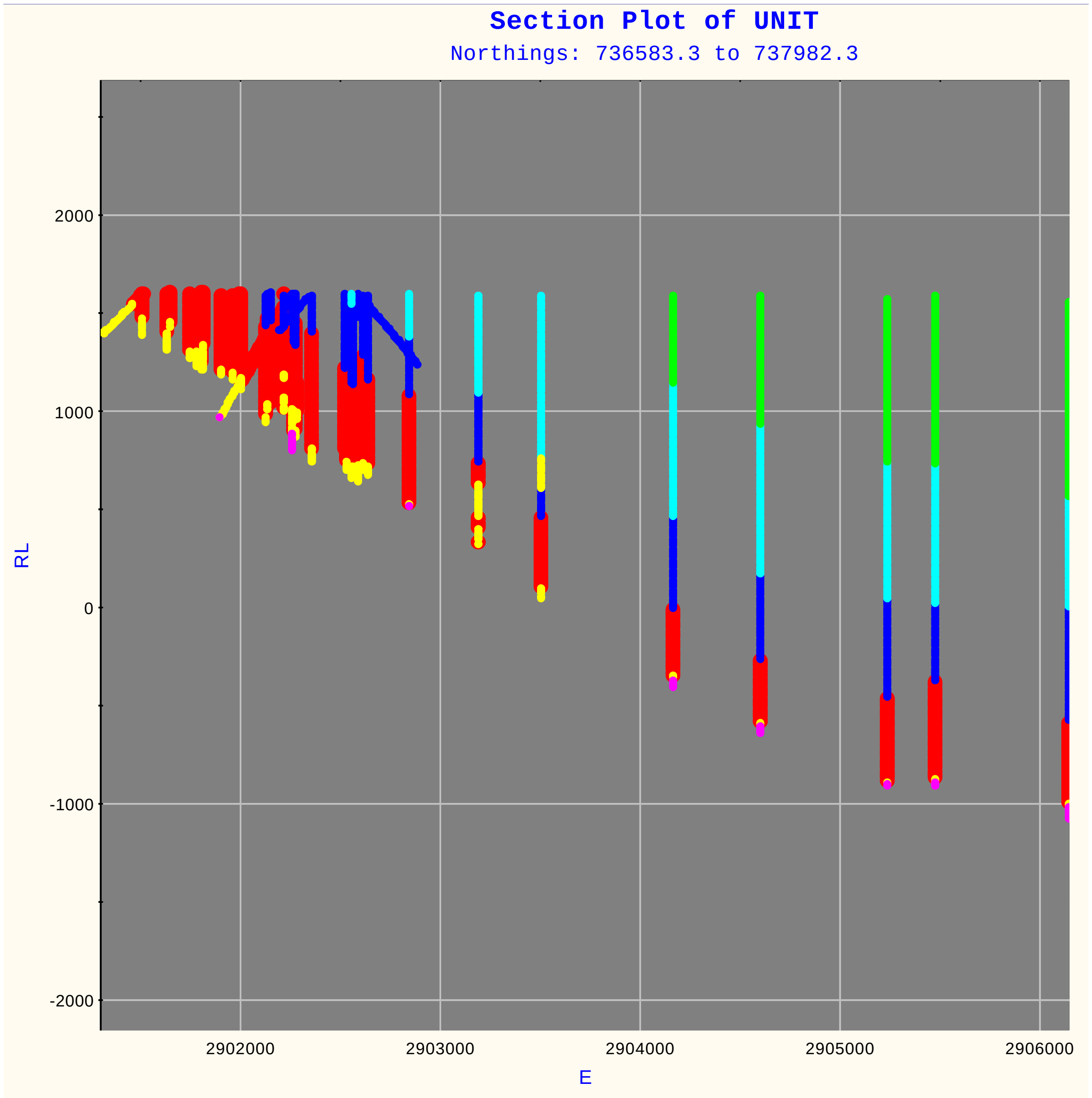

Figure 15. Northwest southeast cross section (rotated data) of Units 1 -30

(Unit 1 = red; 2&3 = blue; 4&5 = cyan; 6 & 7 = green; 20 & 21 = yellow; 30 = purple)

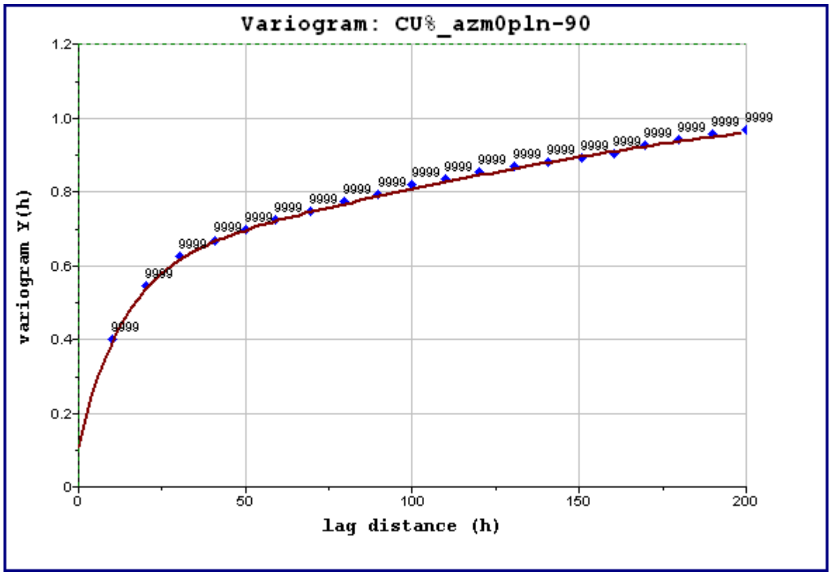

Figure 16. Down hole variogram with model (Cu, all data)

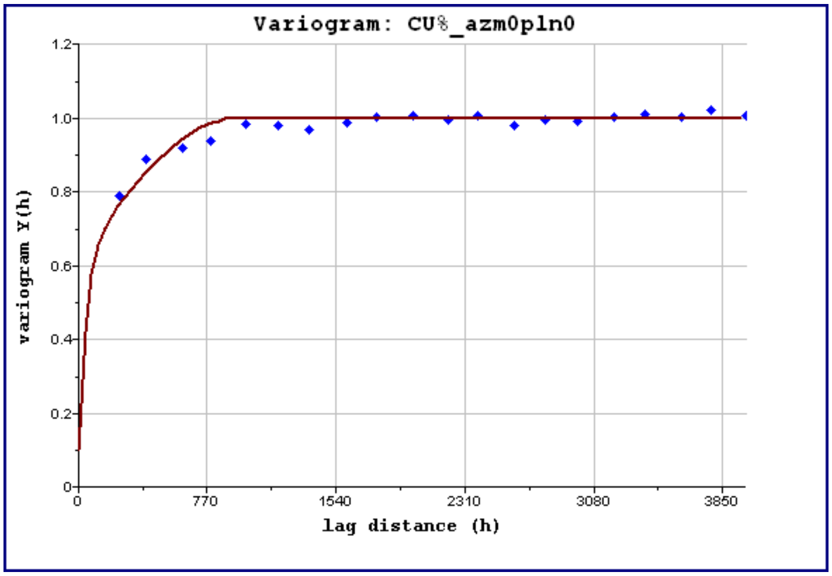

Figure 17. East – west variogram (Cu, rotated data)

11.6 COMPARISON WITH BULK SAMPLES

Modelled grades in blocks were compared to samples in close proximity (within 50 ft) to US Steel bulk samples. Test Pit 1 (2899969E, 735799.2N) is close to drill hole 26058 in the center of the property and Test Pit 2 (2907694E, 740846N) is close to drill hole 26105 at the east end of the property.

