# MINERAL RESOURCE UPDATE NORTHMET POLY-METALLIC DEPOSIT

## MINNESOTA, USA

**Located in N-E Minnesota, USA, near the town of Babbitt**

**FOR**

**POLYMET MINING INC**
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**VANCOUVER, BC, V6E-2K3**
**CANADA**

**JUNE, 2005**

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# 3. SUMMARY

This report describes the results of a mineral resource estimation update of the NorthMet polymetallic Cu-Ni-PGE-Co deposit which is leased by PolyMet Mining Corp. ("PolyMet"), a Vancouver, Canada-based company.

The NorthMet deposit is situated on a mineral lease located in St. Louis County in north-eastern Minnesota, USA at Latitude 47º 36' north, Longitude 91º 58' west, about 70 miles north of the City of Duluth and 6.5 miles south of the town of Babbitt.

The NorthMet deposit is part of the Duluth Intrusive Complex in north-eastern Minnesota, which is a large, composite, grossly layered, tholeiitic mafic intrusion that was emplaced into comagmatic flood basalts along a portion of the Middle Proterozoic (1.1 Ga, Keweenawan) Mid-continent Rift System. NorthMet along with several other Cu-Ni deposits occur along the western edge of the Duluth Complex, and within the Partridge River (PRI) and South Kawishiwi (SKI) intrusions. The NorthMet deposit is hosted within the PRI, which consists of varied troctolitic and (minor) gabbroic rock types that have been subdivided into seven igneous stratigraphic units based on drill core.

The metals of interest at NorthMet are copper, nickel, cobalt, platinum, palladium and gold. Minor amounts of rhodium and ruthenium are also present though these are considered to have no economic significance. In general, with the exception of cobalt and gold, the metals are positively correlated with copper mineralization. Cobalt is well correlated with nickel.

Mineralization occurs in four broadly defined horizons throughout the NorthMet property. Three of these horizons are within basal Unit 1, though they likely will not be discriminated in mining. The thickness of each of the three Unit 1 enriched horizons varies from 5 feet to more than 200 feet. Unit 1 mineralization is found throughout the base of the deposit. A less extensive mineralized zone, enriched with platinum group metals (PGMs), is found in Unit 6.

Drill hole spacing is approximately on 300-400 ft spacing in the north-west area of the deposit and 1000 ft, or more, in the deeper southeast portion of the deposit. Out of 201 holes, 151 have an average separation distance of 362 ft, 129 have a distance of 350 ft, 62 have a distance of 326 ft and 6 have a distance of 277 ft. The best drilled area, which also reflects the area with near-surface mineralization, is drilled at a spacing of about 400 feet. 15% of intervals are by Reverse Circulation (5 inch) drilling with the remainder by diamond coring (BQ to NTW).

The assay and geological database has been thoroughly checked, validated and updated by PolyMet in order to provide the basis for a new resource estimate. This has involved the addition of several thousand new assays since previous estimates in 2001 and a re-evaluation of historic data. Examination of check assay data from previous assay programs as well as from newly received data suggest that Ni and Co are likely to have been understated by between 5% and 15% due to the previous use of an analytical method using incomplete digestion. All recent assaying of drill samples from drilling during February and March 2005 is based on the more appropriate total digestion method. All samples from the summer 2005 drilling program will also be analysed by the more appropriate total digestion method.

A comprehensive QA/QC program involving the use of coarse blanks, standards and duplicates has been instigated.

New resource estimates by the author have been completed using Ordinary Kriging taking into account the distribution of various mineralized units. Results are summarized below.

**January 2005 Mineral Resource Estimates, above 840 ft elevation**

| Cut-off | CATEGORY | M Tonnes | Cu% | Ni% | Co | Pd | Pt | Au |
|---|---|---|---|---|---|---|---|---|
| **0.2% Cu** | Indicated | 177 | 0.31 | 0.09 | 69 | 298 | 77 | 41 |
| **0.2% Cu** | Inferred | 72 | 0.32 | 0.08 | 62 | 328 | 102 | 50 |

(values for Pd, Pt & Au are in ppb)

**January 2005 Mineral Resource Estimates, above 500ft elevation**

| Cut-off | CATEGORY | M Tonnes | Cu% | Ni% | Co | Pd | Pt | Au |
|---|---|---|---|---|---|---|---|---|
| **0.2% Cu** | Indicated | 215 | 0.31 | 0.09 | 69 | 296 | 77 | 41 |
| **0.2% Cu** | Inferred | 110 | 0.32 | 0.08 | 63 | 319 | 96 | 49 |

(values for Pd, Pt & Au are in ppb)

Preliminary pit optimization suggests a pit floor at 640 ft. Accordingly, the estimates quoted are reported above two elevations that bracket this pit base.

During February and March 2005 nearly 14,000 feet of 4 inch and PQ (3.3 inch) diameter core holes were drilled for metallurgical sample collection while a further approximately 16,000 feet of NTW and NQ2 core drilling was completed for resource in-fill and geotechnical evaluation purposes. Up to 60 additional core holes (mostly NTW diameter) totalling approximately 60,000 feet will be drilled during the summer of 2005 primarily for resource definition and in-fill drilling purposes.

Recommendations by the author relate to geological logging, particularly with respect to the compilation of core recovery data and some retrospective check assaying.

## 4. INTRODUCTION AND TERMS OF REFERENCE

This report describes the results of a mineral resource estimation update of the NorthMet polymetallic Cu-Ni-PGE-Co deposit which is owned by PolyMet Mining Inc.("PolyMet"), based in Vancouver, Canada. It was prepared at the request of Mr Don Hunter, Project Manager, NorthMet Project. A drilling program commenced in February 2005 to primarily test potential open pit mineralization and collect metallurgical sample. This report is concerned with the drilling results available to PolyMet prior to that program.

Information, conclusions and recommendations contained herein are based on a field examination, including a study of relevant and available data and discussions with site geologists. The writer visited the project area for a total of ten days in September 2004 and May 2005.

The resource estimates were completed at the request of PolyMet in order to provide input to preliminary pit optimization studies for a drilling program that commenced in February 2005.

The work, upon which this report is based, has been in collaboration with Mr. Richard Patelke, PolyMet's resident project geologist. Mr. Patelke resides in Minnesota and is a Registered Professional Geologist of good standing with the State of Minnesota. Mr Patelke has been involved in fieldwork at NorthMet and several of the adjacent copper-nickel deposits over a number of years and has conducted regional field mapping and logging of drill core recovered from the deposit during previous drilling campaigns.

All units are imperial unless otherwise stated, grid references are based on the Minnesota State Plane Grid (NAD83).

Figure 1 shows drill hole locations in relation to the Duluth Complex that hosts the mineralization.

## 5. DISCLAIMER

The writer has prepared this report based upon information believed to be accurate at the time of completion. The writer has relied on several sources of information on the property, including technical reports by consultants to PolyMet, digital geological and assay data and geological interpretations by PolyMet. Therefore, in writing this report the author relies on the truth and accuracy as presented in various sources listed in the References section of this report.

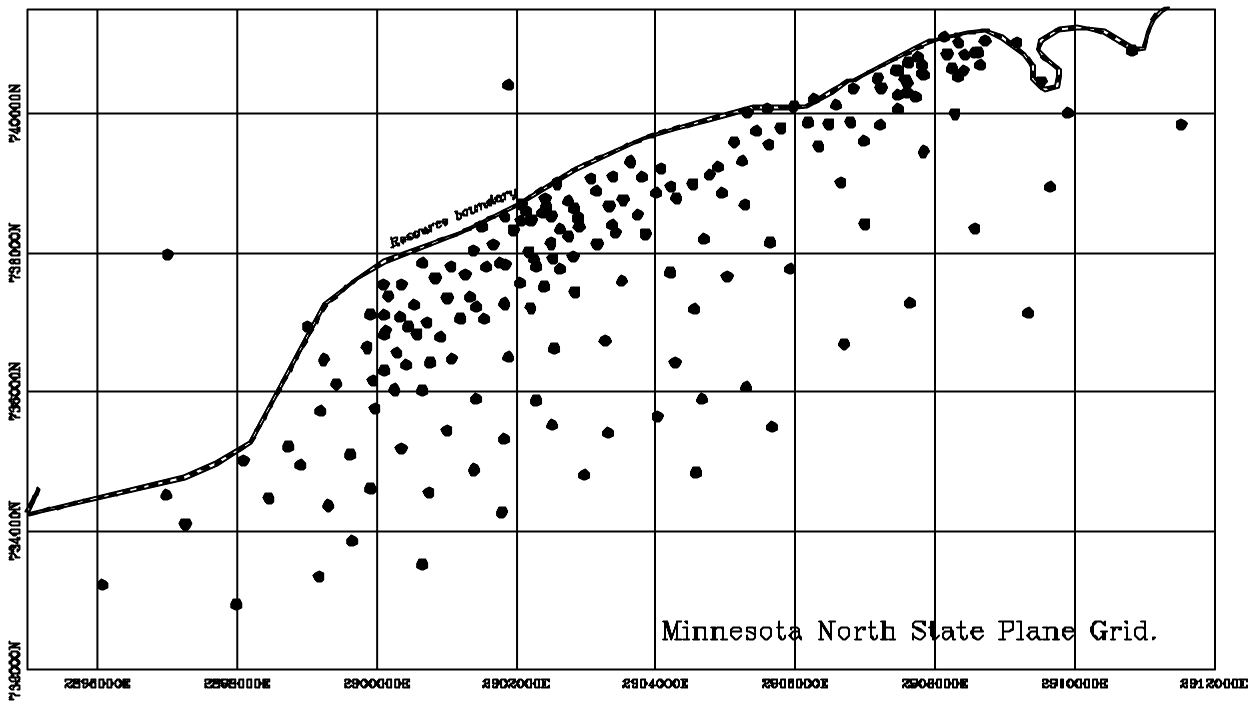


**Figure 1. Location of drill holes**

(Duluth Complex (south east) – Virginia Formation (north west) boundary marks the limit or resource blocks; north up, scale per grid; imperial grid

# 6. PROPERTY DESCRIPTION AND LOCATION[1]

The NorthMet deposit is situated on a mineral lease located in St. Louis County in north-eastern Minnesota at Latitude 47º 36' north, Longitude 91º 58' west, about 70 miles north of the City of Duluth and 6.5 miles south of the town of Babbitt. PolyMet, as Fleck Resources, acquired a 20 year renewable mineral rights lease to the deposit in 1989 from U.S. Steel (leases now controlled by RGGS Inc. of Houston, Texas). The lease is subject to yearly lease payments before production and then to a sliding scale Net Smelter Return ("NSR") royalty ranging from 3 – 5% with lease payments made before production considered as advance royalties and credited to the production royalty.

Mineral and surface rights have been severed, with the US Forest Service being the surface owner of most of the lease area. As a result of U.S Steel retaining the mineral rights and the rights to explore and mine on the site under the original documents that ceded surface title to the Forest Service, the US Forest Service cannot prohibit mining on the lease.

The NorthMet lease held by PolyMet does not cover all areas expected to be disturbed by diamond drilling and eventual mining. Other areas involved are comparatively small and their surface rights are held by the US Forest Service, Cliffs-Erie, and St. Louis County. The Longyear-Mesaba Trust holds the mineral rights to the small area whose surface rights are controlled by the Forest Service.

The deposit is situated 8 miles east of the former LTV Steel Mining Company (LTVSMC) taconite concentrator and pellet plant which ceased operations in 2000. This facility has not operated since 2000. It and the supporting infrastructure, which includes the taconite tailings disposal basin, is, however, reported (Hammond, 2005) to be robust, intact and in good condition. It is PolyMet's intention to refurbish and use selected parts of the crushing, milling and concentrator facilities to process ore from NorthMet. PolyMet has secured from the current owners, Cliffs Erie LLC, an option to purchase selected parts of the process facilities as well as related infrastructure and the entire tailings basin. The option agreement expires on 30 June 2006 or 180 days after Definitive Feasibility Study (DFS) completion.

The project area requirement amounts to approximately 7,500 acres. The only currently known mineralized zone on the lease is the NorthMet deposit. The forest in the area has been extensively and repeatedly logged. There are no mine workings, waste stockpiles, or tailings impoundments on the deposit property. The site is woodland and wetland with no access by the general public as it is surrounded by private mining lands. An un-metalled mine access road runs parallel to the former, and now infrequently used, LTVSMC railroad and traverses the southern part of the lease. Neither is expected to impact the area where mining operations will be carried out.

Environmental studies and data collection have started in preparation for the initiation of a mandatory project Environmental Impact Statement (EIS) and submission of applications for environmental permits. A permit to drill has been granted by the US Forest Service.

[1] Largely provided by R Patelke, PolyMet, and R Hammond, 2005

## 7. ACCESS, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

The project site is situated in the eastern part of the historically important Mesabi Iron Range, which still accounts for the production of approximately 42 million tons per annum of taconite pellets and iron ore concentrate. There are six producing iron ore mines on the Range of which the nearby Northshore open pit mine operated by Cleveland-Cliffs is one of the largest. The Northshore pit is located approximately 2 miles north of the NorthMet deposit.

Access to the property is by a combination of good quality asphalt and gravel roads via the LTVSMC plant site. The nearest centre of population is the town of Hoyt Lakes which has a population of about 2,500. There are a number of similarly sized communities in the vicinity, all of which are well serviced, provide ready accommodation, and have been or, still are, directly associated with the region's extensive taconite mining industry. The road network in the area is well developed though not heavily trafficked and there is an extensive railroad network which serves the taconite mining industry across the entire Range. There is access for ocean shipping via Duluth and the St. Lawrence Seaway.

The Iron Range forms an extensive and prominent regional topographic feature. The project site is located a short distance south of the Range where the surrounding countryside is characterized as being gently undulating. Elevation at the project site is about 1,600 feet above sea level (1,000 feet above Lake Superior). Much of the region is poorly drained and the predominant vegetation comprises wetlands and boreal forest. Forestry is a major local industry and the project site and much of the surrounding area has been repeatedly logged. Relief variation across the site is approximately 100ft.

Climate is continental and characterized by wide temperature variations and significant precipitation. The temperature in the town of Babbitt, about 6.5 miles north of the deposit, averages 4º F in January and 66ºF in July. During short periods in summer, temperatures may reach as high as 90ºF with high humidity. Average annual precipitation is about 28 inches with about 30% of this falling mostly as snow between November and April. Annual snowfall is typically about 60 inches with 2 to 3 feet on the ground at any one time. The local taconite mines operate year round and it is rare for snow or inclement weather to cause production delays.