Table 14. Bulk samples compared to modeled grades

	Model	Pit 1	Pit 2 – Sample 1	Model	Pit 2 – Sample 2
Cu%	0.18, 0.14, 0.23	0.39	0.40	0.49, 0.48, 0.46	0.58
Ni%	0.05, 0.05, 0.07	0.14	0.13	0.12, 0.12, 0.13	0.22
S%	0.36, 0.32, 0.44	0.50	0.97	0.98, 1.14, 1.74	0.98
Unit	5, 5, 3		1, 1, 1		

Three block grades for each location are given in Table 144. These correspond to the surface block and two blocks directly below. Given the uncertainties of the historic bulk sampling and assaying, these results are encouraging. Modeled grades of Cu and Ni are close to those in the bulk samples from Pit 2 and are less than those from Pit 1.

11.7 CHECK RESOURCE ESTIMATION AND SELECTIVE MINING UNIT

As a check on the models constructed by the author, Mr. N. A. Schofield of H&S, undertook an analysis of the NMV data and constructed an Ordinary Kriging model of NMV as well as undertaking some global recoverable grade calculations. Overall, for Measured and Indicated (Cats 1 & 2) the NAS model has 2% less tons and 0.3% higher grade. This agreement, within <5%, is exceptionally good.

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APPENDIX 1

MICROPROBE DATA-EACH MINERAL AVERAGED BY MAJOR GEOLOGIC UNIT

POLYMET-DECEMBER 26
MINERAL CHEMISTRY MICROPROBE DATA-EACH MINERAL AVERAGED BY UNIT

SILICATE-OXIDE-SULFIDE	UNIT	MINERAL	OXIDES AS PERCENTAGES-->>>															
			SIO2	AL2O3	TIO2	FEO	MNO	MGO	K2O	CAO	NA2O	CR2O3	S	NIO	CUO	COO	ZN	AS
SILICATE	1	BIOTITE	37.24	14.38	5.31	13.42	0.45	15.12	9.15	0.25	0.27			0.60	0.90	0.22		
SILICATE	2	BIOTITE	37.22	13.95	6.66	12.36	0.40	15.63	9.37	0.17	0.17			0.94	0.73	0.23		
SILICATE	3	BIOTITE	37.46	13.68	6.13	14.45	0.47	13.99	9.45	0.14	0.78			0.75	0.92	0.20		
SILICATE	4	BIOTITE	37.46	14.18	5.94	13.70	0.45	14.71	9.98	0.20	0.38			0.24	0.15	0.24		
SILICATE	5	BIOTITE	37.93	14.73	4.27	1.94	0.28	17.25	9.43	0.47	0.92			0.82	0.68	0.29		
SILICATE	6	BIOTITE	37.95	14.34	4.85	1.92	0.34	17.53	8.79	0.29	0.42			0.98	0.23	0.18		
SILICATE	1	CORDIERITE	48.77	33.80	0.29	6.98	0.57	9.45	0.13	0.28	0.14			0.16	0.17	0.15		
SILICATE	1	CLINOPYROXENE	51.27	1.86	0.82	11.66	0.27	13.46	0.14	2.21	0.25			0.28	0.88	0.13		
SILICATE	2	CLINOPYROXENE	5.83	2.51	1.18	1.64	0.23	14.59	0.13	2.47	0.36			0.27	0.58	0.14		
SILICATE	3	CLINOPYROXENE	51.39	2.37	1.40	1.52	0.27	13.94	0.79	2.38	0.27			0.23	0.89	0.21		
SILICATE	4	CLINOPYROXENE	51.67	1.88	0.80	1.97	0.29	13.64	0.17	2.37	0.24			0.69	0.39	0.76		
SILICATE	5	CLINOPYROXENE	51.63	2.51	0.84	9.69	0.21	14.48	0.16	2.34	0.25			0.59	0.59	0.18		
SILICATE	6	CLINOPYROXENE	51.34	2.59	0.95	8.90	0.23	14.47	0.15	21.20	0.32			0.25	0.71	0.12		
SILICATE	1	OLIVINE	35.24	0.20	0.45	38.14	0.45	25.75	0.13	0.58	0.44			0.81	0.76	0.63		
SILICATE	2	OLIVINE	36.24	0.12	0.52	34.13	0.43	29.12	0.13	0.42	0.19			0.12	0.46	0.63		
SILICATE	3	OLIVINE	36.53	0.18	0.52	34.65	0.45	25.87	0.18	0.28	0.12			0.98	0.27	0.62		
SILICATE	4	OLIVINE	34.79	0.14	0.59	4.78	0.53	23.35	0.15	0.79	0.45			0.34	0.40	0.69		
SILICATE	5	OLIVINE	39.99	3.59	0.48	28.14	0.54	18.44	0.17	1.42	0.15			0.45	0.82	0.40		
SILICATE	6	OLIVINE	36.56	0.74	0.52	31.87	0.49	3.55	0.15	0.51	0.51			0.15	0.54	0.57		
SILICATE	1	ORTHOPYROXENE	51.45	1.92	0.30	24.56	0.32	2.66	0.17	0.74	0.14			0.12	0.72	0.33		
SILICATE	2	ORTHOPYROXENE	52.48	0.93	0.28	22.77	0.44	21.38	0.86	1.43	0.83			0.41	0.47	0.27		
SILICATE	3	ORTHOPYROXENE	53.61	0.85	0.19	19.82	0.49	23.38	0.32	1.56				0.59		0.42		
SILICATE	4	ORTHOPYROXENE	52.23	1.34	0.35	22.85	0.50	21.89	0.95	0.76	0.19			0.77	0.21	0.36		
SILICATE	5	ORTHOPYROXENE	53.29	1.21	0.32	2.78	0.35	22.73	0.16	2.33	0.18			0.78	0.20			
SILICATE	1	PLAGIOCLASE	53.16	29.73	0.93	0.15	0.14	0.22	0.39	11.99	4.63			0.86	0.55	0.73		
SILICATE	2	PLAGIOCLASE	53.57	29.33	0.14	0.23	0.84	0.35	0.44	11.83	4.62			0.74	0.68	0.43		
SILICATE	3	PLAGIOCLASE	52.46	3.24	0.79	0.20	0.71	0.26	0.49	12.94	4.25			0.38	0.76	0.55		
SILICATE	4	PLAGIOCLASE	55.12	28.75	0.70	0.12	0.15	0.20	0.39	1.74	5.45			0.52	0.91	0.60		
SILICATE	5	PLAGIOCLASE	51.38	3.80	0.19	0.29	0.21	0.30	0.37	13.56	3.82			0.44	0.96	0.51		
SILICATE	6	PLAGIOCLASE	51.92	3.23	0.14	0.26	0.50	0.45	0.37	13.13	4.27			0.23	0.12	0.12		
SULFIDE	6	BORNITE			0.13	12.17							25.42	0.78	62.35	0.23	0.13	0.70
SULFIDE	1	CUBANITE			0.58	41.33							34.83	0.12	23.29	0.39	0.89	0.26
SULFIDE	2	CUBANITE			0.27	41.15							35.13	0.18	22.96	0.44	0.93	0.16
SULFIDE	3	CUBANITE			0.30	41.90							35.60	0.44	22.94	0.52	0.12	0.24
SULFIDE	4	CUBANITE			0.24	41.15							35.33	0.15	23.14	0.43	0.12	0.70
SULFIDE	6	CUBANITE			0.11	48.18							35.74	2.25	12.40	0.50	0.29	

SILICATE-OXIDE-SULFIDE	UNIT	MINERAL	OXIDES AS PERCENTAGES-->>>															
			SIO2	AL2O3	TIO2	FEO	MNO	MGO	K2O	CAO	NA2O	CR2O3	S	NIO	CUO	COO	ZN	AS
SULFIDE	1	COBALTITE				3.88							18.77	11.26	0.30	2.77		45.20
SULFIDE	4	COBALT-RICH PENTLANDITE				12.27							4.95	2.69	5.59	19.90	0.18	0.73
SULFIDE	1	CHALCOPYRITE			0.31	3.64							34.46	0.47	34.84	0.44	0.17	0.64
SULFIDE	2	CHALCOPYRITE			0.37	3.69							34.37	0.92	33.98	0.43	0.15	0.39
SULFIDE	3	CHALCOPYRITE			0.56	3.47							34.55	0.36	34.65	0.31	0.19	0.13
SULFIDE	4	CHALCOPYRITE			0.23	3.75							34.71	0.21	33.74	0.39	0.15	0.16
SULFIDE	5	CHALCOPYRITE			0.34	3.69							34.39	0.38	34.83	0.37	0.17	0.31
SULFIDE	6	CHALCOPYRITE			0.46	3.56							34.66	0.37	33.97	0.29	0.14	0.46
SULFIDE	1	MAUCHERITE			0.42	0.36							0.34	5.28	0.55	1.15	0.25	42.63
SULFIDE	1	PENTLANDITE			0.26	31.32							32.88	32.47	0.22	2.75	0.39	0.43
SULFIDE	2	PENTLANDITE			0.26	32.87							32.89	31.77	0.43	1.53	0.76	0.28
SULFIDE	3	PENTLANDITE			0.27	3.61							33.63	32.56	0.28	3.00	0.13	0.15
SULFIDE	4	PENTLANDITE				34.45							32.40	3.10	0.83	2.79	0.36	
SULFIDE	5	PENTLANDITE				3.40							32.89	34.25	0.16	2.71	0.39	0.38
SULFIDE	6	PENTLANDITE			0.68	34.23							33.83	28.82	1.25	1.73		0.68
SULFIDE	5	PYRITE			0.10	46.10							52.19	0.95	0.38	0.47	0.84	0.28
SULFIDE	4	PYRITE			0.11	46.99							53.13	0.38	0.20	0.68	0.86	0.73
SULFIDE	5	PYRRHOTITE			0.27	59.26							39.43	0.93	0.12	0.64		0.47
SULFIDE	3	PYRRHOTITE			0.10	6.61							38.52	0.26	0.13	0.64	0.29	0.12
SULFIDE	4	PYRRHOTITE			0.82	61.16							38.20	0.35	0.57	0.12	0.29	0.61
SULFIDE	1	PYRRHOTITE			0.65	61.17							38.13	0.17	0.68	0.60	0.24	0.17
SULFIDE	2	PYRRHOTITE			0.43	61.78							37.53	0.19	0.93	0.62	0.47	0.13
SULFIDE	6	PYRRHOTITE			0.37	63.58							36.17	0.77	0.60	0.54	0.14	0.20
SULFIDE	4	SPHALERITE				9.63							32.13	0.65	0.13	0.11	57.17	
OXIDE	1	ILMENITE	0.86	0.44	51.77	44.46	0.46	1.46				0.93		0.13	0.43	0.46		
OXIDE	2	ILMENITE		0.63	5.75	44.28	0.49	2.39				0.16		0.32	0.38	0.61		
OXIDE	3	ILMENITE		0.53	5.87	44.68	0.56	2.94				0.59		0.20	0.15	0.53		
OXIDE	4	ILMENITE		0.19	52.59	44.83	0.63	0.89				0.35		0.52	0.38	0.51		
OXIDE	5	ILMENITE	0.21	0.41	52.16	42.72	0.51	2.40				0.18		0.28	0.17	0.56		
OXIDE	6	ILMENITE		0.33	51.35	44.30	0.65	1.48				0.19		0.37	0.71	0.59		
OXIDE	1	MAGNETITE	0.27	1.27	3.18	86.66	0.32	0.57				1.80		0.48	0.67	0.17		
OXIDE	2	MAGNETITE		6.35	8.23	63.88	0.37	1.40				14.80		0.95	0.62	0.88		
OXIDE	3	MAGNETITE	0.42	8.49	5.21	56.59	0.34	1.38				22.65		0.83	0.25	0.96		
OXIDE	6	MAGNETITE		5.43	7.64	66.77	0.36	1.15				12.53		0.16		0.12		

APPENDIX 2

AVERAGE VALUE FOR EACH MINERAL FOR EACH MAJOR ROCKTYPE IN EACH MAJOR GEOLOGICAL UNIT

POLYMET-MICROPROBE DATA AVERAGED BY EACH ROCKTYPE WITHIN UNIT

SILICATE-OXIDE-SULFIDE	UNIT	ROCKTYPE	N	MINERAL	OXIDES OR METALS AS PERCENTAGES-->>>																
					SIO2	AL2O3	TIO2	FEO	MNO	MGO	K2O	CAO	NA2O	CR2O3	S	NIO	CUO	COO	ZN	AS	TOTAL
SILICATE	1	ANORTHOSITIC	3	BIOTITE	38.63	14.79	4.20	8.87	0.52	18.67	9.49	0.57	0.12			0.79	0.17	0.13			94.96
SILICATE	1	TROCTOLITIC	12	BIOTITE	36.96	14.17	6.42	13.79	0.45	14.50	9.18	0.22	0.29			0.49	0.60	0.28			95.74
SILICATE	1	ULTRAMAFIC	6	BIOTITE	36.98	14.58	5.33	13.79	0.45	15.32	9.28	0.18	0.33			0.88	0.88	0.19			95.24
SILICATE	1	VF-INCLUSION	3	BIOTITE	37.48	14.43	4.40	15.83	0.38	13.64	8.91	0.27	0.19			0.28	0.14	0.12			94.62
SILICATE	2	ANORTHOSITIC	3	BIOTITE	36.45	13.65	6.46	16.28	0.59	12.69	9.40	0.34	0.81			0.93	0.55	0.15			95.23
SILICATE	2	TROCTOLITIC	8	BIOTITE	37.19	13.88	5.82	12.69	0.28	15.95	9.47	0.78	0.15			0.88	0.13	0.27			94.69
SILICATE	2	ULTRAMAFIC	6	BIOTITE	37.60	14.19	6.22	1.77	0.46	16.69	9.22	0.22	0.23			0.12	0.77	0.23			95.96
SILICATE	3	ANORTHOSITIC	3	BIOTITE	37.50	13.84	6.12	14.78	0.42	14.22	9.50	0.19	0.69			0.82	0.80	0.93			96.18
SILICATE	3	TROCTOLITIC	6	BIOTITE	37.45	13.49	6.14	14.28	0.49	13.87	9.42	0.28	0.83			0.70	0.98	0.25			94.93
SILICATE	4	TROCTOLITIC	9	BIOTITE	37.46	14.18	5.94	13.70	0.45	14.71	9.98	0.20	0.38			0.24	0.15	0.24			95.59
SILICATE	5	TROCTOLITIC	6	BIOTITE	37.93	14.73	4.27	1.94	0.28	17.25	9.43	0.47	0.92			0.82	0.68	0.29			94.77
SILICATE	6	TROCTOLITIC	6	BIOTITE	37.95	14.34	4.85	1.92	0.34	17.53	8.79	0.29	0.42			0.98	0.23	0.18			94.98
SILICATE	1	ANORTHOSITIC	3	CLINIOPYROXENE	51.42	2.51	1.36	11.20	0.27	14.19	0.11	19.33	0.18			0.37		0.17			1.42
SILICATE	1	TROCTOLITIC	8	CLINIOPYROXENE	51.33	1.78	0.67	11.15	0.26	13.73	0.11	2.33	0.27			0.25	0.11	0.12			99.30
SILICATE	1	ULTRAMAFIC	4	CLINIOPYROXENE	51.45	1.89	0.69	12.81	0.27	12.39	0.25	2.52	0.27			0.26	0.11	0.14			99.97
SILICATE	2	ANORTHOSITIC	3	CLINIOPYROXENE	5.23	1.89	1.43	12.77	0.23	13.99	0.12	19.21	0.25			0.30	0.75	0.14			99.99
SILICATE	2	TROCTOLITIC	9	CLINIOPYROXENE	5.77	2.49	1.14	1.40	0.24	14.43	0.13	2.34	0.34			0.32	0.39	0.13			1.16
SILICATE	2	ULTRAMAFIC	7	CLINIOPYROXENE	51.18	2.90	1.14	8.51	0.30	14.83	0.15	21.71	0.33			0.19	0.74	0.15			1.70
SILICATE	3	ANORTHOSITIC	3	CLINIOPYROXENE	51.49	2.44	0.72	11.77	0.32	13.49	0.91	19.98	0.30			0.15		0.19			1.54
SILICATE	3	TROCTOLITIC	4	CLINIOPYROXENE	5.71	2.32	1.28	9.59	0.23	14.28	0.75	2.69	0.25			0.24	0.16	0.24			99.40
SILICATE	4	TROCTOLITIC	5	CLINIOPYROXENE	51.67	1.88	0.80	1.97	0.29	13.64	0.17	2.37	0.24			0.69	0.39	0.76			99.89
SILICATE	5	TROCTOLITIC	5	CLINIOPYROXENE	51.63	2.51	0.84	9.69	0.21	14.48	0.16	2.34	0.25			0.59	0.59	0.18			99.36
SILICATE	6	TROCTOLITIC	6	CLINIOPYROXENE	51.34	2.59	0.95	8.90	0.23	14.47	0.15	21.20	0.32			0.25	0.71	0.12			99.99
SILICATE	1	VF-INCLUSION	4	CORDIERITE	48.77	33.80	0.29	6.98	0.57	9.45	0.13	0.28	0.14			0.16	0.17	0.15			99.17
SILICATE	1	ANORTHOSITIC	3	OLIVINE	36.53	0.83	0.46	33.45	0.50	29.41	0.13	0.61	0.19			0.12	0.63	0.61			1.17
SILICATE	1	TROCTOLITIC	13	OLIVINE	34.62	0.13	0.26	4.68	0.49	23.82	0.15	0.51	0.33			0.55	0.54	0.67			99.85
SILICATE	1	ULTRAMAFIC	7	OLIVINE	35.82	0.37	0.83	35.44	0.35	27.78	0.72	0.45	0.74			0.12	0.12	0.57			99.75
SILICATE	2	TROCTOLITIC	9	OLIVINE	35.75	0.12	0.57	35.88	0.45	27.69	0.13	0.45	0.16			0.11	0.19	0.71			1.91
SILICATE	2	ULTRAMAFIC	6	OLIVINE	36.97	0.12	0.44	31.57	0.39	31.27	0.15	0.44	0.24			0.13	0.88	0.59			1.44
SILICATE	3	ANORTHOSITIC	3	OLIVINE	35.17	0.97	1.00	39.79	0.59	24.48	0.17	0.62	0.84			0.93	0.59	0.72			1.34
SILICATE	3	TROCTOLITIC	7	OLIVINE	37.20	0.21	0.67	32.45	0.38	26.46	0.18	0.38	0.14			0.91	0.13	0.59			97.55
SILICATE	4	TROCTOLITIC	6	OLIVINE	34.79	0.14	0.59	4.78	0.53	23.35	0.15	0.79	0.45			0.34	0.40	0.69			99.72
SILICATE	5	TROCTOLITIC	5	OLIVINE	39.99	3.59	0.48	28.14	0.54	18.44	0.17	1.42	0.15			0.45	0.82	0.40			92.14
SILICATE	6	TROCTOLITIC	6	OLIVINE	36.56	0.74	0.52	31.87	0.49	3.55	0.15	0.51	0.51			0.15	0.54	0.57			99.74