The area has been economically dependent on the iron ore industry for many years and while there is an abundance of skilled labor and local mining expertise, the closure in 2000 of the LTVSMC open pit mine and taconite processing facility has had a significant negative impact on the local economy and population growth. There are, however, a number of other operating mines in other parts of the Iron Range. Hence the mining, support industries and industrial infrastructure remains well developed and of a high standard.

The LTVSMC plant site is still connected to the electrical power supply grid and a main HV electrical power line runs parallel to the road and railroad, which traverses the southern part of the mining lease area. There is a coal fired 130 MW power station operated by Minnesota Power situated just west of Hoyt Lakes and about 5 miles from the LTVSMC plant site. There are local sources of fresh water.

# 8. HISTORY[2]

There has been no prior mineral production from the NorthMet deposit though it has been subject to several episodes of exploration and drilling since its discovery in 1969 by U.S. Steel. Table 1 summarizes the exploration drilling activities since 1969 and the amount of assay data.

U.S. Steel held mineral and surface rights over much of the area, including the NorthMet lease until the 1930's when for political and land management reasons surface title was ceded to the US Forest Service. In negotiating the deeds that separated the titles, U.S. Steel retained the mineral rights and the rights to explore and mine any minerals on the site, effectively removing the possibility of veto to such activities by the US Forest Service.

In 1989 Fleck Resources Ltd. (Fleck), a company registered in British Columbia, Canada, acquired a 20 year renewable mineral rights lease to the NorthMet deposit from U.S. Steel and undertook exploration of the deposit. Fleck also developed joint ventures with NERCO and Argosy in order to progress exploration. In June 1998, Fleck Resources Ltd changed its name to PolyMet Mining Corp. which, with the exception of an hiatus between 2001 and 2003, has continued exploration and evaluation of the deposit up to the present. In 2004 U.S. Steel sold much of its real estate and mineral rights in the area, including the NorthMet deposit, to a private company, RGGS of Houston Texas. PolyMet's U.S. Steel mineral lease was transferred to RGGS at that time.

In 2000, PolyMet commissioned Independent Mining Consultants, Inc. of Tucson, Arizona to carry out a Pre-feasibility Study of exploiting the deposit and the report, which was published in 2001, was filed on SEDAR (IMC, 2000). One of the conclusions of the IMC Pre-feasibility Study report was that proceeding to the preparation of a full Feasibility Study was warranted.

USS took at least three bulk samples in September, 1970, and 1971. These totalled approximately 9, 300 and 20 tons. The samples came from mineralisation in Units 3 (or 4?), 1 and 1, respectively. Sampled grades are consistent with modeled grades (see Section 19).

A 1970s USS report (in Patelke & Severson, 2005) provides a preliminary estimate of 109 mt of material containing 0.77% Cu and 0.24% Ni. This was considered to be potentially mineable by underground methods and it was also estimated that "Reserves" could be doubled if the average combined cut-off grade was dropped by 0.2%.

[2] Largely summarized from R Patelke and S Geerts, 2005 and R Hammond, 2005

**Table 1. Summary of NorthMet exploration activity since 1969.**

| Company | Period | Drilling Type | Number of Holes | Number of Feet Drilled | Number of Assay Intervals (used in "accepted values" assay file) |
|---|---|---|---|---|---|
| U S Steel | 1969-1973 | BQ core | 112 | 133,716 | 7,734 |
| U S Steel | 1971-1972 | Three surface bulk samples for metallurgical testing taken from two locations | | | |
| NERCO | 1991 | BQ core/PQ core | 2 (2 pairs) | 842 (BQ)<br>833 (PQ) | 162 |
| NERCO | 1991 | Bulk metallurgical sample from large size (PQ) core used for tests of CUPREX hydrometallurgical process (842 ft) | | | |
| PolyMet | 1998-2000 | 6" RC | 52 | 24,650 | 4,699 |
| PolyMet | 1999-2000 | BTW and NTW core | 32 | 22,156 | 3,920 |
| PolyMet | 1998-2000 | 6" RC with AQ core tail | 3 | 2,696 | 511 |
| PolyMet | 1998 & 2000 | Two flotation pilot plant campaigns used about 60 tons of sample derived from RC drilling programs. | | | |
| US Steel stratigraphic holes* | 1970's? | BQ | 6 | 9,647 | none used |
| INCO* | 1956 | Core size unknown | 1 | 449 | none used |
| Bear Creek/ AMAX* | 1967-1977 | Core size unknown | 4 | 6,182 | none used |
| Humble Oil (Exxon)* | 1968-1969 | Core size unknown | 3 (several miles south of deposit) | 9,912 | none used |

**Notes on** Table 1. The number of assays used in PolyMet data file reflects numerous generations of sampling. See Section 15 for the assay history. * Indicates "stratigraphic holes" which are holes in area from other projects used to help define edge of geologic model—not necessarily drilled for this project. Note that assays, especially for USS drilling, were not all completed at the time of the original drilling

Numerous historical resource estimates by USS, Fleck and Nerco were quoted by Peatfield (1999) who regarded these as preliminary in nature and lacking detailed documentation. They are reproduced in Table 2 purely for a record. The estimates should not be regarded as conforming to either NI43-101 rules or CIM standards. Details on cut-off grades used are mostly absent though appear to be from 0.1 to 0.2 % Cu.

**Table 2. Previously quoted resource estimates (from Peatfield, 1999)**

(note that these do not conform to NI43-101 standards)

| Origin | M Tonnes | Cu% | Ni% | Ag ppm | Au ppm | Pt ppm | Pd ppm | Notes |
|---|---|---|---|---|---|---|---|---|
| **USX** | 272 | 0.50 | 0.16 | - | - | - | - | geological resource |
| **USX** | 99 | 0.77 | 0.24 | - | - | - | - | to 2000 ft depth |
| **Fleck? (1989)** | 75 | 0.57 | 0.13 | 2.1 | 0.069 | 0.171 | 0.274 | to 800 ft depth |
| **Fleck (1989)** | 157 | 0.47 | 0.11 | - | - | - | - | in pit, undiluted |
| **Fleck (1990)** | 154 | 0.48 | 0.11 | 1.7 | 0.068 | 0.133 | 0.454 | in pit, "undiluted" |
| **Fleck (1989)** | 173 | 0.43 | 0.10 | - | - | - | - | "diluted", to 800 ft |
| **Fleck (1990)** | 179 | 0.42 | 0.09 | 1.5 | 0.06 | 0.117 | 0.399 | "diluted", to 800 ft |
| **Nerco (1991)** | 1,419 | 0.40 | 0.09 | 1.3 | 0.061 | 0.118 | 0.445 | "global", 0.1% Cu COG |
| **Nerco (1991)** | 808 | 0.43 | 0.11 | 1.5 | 0.061 | 0.116 | 0.437 | in pit |

The most recent resource estimates regarded by Peatfield as conforming to NI43-101 standards are those by Independent Mining Consultants ("IMC") (Table 3) as revised on March 8, 2001. Assuming the block model extents are those described in IMC's interim 1999 report, the resources in Table 3 extend from surface to 800 metres below surface. The large vertical extent of the model means that the estimates include material that does not satisfy the "reasonable prospects for economic extraction" guideline (CIM) for reporting and estimation of mineral resources. The "Mineable Resources" of IMC given in Table 4, although an unacceptable term for reporting of resources, provide more realistic estimates.

**Table 3. IMC resource estimates (IMC, 2001)**

| Cu Cut-off (%) | M Tons | Cu% | Ni% | Co ppm | Au ppm | Pt ppm | Pd ppm | Category |
|---|---|---|---|---|---|---|---|---|
| **0.1** | 362 | 0.301 | 0.084 | 66 | 0.040 | 0.078 | 0.286 | Measured |
| **0.1** | 303 | 0.328 | 0.085 | 62 | 0.047 | 0.090 | 0.324 | Indicated |
| **0.1** | 340 | 0.336 | 0.085 | 59 | 0.048 | 0.093 | 0.341 | Inferred |
| **0.2** | 290 | 0.336 | 0.091 | 67 | 0.045 | 0.087 | 0.323 | Measured |
| **0.2** | 255 | 0.359 | 0.091 | 62 | 0.052 | 0.100 | 0.361 | Indicated |

| Cu Cut-off (%) | M Tons | Cu% | Ni% | Co ppm | Au ppm | Pt ppm | Pd ppm | Category |
|---|---|---|---|---|---|---|---|---|
| **0.2** | 275 | 0.379 | 0.094 | 60 | 0.055 | 0.107 | 0.396 | Inferred |

IMC completed mining studies and reported Measured, Indicated and Inferred categories within a pit design (to 200 ft elevation, IMC, 2001 p6-2) and referred to these resources as "Mineable Resources" which is not a classification that conforms to either NI43-101 rules or CIM guidelines. The amalgamation of Measured, Indicated and Inferred is also unacceptable as is the reference to "ore" for material including Inferred. The estimates are included here solely for the record but may provide a better basis for comparison for the new resource estimates provided in this report.

**Table 4. IMC "Mineable Resources" (IMC, 2001)**

(note that these do not conform to NI43-101 standards)

| Cu Cut-off (%) | M Tons | Cu% | Ni% | Co ppm | Au ppm | Pt ppm | Pd ppm | Category |
|---|---|---|---|---|---|---|---|---|
| **0.1** | 489 | 0.30 | 0.08 | 66 | 0.042 | 0.083 | 0.285 | Total "ore" |
| **0.1** | 406 | | | | | | | Meas + Ind |
| **0.2** | 340 | 0.336 | 0.085 | 59 | 0.048 | 0.093 | 0.341 | Total "ore" |
| **0.2** | 290 | | | | | | | Meas + Ind |

The IMC search distances used (IMC, 1999) were 250m along strike (N58°E), 150m down dip (S32°E) and 25m perpendicular to the dip. These are larger than used in the present study.

## 9. GEOLOGICAL SETTING[3]

The NorthMet deposit is situated in the Duluth Complex in north-eastern Minnesota. This is a large, composite, grossly layered, tholeiitic mafic intrusion that was emplaced into comagmatic flood basalts along a portion of the Middle Proterozoic (1.1 Ga, Keweenawan) Mid-continent Rift System. Along the western edge of the Duluth Complex, and within the Partridge River (PRI) and South Kawishiwi ("SKI) intrusions, several Cu-Ni deposits/prospects occur. The NorthMet deposit is situated within the PRI, which consists of varied troctolitic and (minor) gabbroic rock types that have been subdivided into seven igneous stratigraphic units based on drill core.

[3] Largely taken from Hammond (2005) and Patelke & Geerts (2005).

The regional and local geology are well known (Geerts et al, 1990; Geerts, 1991, 1994; Severson, 1988; Severson and Hauck, 1990, 1997; Severson and Zanko, 1996; Severson and Miller, 1999; Severson et al., 2000; Hauck et al., 1997; Miller et al., 2001, 2002). There are over 1,000 exploration drill holes on this part of the Complex, and nearly 800,000 feet of core have been re-logged in the past fifteen years by a small group of company and university research geologists (see Patelke, 2003).

All of these igneous units, which are described below from bottom to top, (Table 5) exhibit shallow dips (10º-25º) to the south-southeast. The deposit, and the contact between the Duluth Complex and the Virginia Formation, strike about 35° NE.

**Table 5. Description of Geological Units**

| Unit | Description |
|---|---|
| 1 | Heterogeneous mixture of troctolitic to gabbroic rocks, with abundant inclusions of hornfelsed sedimentary footwall rocks and lesser discontinuous layers of ultramafic rock. Unit 1 is the dominant sulfide-bearing member in the NorthMet deposit. At least three Platinum group element (PGE) enriched "stratabound" layers are present within Unit 1, the uppermost of which has the highest concentrations of PGE. Unit 1 is 200 feet to 1000 feet thick, averaging 450 feet. |
| 2 | Homogenous troctolitic rocks, with minor sulfide mineralization, and a fairly persistent basal ultramafic layer that separates Unit 2 from Unit 1. Unit 2 averages about 200 feet thick. |
| 3 | Fine-grained, poikolitic, anorthositic troctolite. Unit 3 is the major marker bed within the deposit due to its fine-grained nature and the presence of distinctive olivine oikocrysts that give the rock a mottled appearance. Unit 3 contains little or no mineralization and averages 250 feet thick. |
| 4 | Homogenous ophitic augite troctolite with a local ultramafic layer at, or near, the base of the unit. There is little or no mineralization in this unit and it averages about 300 feet thick. |
| 5 - 7 | Homogenous anorthositic troctolite grading to ophitic augite troctolite; units 6 and 7 have persistent ultramafic bases. There is little or no economic sulfide mineralization except for a small horizon in six drill holes in Unit 6. These generally unmineralized units average about 1,200 feet in thickness, but because the top of Unit 7 has not been seen in drill core, this figure is probably a minimum. Preliminary assessment shows that PolyMet would intersect very little of these upper units in its pit development. |

The footwall rock at NorthMet is the metasedimentary Lower Proterozoic (1.8 Ga) Virginia Formation which is underlain by the Biwabik Iron-Formation.

Geology at NorthMet is well constrained by outcrop mapping (Severson and Zanko, 1996), and drill core logging on the USS holes, mostly by Geerts (Geerts et al. 1990, Geerts 1991, 1994), Severson (Severson et al., 2000), and Patelke (2001). This has been rather detailed logging providing the framework for the more production oriented logging done by PolyMet during 1998-2000 drilling programs.

## 10. DEPOSIT TYPES[4]

The NorthMet deposit itself is a low-grade, large-tonnage, disseminated accumulation of sulfide in mafic rocks, with rare massive sulfides. Copper to nickel ratios generally range from 3:1 to 4:1. Primary mineralization is probably magmatic, though the possibility of structurally controlled re-mobilization of the mineralization (especially PGEs) has not been excluded. Sulfur source is both local and magmatic (Theriault et al., 2000). Extensive detailed logging has shown no definitive relation between specific rock type and the quantity of sulfide mineralization in the Unit 1 mineralized zone or in other units, though the localized noritic rocks (related to footwall assimilation) tend to be of poorer PGE grade and higher in sulfur.

Footwall faults are inferred from bedding dips in the underlying sedimentary rocks, considering the possibility that Keweenawan syn-rift faults may affect these underlying units and show less movement, or indeed no effect on the igneous units. Nonetheless, without faults, the dips do not reconcile perfectly with the overall slope of the footwall. However, exposed bedding planes in the nearby iron mines show a rolling surface with a general dip to the south, but local dips in all compass directions. This would indicate that dips seen in core are fully indicative of the units dips. There are some apparent offsets in the igneous units, but definitive fault zones have not been identified. So far, no apparent local relation between the inferred location of faults and mineralization has been delineated.

Outcrop mapping (Severson and Zanko, 1996) shows apparent unit relations that require faults for perfect reconciliation. But, as with information derived from drill core, neither igneous stratigraphic unit recognition, nor outcrop density, is sufficiently definitive to establish exact fault locations without other evidence.