SILICATE-OXIDE-SULFIDE	UNIT	ROCKTYPE	N	MINERAL	OXIDES OR METALS AS PERCENTAGES--->>>																
					SIO2	AL2O3	TIO2	FEO	MNO	MGO	K2O	CAO	NA2O	CR2O3	S	NIO	CUO	COO	ZN	AS	TOTAL
SILICATE	1	ULTRAMAFIC	1	ORTHOPYROXENE	51.75	0.84	0.24	17.62	0.32	25.37	0.12	0.93	0.15			0.23	0.68	0.29			97.14
SILICATE	1	VF-INCLUSION	3	ORTHOPYROXENE	49.43	3.37	0.34	28.47	0.19	16.92	0.18	0.18	0.23			0.32	0.81	0.26			98.94
SILICATE	2	ANORTHOSITIC	3	ORTHOPYROXENE	52.18	0.89	0.37	23.87	0.45	2.45	0.90	1.66	0.59			0.44		0.27			99.67
SILICATE	2	TROCTOLITIC	1	ORTHOPYROXENE	53.87	0.94	0.22	19.67	0.38	24.15	0.75	0.74	0.14			0.32	0.19	0.29			1.54
SILICATE	3	TROCTOLITIC	1	ORTHOPYROXENE	53.61	0.85	0.19	19.82	0.49	23.38	0.32	1.56				0.59		0.42			99.50
SILICATE	4	TROCTOLITIC	7	ORTHOPYROXENE	52.23	1.34	0.35	22.85	0.50	21.89	0.95	0.76	0.19			0.77	0.21	0.36			99.16
SILICATE	5	TROCTOLITIC	1	ORTHOPYROXENE	53.29	1.21	0.32	2.78	0.35	22.73	0.16	2.33	0.18			0.78	0.20				11.53
SILICATE	1	ANORTHOSITIC	3	PLAGIOCLASE	49.88	32.70	0.56	0.13	0.37	0.23	0.22	15.31	3.19			0.11	0.14	0.88			1.91
SILICATE	1	TROCTOLITIC	12	PLAGIOCLASE	53.70	29.12	0.87	0.16	0.24	0.18	0.34	11.43	4.91			0.18	0.43	0.73			99.82
SILICATE	1	ULTRAMAFIC	7	PLAGIOCLASE	53.65	29.68	0.12	0.15	0.78	0.22	0.29	11.53	4.75			0.38	0.45	0.68			1.21
SILICATE	2	ANORTHOSITIC	4	PLAGIOCLASE	53.87	28.87	0.89	0.29	0.19	0.22	0.44	11.58	4.88			0.38	0.13				99.44
SILICATE	2	TROCTOLITIC	9	PLAGIOCLASE	52.68	29.82	0.14	0.24	0.89	0.33	0.45	12.67	4.33			0.96	0.34	0.48			1.28
SILICATE	2	ULTRAMAFIC	6	PLAGIOCLASE	54.74	28.92	0.11	0.18	0.63	0.51	0.54	11.93	4.96			0.66	0.83	0.74			1.58
SILICATE	3	ANORTHOSITIC	3	PLAGIOCLASE	54.16	29.34	0.38	0.24	0.56	0.12	0.45	12.17	4.78			0.98	0.12	0.18			11.23
SILICATE	3	TROCTOLITIC	6	PLAGIOCLASE	51.61	3.69	0.99	0.18	0.79	0.34	0.39	13.32	3.98			0.72	0.64	0.29			1.32
SILICATE	4	TROCTOLITIC	9	PLAGIOCLASE	55.12	28.75	0.70	0.12	0.15	0.20	0.39	1.74	5.45			0.52	0.91	0.60			1.68
SILICATE	5	TROCTOLITIC	6	PLAGIOCLASE	51.38	3.80	0.19	0.29	0.21	0.30	0.37	13.56	3.82			0.44	0.96	0.51			1.47
SILICATE	6	TROCTOLITIC	6	PLAGIOCLASE	51.92	3.23	0.14	0.26	0.50	0.45	0.37	13.13	4.27			0.23	0.12	0.12			1.40
SULFIDE	6	TROCTOLITIC	3	BORNITE			0.13	12.17							25.42	0.78	62.35	0.23	0.13	0.70	1.63
SULFIDE	1	ANORTHOSITIC	3	CHALCOPYRITE			0.30	3.62							34.75	0.57	33.69	0.36	0.20		99.18
SULFIDE	1	TROCTOLITIC	13	CHALCOPYRITE			0.39	3.69							34.32	0.39	34.12	0.56	0.16	0.77	99.21
SULFIDE	1	ULTRAMAFIC	6	CHALCOPYRITE			0.48	3.49							34.62	0.52	34.12	0.35	0.22	0.17	99.34
SULFIDE	1	VF-INCLUSION	3	CHALCOPYRITE			0.20	3.73							34.54	0.20	34.33	0.42	0.12	0.13	99.63
SULFIDE	2	ANORTHOSITIC	3	CHALCOPYRITE			0.43	3.68							34.20	0.37	34.36	0.32	0.16	0.73	99.33
SULFIDE	2	TROCTOLITIC	1	CHALCOPYRITE			0.32	3.78							34.52	0.12	33.89	0.45	0.12	0.25	99.37
SULFIDE	2	ULTRAMAFIC	5	CHALCOPYRITE			0.48	3.52							34.18	0.84	33.90	0.35	0.18	0.49	98.75
SULFIDE	3	ANORTHOSITIC	3	CHALCOPYRITE			0.31	3.84							34.49	0.38	33.92	0.35	0.15	0.13	99.35
SULFIDE	3	TROCTOLITIC	7	CHALCOPYRITE			0.67	3.34							34.57	0.35	34.13	0.33	0.24	0.18	99.96
SULFIDE	4	TROCTOLITIC	1	CHALCOPYRITE			0.23	3.75							34.71	0.21	33.74	0.39	0.15	0.16	99.28
SULFIDE	5	TROCTOLITIC	8	CHALCOPYRITE			0.34	3.69							34.39	0.38	34.83	0.37	0.17	0.31	99.26
SULFIDE	6	TROCTOLITIC	7	CHALCOPYRITE			0.46	3.56							34.66	0.37	33.97	0.29	0.14	0.46	99.28
SULFIDE	1	TROCTOLITIC	1	COBALTITE				3.88							18.77	11.26	0.30	2.77		45.20	100.00
SULFIDE	4	TROCTOLITIC	3	COBALT-RICH PENTLANDITE				12.27							4.95	2.69	5.59	19.90	0.18	0.73	99.17