## 11. MINERALIZATION[5]

The metals of interest at NorthMet are copper, nickel, cobalt, platinum, palladium, gold. Minor amounts of rhodium and ruthenium are present though these are considered to have no economic significance. In general, with the exception of cobalt and gold, the metals are positively correlated with copper mineralization. Cobalt is well correlated with nickel.

Mineralization occurs in four broadly defined horizons throughout the NorthMet property. Three of these horizons are within basal Unit 1, though they likely will not be discriminated in mining. The thickness of each of the three Unit 1 enriched horizons varies from 5 feet to more than 200 feet. Unit 1 mineralization is found throughout the base of the deposit. A less extensive mineralized zone is found in Unit 6, and it is relatively enriched in PGEs compared to Unit 1 (after Geerts, 1994).

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[4] Largely taken from Hammond, 2005.

[5] Largely taken from Patelke and Geerts, 2005 and Hammond, 2005.

Mineralization occurs in two broad forms. Firstly, sulfides may be disseminated in heterogeneous troctolitic rocks (mainly Unit 1) in which the grain sizes of both silicates and sulfides widely vary. The occurrence of this mineralization within drill holes is unpredictable over the scale of 20 to 30 ft. Secondly, sulfides may be coarse grained and copper-rich in the upper units (2-7).

Sulfide mineralization consists of chalcopyrite and cubanite (in roughly equal proportions), pyrrhotite, and pentlandite, with minor bornite, violarite, pyrite, sphalerite, galena, talnakhite, mackinawite, and valerite. Sulfide minerals occur mainly as blebs interstitial to plagioclase, olivine, and augite grains, but also may occur within plagioclase and augite grains, as intergrowths with silicates, or as fine veinlets. Small globular aggregates of sulfides (< 2 cm) have been observed in core and in the small test pit on the site. The percentage of sulfide varies from trace to about 5%, but is rarely greater than 3%. Palladium, platinum, and gold are associated with the sulfides (after Geerts, 1994).

## 12. EXPLORATION[6]

Exploration history is outlined above in Section 8 (above). In general, the early drilling by U.S. Steel is widely spaced but comparatively regularly distributed (approximate 600 ft x 600 ft), with some omissions that left substantial undrilled areas, especially down-dip. Subsequent programs by PolyMet were focused on extracting metallurgical samples and on proving the up-dip and more readily accessible parts of the deposit.

During 2000 and 2001 PolyMet drilled 13 holes to in-fill a marked gap in the drilling and in so doing achieved an adequate coverage of the near-surface sections of the deposit (hole spacings generally in the order of 150 to 300 ft).

Those parts of the deposit at moderate depth largely continue to have the original U.S. Steel drill-hole spacing, which, in the eastern half of the deposit, is approximately 600 ft x 1,200 ft.

Drill spacing in the deepest known section of the deposit is approximately 1,200 ft x 1,200 ft. The deposit is definitely open at depth and while the deeper parts of the deposit (below about 1,000 feet below surface) may be of interest in the future they are considered to fall outside the scope of the current evaluation and Definitive Feasibility Study.

[6] Largely taken from Patelke and Geerts, 2005 and Hammond, 2005.

**Table 6. Summary of Drill Spacing**

| Area | Drillholes | | |
|---|---|---|---|
| | **Drilling proponent/campaign** | **No. of holes** | **Avg Hole Spacing (feet)** |
| **2003 Project Review ultimate pit outline** | USS, PolyMet, NERCO | 161 | 410 |
| **5 year pit* outlines** | USS, PolyMet, NERCO | 40 | 395 |
| **10 year pit* outlines** | USS, PolyMet, NERCO | 75 | 390 |
| **15 year pit* outlines** | USS, PolyMet, NERCO | 103 | 405 |
| **20 year pit* outlines** | USS, PolyMet, NERCO | 149 | 400 |

* Pit outlines refer to preliminary, conceptual level of definition pit outlines produced by AMDAD in Autumn 2004, from a revised geological and grade model produced by the author.

Drill hole spacing is approximately 300-400 ft in the north-west area of the deposit and 1000 ft, or more, in the deeper southeast portion of the deposit. Holes 26040 and 26102 are within a few feet of each other. Of the 201 legitimate holes, 151 have an average separation distance of 362 ft, 129 have a distance of 350 ft, 62 have a distance of 326 ft and 6 have a distance of 277 ft. The best drilled area, which also reflects the area with near-surface mineralization, is drilled at a spacing of about 400 feet.

## 13. DRILLING[7]

Collar data was extracted and is summarized in Table 7 (collars plotted in Figure 1).

There have been three major (and one minor) drilling campaigns on the property. These are outlined in Section 8, above. This discussion is largely taken from Patelke and Geerts (2005).

In all cases drilling has shown a basal mineralized zone (Unit 1) in troctolitic rocks with the highest NSR grades at its top and with grades diminishing with vertical depth. Grade appears to increase down dip. The main ore zone is from 200 to 1,000 feet thick, averaging about 450 feet. Mineralization sub-crops at the north edge of the deposit and continues to depths of greater than 2,000 feet. Sampling on the longest holes (well outside of any likely pit area) is sparse, with little in-fill work done since the original USS sampling.

While the concept of at least some structural control on mineralization is valid (i.e., proximity to a vent system or re-mobilization of some metals) no evidence collected to

[7] Largely taken from Patelke and Geerts, 2005.

date fully supports this view. More likely, this is a magmatic sulfide system which was then contaminated by sulfur from assimilated footwall rocks.

Core recovery is reported by PolyMet to be upwards of 98% with rare zones of poor recovery. Experience in the Duluth Complex indicates that core drilling has no difficulty in producing samples that are representative of the rock mass. Rock is fresh and competent and the common types of alteration in the deposit are not those that seem to affect recovery. Core recovery was recorded by USS but not by PolyMet in its earlier work. It is recommended that core recovery be recorded for all sampled intervals with previous and newly acquired data added to the current computerised database. It is currently not possible to provide quantified summaries of core recoveries.

In detail, the deposit geology is complex. However, at the mining scale, the overriding lithology will be troctolite to augite-troctolite (plagioclase>olivine>>pyroxene with biotite and minor ilmenite). In general, rocks are medium-grained, fresh, and competent.

**US Steel, 1969-1974.** From 1969 to 1974 USS drilled 112 holes across the property. Drilling began in an attempt to intersect a geophysical conductor (virtually all of the deposits in the area were originally drilled on geophysical targets) and the first hole hit 3 feet of massive sulfide with 4.8% copper, 115 feet from the surface. Drilling continued, without discovery of any more such dramatic results and eventually defined a broad zone of low-grade copper-nickel sulfide mineralization. Further drilling indicated that the original geophysical target was graphitic argillite in the footwall, rather than any mineralization in the Duluth Complex.

USS assayed only about 22,000 feet of the 133,000 feet they drilled, generally on ten foot intervals. Their focus was on developing an underground reserve and sampling was limited to zones of continuous "higher grade" mineralization. They were aware of the PGE value from the assaying of concentrates derived from bench work and a test pit, but did no assaying for these metals on drill core. Nearly all core was BQ size, and only 14 of the holes were angled (all to the northwest, grid north). Hole depths ranged from 162 feet to 2,647 feet, averaging 1,193 feet. Five holes were over 2,500 feet in length.

USS drilling was by Longyear. Virtually all of the core from this program exists and is available for further sampling. Seventeen USS holes were "skeletonized" after assaying, with only a foot kept for each five or ten foot run. Core was split by USS using a manual core splitter. Samples submitted for assay were half core.

The USS geologists logged all their holes, but neither recognized nor documented any igneous stratigraphy. Mark Severson of the Natural Resources Research Institute (NRRI), Duluth, Minnesota began re-logging these holes in the late 1980's as part of a Partridge River intrusion geochemistry project. He recognized a marker horizon, which led to correlations with other horizons.

Steve Geerts, working for the NRRI with Fleck Resources (PolyMet precursor) refined the geologic model for the deposit in light of this stratigraphy. This basic model is still considered by PolyMet to be valid and currently guides the interpretation of the deposit (Severson 1988, Severson and Hauck 1990, Geerts et al. 1990, Geerts 1991, 1994).

**NERCO, 1991.** NERCO conducted a minor drilling campaign in 1991—four holes at two sites. At each site a BQ sized core hole (1.43 inch) was drilled and sampled from ledge to bottom of hole. A PQ (3.3 inch) hole twinned each of these two holes and was sent in its entirety for metallurgical work. Both sets of holes twinned existing USS holes (Pancoast, 1991).

**PolyMet, 1998 – 2000, Reverse Circulation Holes.** PolyMet drilled 52 vertical reverse circulation (RC) holes to supply material for a bulk sample(s) in 1998 to 2000. These holes both twinned USS holes and served as in-fill for parts of the deposit. The drilling was done by a contractor from Duluth with extensive RC experience and was carried out in both summer and winter. The type of bit and extraction system used (cross-over sub or face-sampling) is not known. Sample quality cannot be directly assessed because recovered weights were not recorded. Metallurgical drilling in February and March 2005 twinned some RC holes. Data from these core holes will be used to undertake more assessment of closely situated RC samples. Visual assessment from these core holes are reported to be consistent with neighbouring RC intervals.

The RC holes were assayed on 5 foot intervals. Six inch reverse circulation drilling produced about 135 pounds of sample for every five feet of drilling. This material was split using a riffle splitter into two samples and placed in plastic bags and stored underwater in five gallon plastic buckets. A 1/16th sample was taken by rotary splitter from each five feet of chip sample and assayed. The assay values were used to develop a composite pilot plant sample from bucket samples. Actual compositing was done after samples had been shipped to Lakefield (Patelke and Severson, in prep).

Chip samples were collected and later logged at the PolyMet office. PolyMet retains these samples in their warehouse. Logging is obviously not as precise as that for core, but the major silicate and sulfide minerals can be recognized and location of marker horizons derived. The underlying metasedimentary rocks (Virginia Formation) are easily recognized and finding the bottom of the deposit is relatively straightforward.

**PolyMet, 1998 – 2000, Diamond Core Holes.** The PolyMet core drilling program was carried out during the later parts of the RC program, with three holes drilled late in 1999 and the remainder in early 2000. There were seventeen BTW (1.65 inch) and fifteen NTW (2.2 inch) holes all of which were vertical.

These holes were assayed from top to bottom (with rare exception) on 5 foot lengths. Samples were half core. Cutting was done at the PolyMet field office in Aurora, Minnesota.

Core logging was done at the PolyMet office by a variety of geologists, all trained in recognition of the units and the subtleties of the mineralogy and textures by Severson of the NRRI.

The PolyMet drilling in 1998 to 2000 targeted the up-dip portions of the deposit and was essentially in-fill drilling. RC holes averaged 474 feet in length with a minimum of 65 feet and a maximum depth of 745 feet. Core holes averaged 692 feet in length with a minimum of 229 feet and a maximum depth of 1192 feet (this does not include the 3 RC holes completed with AQ core).