SILICATE-OXIDE-SULFIDE	UNIT	ROCKTYPE	N	MINERAL	OXIDES OR METALS AS PERCENTAGES--->>>																
					SIO2	AL2O3	TIO2	FEO	MNO	MGO	K2O	CAO	NA2O	CR2O3	S	NIO	CUO	COO	ZN	AS	TOTAL
SULFIDE	1	VF-INCLUSION	3	CUBANITE				41.47							35.15	0.15	23.19	0.34	0.15	0.48	99.46
SULFIDE	2	ANORTHOSITIC	1	CUBANITE				4.92							34.48	0.13	23.60	0.31	0.69		98.51
SULFIDE	2	TROCTOLITIC	9	CUBANITE			0.41	41.12							35.27	0.66	23.91	0.46	0.14	0.24	99.68
SULFIDE	2	ULTRAMAFIC	4	CUBANITE				41.29							34.98	0.48	22.65	0.44	0.70	0.10	99.44
SULFIDE	3	TROCTOLITIC	6	CUBANITE			0.30	41.90							35.60	0.44	22.94	0.52	0.12	0.24	99.20
SULFIDE	4	TROCTOLITIC	3	CUBANITE			0.24	41.15							35.33	0.15	23.14	0.43	0.12	0.70	99.36
SULFIDE	6	TROCTOLITIC	2	CUBANITE			0.11	48.18							35.74	2.25	12.40	0.50	0.29		99.22
SULFIDE	1	TROCTOLITIC	1	MAUCHERITE			0.44	0.56							0.26	45.88	0.77	0.40		49.55	96.49
SULFIDE	1	VF-INCLUSION	2	MAUCHERITE			0.41	0.26							0.38	52.48	0.45	1.53	0.38	38.32	92.69
SULFIDE	1	ANORTHOSITIC	7	PENTLANDITE			0.34	33.28							32.68	32.14	0.13	1.31	0.42	0.94	99.48
SULFIDE	1	TROCTOLITIC	12	PENTLANDITE			0.32	31.52							32.79	32.25	0.75	3.16	0.44	0.92	99.80
SULFIDE	1	ULTRAMAFIC	6	PENTLANDITE			0.14	28.79							33.46	34.52	0.72	2.24	0.25	0.73	99.69
SULFIDE	1	VF-INCLUSION	3	PENTLANDITE			0.13	31.75							32.54	29.95	0.25	5.77	0.44	0.19	99.35
SULFIDE	2	ANORTHOSITIC	4	PENTLANDITE			0.28	32.93							33.00	31.90	0.15	1.73	0.43		99.68
SULFIDE	2	TROCTOLITIC	1	PENTLANDITE			0.39	35.15							32.90	29.86	0.13	1.65	0.58	0.13	99.69
SULFIDE	2	ULTRAMAFIC	7	PENTLANDITE			0.57	29.59							32.86	34.43	1.22	1.23	0.14	0.65	99.97
SULFIDE	3	ANORTHOSITIC	3	PENTLANDITE			0.37	32.60							33.26	32.69	0.86	2.16	0.25		1.28
SULFIDE	3	TROCTOLITIC	7	PENTLANDITE			0.37	29.24							33.78	32.56	0.37	3.35	0.83	0.22	99.25
SULFIDE	4	TROCTOLITIC	2	PENTLANDITE				34.45							32.40	3.10	0.83	2.79	0.36		99.43
SULFIDE	5	TROCTOLITIC	8	PENTLANDITE				3.40							32.89	34.25	0.16	2.71	0.39	0.38	99.78
SULFIDE	6	TROCTOLITIC	4	PENTLANDITE			0.68	34.23							33.83	28.82	1.25	1.73		0.68	99.84
SULFIDE	4	TROCTOLITIC	7	PYRITE			0.11	46.99							53.13	0.38	0.20	0.68	0.86	0.73	1.63
SULFIDE	5	TROCTOLITIC	2	PYRITE			0.10	46.10							52.19	0.95	0.38	0.47	0.84	0.28	99.26
SULFIDE	1	ANORTHOSITIC	5	PYRRHOTITE			0.47	61.12							38.27	0.13	0.11	0.55	0.28	0.80	99.68
SULFIDE	1	TROCTOLITIC	12	PYRRHOTITE			0.67	61.78							37.53	0.74	0.34	0.65	0.14	0.12	99.50
SULFIDE	1	ULTRAMAFIC	4	PYRRHOTITE			0.54	59.72							39.17	0.54	0.15	0.57	0.68	0.57	99.65
SULFIDE	1	VF-INCLUSION	3	PYRRHOTITE			0.13	6.72							38.89	0.12	0.26	0.57		0.60	99.82
SULFIDE	2	ANORTHOSITIC	3	PYRRHOTITE			0.19	6.91							38.61	0.76	0.28	0.61	0.55		99.76
SULFIDE	2	TROCTOLITIC	9	PYRRHOTITE			0.21	62.98							36.54	0.25	0.53	0.59	0.54	0.23	99.67
SULFIDE	2	ULTRAMAFIC	6	PYRRHOTITE			0.42	6.43							38.48	0.49	0.18	0.62	0.14	0.35	99.63
SULFIDE	3	ANORTHOSITIC	3	PYRRHOTITE			0.27	61.53							38.21	0.27	0.42	0.55	0.60	0.14	1.11
SULFIDE	3	TROCTOLITIC	5	PYRRHOTITE				6.58							38.70	0.26	0.18	0.68	0.16	0.19	99.28
SULFIDE	4	TROCTOLITIC	7	PYRRHOTITE			0.82	61.16							38.20	0.35	0.57	0.12	0.29	0.61	99.71
SULFIDE	5	TROCTOLITIC	3	PYRRHOTITE			0.27	59.26							39.43	0.93	0.12	0.64		0.47	99.78
SULFIDE	6	TROCTOLITIC	5	PYRRHOTITE			0.37	63.58							36.17	0.77	0.60	0.54	0.14	0.20	99.88
SULFIDE	4	TROCTOLITIC	1	SPHALERITE				9.63							32.13	0.65	0.13	0.11	57.17		99.29