**Table 7. Drill Hole Collar Details (Minnesota North State Plane Grid, NAD83)**

| ID | East | North | ELEV | TD | DIP | AZ | ID | East | North | ELEV | TD | DIP | AZ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00-325B | 2902202.8 | 738463.3 | 1615.5 | 325 | 90 | 0 | 11550 | 2894005.8 | 733292.8 | 1628.0 | 449 | 70 | 315 |
| 00-326C | 2902282.5 | 737801.1 | 1613.2 | 870 | 90 | 0 | 25415 | 2889814.3 | 740064.4 | 1614.0 | 465 | 90 | 0 |
| 00-327C | 2903151.7 | 738883.2 | 1609.0 | 500 | 90 | 0 | 25416 | 2897018.3 | 743493.1 | 1610.0 | 446 | 90 | 0 |
| 00-328B | 2902062.6 | 738454.4 | 1616.2 | 305 | 90 | 0 | 25417 | 2901709.3 | 744382.9 | 1609.0 | 495 | 90 | 0 |
| 00-329B | 2902372.9 | 738564.5 | 1610.6 | 385 | 90 | 0 | 25418 | 2906726.5 | 747208.7 | 1609.0 | 485 | 90 | 0 |
| 00-330C | 2903329.3 | 738665.1 | 1607.8 | 650 | 90 | 0 | 25420 | 2904273.3 | 746125.8 | 1605.0 | 518 | 90 | 0 |
| 00-331C | 2901958.6 | 738318.2 | 1612.7 | 375 | 90 | 0 | 25421 | 2905338.3 | 744409.8 | 1600.0 | 465 | 90 | 0 |
| 00-332B | 2902410.8 | 738770.6 | 1613.0 | 185 | 90 | 0 | 26010 | 2901423.6 | 737220.7 | 1602.0 | 620 | 50 | 315 |
| 00-333B | 2902433.4 | 738666.9 | 1612.8 | 345 | 90 | 0 | 26011 | 2901423.6 | 737220.7 | 1602.0 | 455 | 90 | 0 |
| 00-334C | 2902621.8 | 737760.9 | 1603.8 | 969 | 90 | 0 | 26013 | 2903528.4 | 738759.3 | 1610.0 | 740 | 60 | 333 |
| 00-335B | 2902622.4 | 738332.8 | 1612.2 | 665 | 90 | 0 | 26015 | 2902522.0 | 737911.3 | 1604.0 | 893 | 50 | 330 |
| 00-336B | 2902833.1 | 738642.2 | 1613.7 | 485 | 90 | 0 | 26017 | 2902522.0 | 737911.3 | 1605.0 | 861 | 90 | 0 |
| 00-337C | 2905438.4 | 739743.9 | 1609.7 | 600 | 90 | 0 | 26021 | 2901538.7 | 737040.4 | 1605.0 | 608 | 90 | 0 |
| 00-338B | 2902900.8 | 738360.3 | 1612.1 | 745 | 90 | 0 | 26022 | 2899239.0 | 736463.1 | 1605.0 | 606 | 90 | 0 |
| 00-339C | 2905235.6 | 739311.0 | 1604.6 | 699 | 90 | 0 | 26023 | 2899420.0 | 736115.5 | 1605.0 | 725 | 90 | 0 |
| 00-340C | 2904942.3 | 738857.2 | 1601.6 | 1020 | 90 | 0 | 26024 | 2899005.4 | 736925.5 | 1605.0 | 586 | 90 | 0 |
| 00-341B | 2902263.4 | 737901.1 | 1611.4 | 725 | 90 | 0 | 26025 | 2897253.4 | 734097.8 | 1613.0 | 1042 | 90 | 0 |
| 00-342B | 2901384.2 | 738028.5 | 1603.6 | 365 | 90 | 0 | 26026 | 2900285.8 | 736553.1 | 1614.0 | 715 | 90 | 0 |
| 00-343C | 2903799.0 | 739093.7 | 1609.4 | 560 | 90 | 0 | 26027 | 2898909.6 | 734946.6 | 1606.0 | 910 | 90 | 0 |
| 00-344C | 2900420.7 | 736390.9 | 1613.2 | 968.5 | 90 | 0 | 26028 | 2901331.5 | 737358.4 | 1599.0 | 381 | 50 | 327 |
| 00-345B | 2900657.3 | 737856.4 | 1609.4 | 265 | 90 | 0 | 26029 | 2896063.4 | 733226.6 | 1630.0 | 1181 | 90 | 0 |
| 00-346B | 2900837.7 | 737632.9 | 1612.1 | 305 | 90 | 0 | 26030 | 2901887.3 | 736492.8 | 1622.0 | 1094 | 90 | 0 |
| 00-347C | 2899944.4 | 736155.8 | 1618.5 | 924 | 90 | 0 | 26031 | 2902837.7 | 737432.6 | 1599.0 | 1116 | 90 | 0 |
| 00-348B | 2900098.1 | 737540.8 | 1610.1 | 265 | 90 | 0 | 26032 | 2904889.6 | 739230.3 | 1609.0 | 690 | 90 | 0 |
| 00-349B | 2900167.4 | 737380.1 | 1607.5 | 365 | 90 | 0 | 26033 | 2903847.3 | 738267.4 | 1614.0 | 1104 | 90 | 0 |
| 00-350C | 2901202.0 | 737062.8 | 1600.3 | 619 | 90 | 0 | 26034 | 2907832.9 | 739450.7 | 1600.0 | 1375 | 90 | 0 |
| 00-351B | 2900331.4 | 737073.5 | 1610.0 | 565 | 90 | 0 | 26035 | 2909169.8 | 741014.4 | 1600.0 | 915 | 90 | 0 |
| 00-352C | 2900913.6 | 736788.9 | 1600.3 | 694 | 90 | 0 | 26036 | 2909521.6 | 740453.8 | 1596.0 | 1237 | 90 | 0 |
| 00-353B | 2900574.5 | 736831.3 | 1603.0 | 645 | 90 | 0 | 26037 | 2902579.7 | 738991.0 | 1605.0 | 301 | 45 | 327 |
| 00-354C | 2901009.3 | 737344.6 | 1600.8 | 429 | 90 | 0 | 26038 | 2902750.7 | 738735.3 | 1613.0 | 405 | 90 | 0 |
| 00-355C | 2901265.3 | 737674.8 | 1600.0 | 271 | 90 | 0 | 26039 | 2902204.6 | 737208.6 | 1606.0 | 956 | 90 | 0 |
| 00-356B | 2900445.3 | 736945.4 | 1602.0 | 605 | 90 | 0 | 26040 | 2910823.8 | 740908.3 | 1596.0 | 679 | 90 | 0 |
| 00-357C | 2902887.2 | 738494.7 | 1613.3 | 565.5 | 90 | 0 | 26041 | 2902212.6 | 738465.3 | 1614.9 | 387 | 90 | 0 |
| 00-358B | 2900100.1 | 737103.8 | 1612.4 | 585 | 90 | 0 | 26042 | 2902278.6 | 735879.7 | 1594.0 | 1946 | 90 | 0 |
| 00-359B | 2901759.7 | 737857.3 | 1606.9 | 425 | 90 | 0 | 26043 | 2904205.8 | 737716.6 | 1606.0 | 1559 | 90 | 0 |
| 00-360B | 2901569.1 | 737793.4 | 1601.4 | 425 | 90 | 0 | 26044 | 2902750.7 | 738735.3 | 1612.0 | 205 | 90 | 0 |
| 00-361C | 2904528.8 | 738984.6 | 1605.2 | 775 | 90 | 0 | 26045 | 2901072.8 | 736471.4 | 1605.1 | 926 | 90 | 0 |
| 00-362C | 2905596.7 | 740055.1 | 1611.2 | 314 | 90 | 0 | 26046 | 2903158.4 | 738122.1 | 1603.0 | 945 | 90 | 0 |
| 00-363C | 2905969.9 | 740101.9 | 1608.0 | 329 | 90 | 0 | 26047 | 2904292.9 | 738786.4 | 1604.0 | 800 | 90 | 0 |
| 00-364C | 2906263.1 | 740205.1 | 1605.7 | 229 | 90 | 0 | 26048 | 2903271.8 | 736724.3 | 1598.0 | 1902 | 90 | 0 |
| 00-365C | 2906829.4 | 740349.6 | 1620.2 | 299 | 90 | 0 | 26049 | 2905274.3 | 738676.2 | 1608.0 | 1207 | 90 | 0 |
| 00-366C | 2907213.4 | 739829.8 | 1619.9 | 799 | 90 | 0 | 26050 | 2904552.4 | 737185.3 | 1605.8 | 2005 | 90 | 0 |
| 00-367C | 2908280.5 | 739993.1 | 1604.5 | 1195 | 90 | 0 | 26051 | 2904684.3 | 738199.6 | 1602.0 | 1454 | 90 | 0 |
| 00-368C | 2906789.3 | 739874.9 | 1620.7 | 969 | 90 | 0 | 26052 | 2905921.9 | 737764.8 | 1592.0 | 1866 | 90 | 0 |
| 00-369C | 2906974.9 | 739609.1 | 1609.4 | 959 | 90 | 0 | 26053 | 2900650.7 | 736018.7 | 1595.0 | 1018 | 90 | 0 |
| 00-370C | 2906476.6 | 739841.3 | 1619.5 | 878 | 90 | 0 | 26054 | 2899614.9 | 735108.3 | 1598.0 | 776 | 90 | 0 |
| 00-371C | 2905617.8 | 739546.3 | 1609.4 | 780 | 90 | 0 | 26055 | 2901005.9 | 735441.6 | 1595.0 | 1672 | 90 | 0 |
| 00-372C | 2905789.3 | 739789.1 | 1614.7 | 740 | 90 | 0 | 26056 | 2899910.9 | 734616.5 | 1592.0 | 1693 | 90 | 0 |
| 00-373C | 2906177.4 | 739870.0 | 1606.9 | 700 | 90 | 0 | 26057 | 2900718.4 | 736983.5 | 1598.0 | 608 | 90 | 0 |