SILICATE-OXIDE-SULFIDE	UNIT	ROCKTYPE	N	MINERAL	OXIDES OR METALS AS PERCENTAGES--->>>																
					SIO2	AL2O3	TIO2	FEO	MNO	MGO	K2O	CAO	NA2O	CR2O3	S	NIO	CUO	COO	ZN	AS	TOTAL
OXIDE	1	TROCTOLITIC	12	ILMENITE	0.16	0.55	51.59	44.58	0.44	1.59				0.13		0.14	0.68	0.48			1.00
OXIDE	1	ULTRAMAFIC	4	ILMENITE		0.27	51.69	45.12	0.50	1.14				0.33		0.78	0.20	0.46			1.00
OXIDE	1	VF-INCLUSION	3	ILMENITE		0.29	51.36	45.76	0.41	0.27						0.73	0.10	0.36			1.00
OXIDE	2	ANORTHOSITIC	1	ILMENITE		0.46	49.98	44.31	0.64	2.39				0.15		0.21		0.51			1.00
OXIDE	2	TROCTOLITIC	9	ILMENITE		0.70	5.36	44.57	0.47	2.24				0.95		0.28	0.31	0.64			1.00
OXIDE	2	ULTRAMAFIC	6	ILMENITE		0.56	51.45	43.14	0.50	2.63				0.26		0.47	0.54	0.58			1.00
OXIDE	3	ANORTHOSITIC	3	ILMENITE		0.76	49.84	45.92	0.45	1.84						0.22	0.19	0.53			1.00
OXIDE	3	TROCTOLITIC	3	ILMENITE		0.36	51.89	43.44	0.56	2.18				0.12		0.18	0.12	0.47			1.00
OXIDE	4	TROCTOLITIC	9	ILMENITE		0.19	52.59	44.83	0.63	0.89				0.35		0.52	0.38	0.51			1.00
OXIDE	5	TROCTOLITIC	4	ILMENITE	0.21	0.41	52.16	42.72	0.51	2.40				0.18		0.28	0.17	0.56			1.00
OXIDE	6	TROCTOLITIC	5	ILMENITE		0.33	51.35	44.30	0.65	1.48				0.19		0.37	0.71	0.59			1.00
OXIDE	1	TROCTOLITIC	1	MAGNETITE		3.80	9.53	73.84	0.29	1.43				5.40		0.14	0.31	0.96			1.00
OXIDE	1	ULTRAMAFIC	2	MAGNETITE	0.31	0.11		93.64	0.32	0.33							0.76	0.11			1.00
OXIDE	2	ANORTHOSITIC	2	MAGNETITE		2.71	7.90	8.32	0.29	0.83				2.58		0.99	0.34	0.96			1.00
OXIDE	2	ULTRAMAFIC	3	MAGNETITE		8.78	8.18	52.92	0.43	1.65				22.94		0.93	0.87	0.82			1.00
OXIDE	3	TROCTOLITIC	4	MAGNETITE	0.42	8.49	5.21	56.59	0.34	1.38				22.65		0.83	0.25	0.96			1.00
OXIDE	6	TROCTOLITIC	2	MAGNETITE		5.43	7.64	66.77	0.36	1.15				12.53		0.16		0.12			1.00

APPENDIX 3

WHOLE ROCK DATA-AVERAGES BY LOGGED UNIT-FROM DRILLING AND SAMPLING IN 2005-2006

POLYMET WHOLE ROCK ON SAMPLES SENT FOR HUMIDITY CELL WORK

WHOLE ROCK DATA--AFTER IRON RECALCULATION-AVERAGED BY ROCK TYPE WITHIN UNIT

LOGGING ROCKTYPE - AVERAGES	OXIDES AS PERCENTAGES -->>>														
	SIO2	AL203	TIO2	FE2O3	FEO	CAO	MGO	MNO	NA2O	K2O	P2O5	CR2O3	BAO	SRO	LOI	TOTALS
UNIT 1 ANORTHOSITIC AVG.==>>	46.46	17.96	2.00	0.86	11.98	8.15	7.15	0.15	2.48	0.72	0.19	0.04	0.02	0.03	0.96	99.16
UNIT 1 SEDIMENTARY INCLUSIONS AVG.==>>	51.03	18.69	1.00	0.11	11.73	2.66	5.68	0.10	1.51	2.06	0.08	0.05	0.05	0.02	3.13	97.90
UNIT 1 TROCTOLITIC AVG.==>>	45.28	16.61	2.00	0.68	12.60	8.25	8.62	0.16	2.32	0.78	0.17	0.04	0.02	0.03		98.30
UNIT 1 ULTRAMAFIC AVG.==>>	46.53	16.65	2.22	0.54	14.05	5.62	7.52	0.16	1.95	0.78	0.16	0.03	0.03	0.02	1.93	98.19
UNIT 2 ANORTHOSITIC AVG.==>>	47.37	21.72	1.02	0.78	7.57	10.78	6.41	0.11	2.80	0.36	0.01	0.04	0.01	0.04		98.98
UNIT 2 TROCTOLITIC AVG.==>>	45.74	17.28	1.45	0.71	11.95	8.74	9.58	0.16	2.50	0.48	0.16	0.03	0.01	0.03		98.55
UNIT 2 ULTRAMAFIC AVG.==>>	41.85	11.47	1.39	2.43	13.89	6.04	16.04	0.21	1.53	0.38	0.14	0.04	0.01	0.02	3.34	98.74
UNIT 3 ANORTHOSITIC AVG.==>>	47.53	21.63	1.13	0.85	7.85	10.63	6.34	0.12	2.95	0.43	0.13	0.04	0.01	0.04		99.96
UNIT 3 TROCTOLITIC AVG.==>>	46.01	19.43	0.80	1.03	9.66	9.36	8.84	0.13	2.56	0.36	0.05	0.03	0.01	0.03		98.87
UNIT 4 TROCTOLITIC AVG.==>>	45.26	17.46	1.74	1.38	11.09	8.38	8.37	0.15	2.37	0.59	0.17	0.08	0.02	0.03	1.45	98.54
UNIT 5 TROCTOLITIC AVG.==>>	45.23	19.13	0.40	1.76	8.94	8.59	9.98	0.13	2.40	0.30	0.08	0.04	0.01	0.03	2.28	99.31
UNIT 6 TROCTOLITIC AVG.==>>	45.50	18.30	0.49	0.79	10.68	8.34	10.26	0.14	2.47	0.33	0.01	0.03	0.01	0.03	0.87	98.24
UNIT 20 VIRGINIA AVG.==>>	56.00	16.42	0.78	0.89	9.29	1.33	3.32	0.06	1.86	3.66	0.11	0.03	0.07	0.02	5.72	99.56

APPENDIX 4

WHOLE ROCK DATA-AVERAGES BY LOGGED UNIT-FROM DRILLING AND SAMPLING IN 2005-2006

POLYMET WHOLE ROCK ON SAMPLES SENT FOR HUMIDITY CELL WORK

WHOLE ROCK DATA--AFTER IRON RECALCULATION

LOGGING UNIT CODE	LOGGING ROCKTYPE	CEMI SAMPLE NUMBER	OXIDES AS PERCENTAGES -->>>															
			SIO2	AL203	TIO2	FE2O3	FEO	CAO	MGO	MNO	NA2O	K2O	P2O5	CR2O3	BAO	SRO	LOI	TOTALS
1	ANORTHOSITIC	25142	44.30	14.85	1.88	1.47	16.40	5.09	9.08	0.18	2.06	0.55	0.07	0.06	0.02	0.02	2.71	98.74
1	ANORTHOSITIC	24915	46.00	19.30	0.84	0.65	10.80	9.09	9.52	0.14	2.44	0.37	0.23	0.04	0.01	0.03	0.06	99.52
1	ANORTHOSITIC	24913	46.50	18.45	2.25	1.05	10.80	9.60	5.94	0.16	2.62	1.10	0.21	0.03	0.03	0.04	0.49	99.27
1	ANORTHOSITIC	24914	46.50	23.10	0.88	0.36	7.78	10.60	6.31	0.10	2.66	0.38	0.01	0.06	0.01	0.04	0.41	99.20
1	ANORTHOSITIC	24916	49.00	14.10	4.16	0.78	14.10	6.38	4.89	0.18	2.61	1.22	0.43	0.03	0.03	0.03	1.13	99.07
	UNIT 1 ANORTHOSITIC AVG.==>>		46.46	17.96	2.00	0.86	11.98	8.15	7.15	0.15	2.48	0.72	0.19	0.04	0.02	0.03	0.96	99.16
1	SEDIMENTARY INCLUSION	25128	42.10	19.85	0.47	0.11	16.10	3.06	6.59	0.08	1.13	0.87	0.07	0.06	0.02	0.02	6.57	97.10
1	SEDIMENTARY INCLUSION	25134	47.10	22.10	0.58	0.33	15.00	0.33	6.80	0.05	0.58	1.13	0.04	0.07	0.02	0.01	2.02	96.16
1	SEDIMENTARY INCLUSION	25131	46.20	19.40	1.99	0.19	16.25	1.80	8.02	0.10	1.04	0.52	0.02	0.08	0.01	0.02	1.43	97.07
1	SEDIMENTARY INCLUSION	24919	51.80	18.30	1.19	-0.12	9.65	5.34	5.64	0.15	1.98	2.70	0.02	0.04	0.11	0.03	2.08	98.91
1	SEDIMENTARY INCLUSION	24918	59.10	15.95	0.92	0.38	5.79	4.23	3.77	0.19	2.23	3.44	0.15	0.03	0.09	0.03	3.74	100.04
1	SEDIMENTARY INCLUSION	24920	59.90	16.55	0.83	-0.25	7.59	1.18	3.23	0.05	2.09	3.71	0.18	0.03	0.07	0.02	2.94	98.12
	UNIT 1 SED. INCL. AVG.==>>		51.03	18.69	1.00	0.11	11.73	2.66	5.68	0.10	1.51	2.06	0.08	0.05	0.05	0.02	3.13	97.90
1	TROCTOLITIC	25127	44.00	16.40	1.23	0.10	13.90	8.07	8.99	0.15	2.38	0.52	0.18	0.03	0.02	0.03	0.56	96.56
1	TROCTOLITIC	24930	43.00	15.80	1.79	0.37	15.95	7.29	7.72	0.13	2.33	0.59	0.12	0.09	0.02	0.03	0.55	95.78
1	TROCTOLITIC	24925	44.40	13.45	2.18	1.02	14.15	7.56	11.95	0.20	2.16	0.61	0.08	0.03	0.02	0.02	0.23	98.06
1	TROCTOLITIC	24922	44.60	20.20	1.25	1.62	6.18	12.70	5.16	0.11	1.78	1.01	0.08	0.02	0.02	0.04	4.96	99.73
1	TROCTOLITIC	24927	45.00	14.95	2.77	0.95	13.90	6.14	8.99	0.21	2.35	1.51	0.20	0.03	0.05	0.03	1.53	98.61
1	TROCTOLITIC	24924	45.20	18.00	1.49	0.92	11.50	9.37	9.05	0.16	2.46	0.53	0.15	0.03	0.02	0.03	-0.59	98.32
1	TROCTOLITIC	24926	45.30	16.10	1.56	0.72	13.70	7.85	11.20	0.18	2.47	0.53	0.08	0.09	0.02	0.03	-0.78	99.05
1	TROCTOLITIC	24929	45.70	13.50	5.62	0.54	15.80	7.72	5.48	0.21	2.43	0.99	0.68	0.02	0.03	0.03	0.23	98.98
1	TROCTOLITIC	24923	46.40	18.80	0.97	0.34	10.40	9.14	9.79	0.14	2.48	0.39	0.01	0.03	0.01	0.03	-0.25	98.68
1	TROCTOLITIC	24928	49.20	18.90	1.18	0.18	10.50	6.66	7.87	0.11	2.33	1.16	0.08	0.02	0.03	0.03	0.93	99.18
	UNIT 1 TROCTOLITIC AVG.==>>		45.28	16.61	2.00	0.68	12.60	8.25	8.62	0.16	2.32	0.78	0.17	0.04	0.02	0.03		98.30
1	ULTRAMAFIC	25130	42.40	15.60	0.85	1.12	12.80	4.99	11.20	0.14	1.62	0.31	0.13	0.04	0.01	0.02	4.89	96.12
1	ULTRAMAFIC	24935	47.70	19.85	2.40	0.31	14.30	4.58	6.07	0.13	1.78	1.09	0.06	0.04	0.05	0.02	0.80	99.18
1	ULTRAMAFIC	24934	49.50	14.50	3.41	0.17	15.05	7.30	5.28	0.20	2.44	0.94	0.28	0.02	0.03	0.03	0.11	99.26
	UNIT 1 ULTRAMAFIC AVG.==>>		46.53	16.65	2.22	0.54	14.05	5.62	7.52	0.16	1.95	0.78	0.16	0.03	0.03	0.02	1.93	98.19

LOGGING UNIT CODE	LOGGING ROCKTYPE	CEMI SAMPLE NUMBER	OXIDES AS PERCENTAGES -->>>															
			SIO2	AL203	TIO2	FE2O3	FEO	CAO	MGO	MNO	NA2O	K2O	P2O5	CR2O3	BAO	SRO	LOI	TOTALS
2	ANORTHOSITIC	24938	46.40	19.95	1.22	0.97	9.07	10.15	7.61	0.13	2.63	0.38	0.01	0.05	0.01	0.03	0.02	98.63
2	ANORTHOSITIC	24936	47.60	22.90	0.73	0.71	6.56	11.05	6.01	0.09	2.83	0.32	0.01	0.02	0.01	0.04	0.02	98.90
2	ANORTHOSITIC	24937	48.10	22.30	1.10	0.67	7.08	11.15	5.62	0.10	2.93	0.37	0.02	0.04	0.01	0.04	-0.13	99.40
	UNIT 2 ANORTHOSITIC AVG.==>>		47.37	21.72	1.02	0.78	7.57	10.78	6.41	0.11	2.80	0.36	0.01	0.04	0.01	0.04		98.98
2	TROCTOLITIC	25137	44.50	14.40	2.09	-0.04	15.20	8.19	10.30	0.19	2.10	0.42	0.36	0.04	0.01	0.02	-0.63	97.15
2	TROCTOLITIC	24941	45.30	16.05	1.36	0.63	13.20	7.98	11.55	0.18	2.39	0.48	0.22	0.04	0.01	0.03	-0.46	98.96
2	TROCTOLITIC	24940	45.40	15.90	1.05	0.92	13.30	7.83	12.65	0.18	2.27	0.36	0.05	0.04	0.01	0.03	-0.53	99.46
2	TROCTOLITIC	24942	45.40	16.85	1.66	0.97	12.35	8.69	9.83	0.17	2.54	0.56	0.23	0.04	0.02	0.03	-0.32	99.02
2	TROCTOLITIC	24939	45.80	19.35	1.28	0.83	9.65	9.99	8.68	0.14	2.38	0.38	0.08	0.03	0.01	0.03	-0.08	98.55
2	TROCTOLITIC	24943	46.40	18.45	1.81	0.94	9.91	9.43	7.00	0.14	2.81	0.59	0.08	0.04	0.02	0.03	-0.05	97.60
2	TROCTOLITIC	24944	47.40	19.95	0.93	0.73	10.05	9.05	7.07	0.13	3.01	0.60	0.11	0.01	0.02	0.04	0.04	99.14
	UNIT 2 TROCTOLITIC AVG.==>>		45.74	17.28	1.45	0.71	11.95	8.74	9.58	0.16	2.50	0.48	0.16	0.03	0.01	0.03		98.55
2	ULTRAMAFIC	25141	37.00	7.47	1.31	5.87	12.80	3.81	20.60	0.22	0.75	0.23	0.19	0.03	0.01	0.01	8.37	98.67
2	ULTRAMAFIC	24945	42.70	13.15	0.96	1.02	13.25	6.34	14.60	0.19	1.39	0.30	0.01	0.04	0.01	0.02	4.01	97.99
2	ULTRAMAFIC	25129	43.60	10.85	2.05	1.67	15.10	6.47	15.35	0.21	1.86	0.61	0.28	0.03	0.02	0.02	0.72	98.84
2	ULTRAMAFIC	24946	44.10	14.40	1.22	1.15	14.40	7.52	13.60	0.20	2.10	0.36	0.06	0.05	0.01	0.02	0.27	99.46
	UNIT 2 ULTRAMAFIC AVG.==>>		41.85	11.47	1.39	2.43	13.89	6.04	16.04	0.21	1.53	0.38	0.14	0.04	0.01	0.02	3.34	98.74
3	ANORTHOSITIC	24948	47.20	21.70	0.50	0.91	7.40	10.10	8.14	0.11	2.74	0.29	0.01	0.06	0.01	0.04	1.14	100.35
3	ANORTHOSITIC	24950	47.60	22.30	1.67	0.91	7.14	11.40	4.30	0.11	3.23	0.55	0.23	0.03	0.02	0.04	-0.09	99.44
3	ANORTHOSITIC	24949	47.80	20.90	1.22	0.74	9.01	10.40	6.58	0.13	2.87	0.44	0.15	0.03	0.01	0.04	-0.23	100.09
	UNIT 3 ANORTHOSITIC AVG.==>>		47.53	21.63	1.13	0.85	7.85	10.63	6.34	0.12	2.95	0.43	0.13	0.04	0.01	0.04		99.96
3	TROCTOLITIC	25133	44.90	21.10	0.49	1.24	9.01	10.10	8.09	0.11	2.70	0.29	0.17	0.03	0.01	0.03	0.49	98.76
3	TROCTOLITIC	25132	42.80	16.35	0.64	2.50	10.80	7.11	11.80	0.16	1.70	0.54	0.03	0.02	0.01	0.03	4.10	98.59
3	TROCTOLITIC	24955	45.30	16.85	1.29	0.95	12.15	8.58	10.85	0.16	2.45	0.40	0.11	0.04	0.01	0.03	-0.10	99.07
3	TROCTOLITIC	24952	45.70	19.10	0.52	0.82	9.97	8.73	9.81	0.13	2.43	0.27	0.01	0.05	0.01	0.03	0.42	98.00
3	TROCTOLITIC	24951	46.80	20.80	0.54	0.71	8.04	9.95	8.57	0.11	2.66	0.27	0.02	0.03	0.01	0.04	0.01	98.56
3	TROCTOLITIC	24956	47.20	20.50	0.67	0.66	9.39	9.72	7.50	0.12	2.86	0.40	0.01	0.03	0.01	0.03	0.33	99.43
3	TROCTOLITIC	24954	47.50	20.90	1.01	0.61	8.49	10.40	6.74	0.12	2.86	0.36	0.01	0.03	0.01	0.04	-0.22	98.86
3	TROCTOLITIC	24953	47.90	19.85	1.25	0.71	9.39	10.30	7.32	0.14	2.79	0.38	0.01	0.04	0.01	0.03	-0.43	99.69
	UNIT 3 TROCTOLITIC AVG.==>>		46.01	19.43	0.80	1.03	9.66	9.36	8.84	0.13	2.56	0.36	0.05	0.03	0.01	0.03		98.87

LOGGING UNIT CODE	LOGGING ROCKTYPE	CEMI SAMPLE NUMBER	OXIDES AS PERCENTAGES --->>>															
			SIO2	AL203	TIO2	FE2O3	FEO	CAO	MGO	MNO	NA2O	K2O	P2O5	CR2O3	BAO	SRO	LOI	TOTALS
4	TROCTOLITIC	25138	44.70	14.75	2.90	2.07	13.75	6.26	8.01	0.18	2.27	1.15	0.46	0.04	0.03	0.03	1.83	98.43
4	TROCTOLITIC	24963	38.10	11.80	3.59	3.10	17.55	3.67	12.65	0.24	1.40	0.57	0.08	0.33	0.01	0.02	5.21	98.32
4	TROCTOLITIC	24960	45.10	16.90	1.55	1.25	10.30	10.25	8.25	0.15	2.41	0.61	0.43	0.04	0.02	0.03	1.78	99.07
4	TROCTOLITIC	24958	45.90	18.75	1.03	1.19	10.40	9.11	9.01	0.15	2.57	0.45	0.09	0.06	0.01	0.03	0.19	98.94
4	TROCTOLITIC	24957	46.40	21.00	0.76	0.80	7.59	10.25	6.92	0.11	2.61	0.38	0.06	0.04	0.01	0.04	0.59	97.56
4	TROCTOLITIC	24959	46.90	19.30	1.14	1.32	8.62	9.93	7.65	0.13	2.65	0.49	0.06	0.05	0.01	0.03	1.21	99.49
4	TROCTOLITIC	24961	47.20	19.50	1.32	1.00	9.58	9.68	7.24	0.13	2.70	0.40	0.04	0.04	0.01	0.03	0.13	99.00
4	TROCTOLITIC	24962	47.80	17.65	1.64	0.33	10.95	7.90	7.22	0.14	2.32	0.68	0.14	0.05	0.02	0.03	0.67	97.54
	UNIT 4 TROCTOLITIC AVG.==>>		45.26	17.46	1.74	1.38	11.09	8.38	8.37	0.15	2.37	0.59	0.17	0.08	0.02	0.03	1.45	98.54
5	TROCTOLITIC	25135	46.00	21.00	0.43	1.73	7.85	9.33	7.78	0.12	2.72	0.32	0.11	0.05	0.01	0.03	1.88	99.36
5	TROCTOLITIC	25136	44.10	17.45	0.51	2.40	9.58	7.90	10.45	0.15	2.23	0.33	0.12	0.03	0.01	0.03	4.03	99.32
5	TROCTOLITIC	24964	45.60	18.95	0.26	1.16	9.39	8.54	11.70	0.12	2.25	0.26	0.01	0.04	0.01	0.03	0.93	99.25
	UNIT 5 TROCTOLITIC AVG.==>>		45.23	19.13	0.40	1.76	8.94	8.59	9.98	0.13	2.40	0.30	0.08	0.04	0.01	0.03	2.28	99.31
6	TROCTOLITIC	25140	45.60	19.75	0.37	0.70	9.13	8.72	8.87	0.13	2.71	0.43	0.01	0.02	0.01	0.03	1.94	98.42
6	TROCTOLITIC	25139	45.50	18.85	0.41	0.56	9.84	8.91	9.63	0.12	2.47	0.26	0.01	0.03	0.01	0.03	0.96	97.59
6	TROCTOLITIC	24966	44.80	16.85	0.56	0.66	12.95	7.66	11.65	0.16	2.35	0.26	0.01	0.02	0.01	0.03	-0.51	97.46
6	TROCTOLITIC	24967	46.10	17.75	0.61	1.25	10.80	8.08	10.90	0.15	2.36	0.35	0.01	0.03	0.01	0.03	1.07	99.50
	UNIT 6 TROCTOLITIC AVG.==>>		45.50	18.30	0.49	0.79	10.68	8.34	10.26	0.14	2.47	0.33	0.01	0.03	0.01	0.03	0.87	98.24
20	VIRGINIA FORMATION	24970	54.80	16.40	0.75	0.58	11.40	0.66	2.64	0.03	2.19	3.90	0.13	0.03	0.07	0.02	5.66	99.26
20	VIRGINIA FORMATION	24969	56.10	16.50	0.74	1.58	7.85	0.51	2.69	0.03	1.66	4.70	0.09	0.03	0.07	0.02	7.10	99.67
20	VIRGINIA FORMATION	24968	57.10	16.35	0.86	0.52	8.62	2.81	4.62	0.11	1.73	2.39	0.12	0.03	0.06	0.02	4.41	99.75
	UNIT 20 VIRGINIA AVG.==>>		56.00	16.42	0.78	0.89	9.29	1.33	3.32	0.06	1.86	3.66	0.11	0.03	0.07	0.02	5.72	99.56