| ID | East | North | ELEV | TD | DIP | AZ | ID | East | North | ELEV | TD | DIP | AZ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26058 | 2899975.1 | 735748.7 | 1612.0 | 817 | 90 | 0 | 26109 | 2907175.3 | 740509.8 | 1612.0 | 242 | 45 | 326 |
| 26059 | 2901842.2 | 737825.7 | 1603.0 | 608 | 90 | 0 | 26110 | 2907227.9 | 740362.1 | 1621.0 | 162 | 45 | 325 |
| 26060 | 2903528.4 | 738759.3 | 1610.0 | 812 | 90 | 0 | 26111 | 2907568.9 | 740483.3 | 1625.8 | 162 | 45 | 340 |
| 26061 | 2903506.9 | 737584.4 | 1602.0 | 1277 | 90 | 0 | 26112 | 2907821.4 | 740697.6 | 1614.0 | 222 | 45 | 325 |
| 26062 | 2901418.8 | 735894.9 | 1593.0 | 1477 | 90 | 0 | 26113 | 2908172.4 | 740832.6 | 1621.0 | 214 | 45 | 340 |
| 26063 | 2905019.7 | 737648.8 | 1594.0 | 1957 | 90 | 0 | 26114 | 2908556.3 | 740859.4 | 1617.0 | 293 | 40 | 329 |
| 26064 | 2902540.1 | 736624.9 | 1595.0 | 1496 | 90 | 0 | 26115 | 2902512.0 | 735519.0 | 1592.0 | 2180 | 90 | 0 |
| 26065 | 2906697.8 | 736689.4 | 1592.0 | 2466 | 90 | 0 | 26116 | 2903312.9 | 735408.5 | 1610.0 | 2245 | 90 | 0 |
| 26066 | 2905632.7 | 738148.3 | 1604.0 | 1677 | 90 | 0 | 26117 | 2904567.2 | 734842.4 | 1586.0 | 2594 | 90 | 0 |
| 26067 | 2907635.6 | 737278.0 | 1598.0 | 2147 | 90 | 0 | 26118 | 2906333.1 | 739530.8 | 1618.0 | 1145 | 90 | 0 |
| 26068 | 2906994.2 | 738409.3 | 1601.0 | 1458 | 90 | 0 | 26119 | 2905662.4 | 735500.1 | 1568.0 | 2647 | 90 | 0 |
| 26069 | 2908569.4 | 738342.5 | 1604.0 | 2006 | 90 | 0 | 26120 | 2906648.9 | 738996.3 | 1597.0 | 1080 | 90 | 0 |
| 26073 | 2902972.4 | 734810.8 | 1603.0 | 2494 | 90 | 0 | 26121 | 2900747.8 | 734545.4 | 1594.0 | 2151 | 90 | 0 |
| 26074 | 2909648.3 | 738937.8 | 1598.0 | 2095 | 90 | 0 | 26122 | 2904276.4 | 736410.6 | 1607.0 | 2242 | 90 | 0 |
| 26075 | 2905294.1 | 736060.8 | 1597.0 | 2505 | 90 | 0 | 26123 | 2901390.5 | 734884.2 | 1597.0 | 2253 | 90 | 0 |
| 26076 | 2906580.3 | 740114.0 | 1619.2 | 1180 | 90 | 0 | 26124 | 2901823.1 | 735317.9 | 1593.0 | 2415 | 90 | 0 |
| 26077 | 2901507.3 | 738380.9 | 1609.0 | 374 | 90 | 0 | 26125 | 2904654.4 | 735889.3 | 1597.0 | 2504 | 90 | 0 |
| 26078 | 2900105.6 | 736310.0 | 1613.0 | 904 | 90 | 0 | 26127 | 2908329.7 | 740537.3 | 1629.0 | 918 | 90 | 0 |
| 26079 | 2900761.8 | 736425.8 | 1597.0 | 864 | 90 | 0 | 26128 | 2907723.6 | 740241.4 | 1632.0 | 1008 | 90 | 0 |
| 26080 | 2897986.8 | 732953.5 | 1597.0 | 1925 | 90 | 0 | 26141 | 2899304.1 | 734366.3 | 1592.0 | 1585 | 90 | 0 |
| 26081 | 2900647.4 | 733524.7 | 1578.0 | 2345 | 90 | 0 | 26142 | 2899642.8 | 733854.8 | 1593.0 | 2118 | 90 | 0 |
| 26082 | 2899194.1 | 735721.4 | 1607.0 | 935 | 90 | 0 | 26143 | 2899174.2 | 733342.3 | 1592.0 | 2125 | 90 | 0 |
| 26083 | 2898085.8 | 735001.3 | 1607.0 | 644 | 90 | 0 | 98-086B | 2907823.2 | 740544.4 | 1617.3 | 585 | 90 | 0 |
| 26084 | 2896977.3 | 734510.9 | 1613.0 | 1354 | 90 | 0 | 98-105B | 2907616.8 | 740731.8 | 1615.9 | 265 | 90 | 0 |
| 26085 | 2899907.6 | 737117.0 | 1605.0 | 535 | 90 | 0 | 98-108B | 2907442.5 | 740618.8 | 1616.8 | 225 | 90 | 0 |
| 26086 | 2907821.9 | 740585.4 | 1616.5 | 574 | 90 | 0 | 98-113B | 2908337.0 | 741005.8 | 1621.4 | 245 | 90 | 0 |
| 26086A | 2907841.8 | 740555.4 | 1621.7 | 522 | 90 | 0 | 98-113C | 2908173.5 | 740850.3 | 1621.5 | 385 | 90 | 0 |
| 26087 | 2909899.6 | 740007.9 | 1595.0 | 1675 | 90 | 0 | 98-114B | 2908617.8 | 740875.6 | 1618.0 | 465 | 90 | 0 |
| 26088 | 2897002.3 | 737966.4 | 1610.0 | 885 | 90 | 0 | 98-201C | 2907605.9 | 740428.0 | 1628.5 | 625 | 90 | 0 |
| 26089 | 2901885.4 | 740404.4 | 1605.0 | 837 | 90 | 0 | 98-202C | 2908131.9 | 741094.9 | 1614.8 | 65 | 90 | 0 |
| 26090 | 2900349.9 | 735178.2 | 1595.0 | 1775 | 90 | 0 | 98-203C | 2908423.8 | 740845.0 | 1620.2 | 505 | 90 | 0 |
| 26091 | 2901061.9 | 737787.9 | 1609.0 | 231 | 90 | 0 | 98-204C | 2908715.6 | 741032.9 | 1615.0 | 305 | 90 | 0 |
| 26092 | 2900353.4 | 737534.4 | 1613.0 | 376 | 90 | 0 | 98-205C | 2908407.2 | 740603.5 | 1623.6 | 665 | 90 | 0 |
| 26093 | 2898452.2 | 734471.6 | 1618.4 | 1085 | 90 | 0 | 98-206C | 2908240.7 | 740644.8 | 1626.7 | 645 | 90 | 0 |
| 26094 | 2901788.4 | 734274.4 | 1582.0 | 2515 | 90 | 0 | 98-207C | 2907460.9 | 740264.0 | 1624.7 | 645 | 90 | 0 |
| 26095 | 2901669.4 | 738108.2 | 1605.0 | 425 | 90 | 0 | 98-208C | 2907598.9 | 740291.9 | 1630.2 | 745 | 90 | 0 |
| 26096 | 2907464.6 | 740060.6 | 1625.0 | 883 | 90 | 0 | 99-301B | 2902879.8 | 738507.3 | 1611.3 | 605 | 90 | 0 |
| 26097 | 2898725.4 | 735222.0 | 1606.0 | 787 | 90 | 0 | 99-302B | 2904216.1 | 738941.2 | 1613.1 | 725 | 90 | 0 |
| 26098 | 2899859.0 | 736634.6 | 1604.0 | 755 | 90 | 0 | 99-303B | 2902504.3 | 738525.6 | 1607.7 | 425 | 90 | 0 |
| 26099 | 2908648.0 | 740691.3 | 1623.6 | 565 | 90 | 0 | 99-304BC | 2902815.6 | 737931.4 | 1605.3 | 890 | 90 | 0 |
| 26100 | 2900534.3 | 737252.4 | 1613.0 | 465 | 90 | 0 | 99-305BC | 2903422.0 | 738283.9 | 1605.5 | 938 | 90 | 0 |
| 26101 | 2900104.9 | 736828.5 | 1607.0 | 655 | 90 | 0 | 99-306B | 2904004.6 | 738854.3 | 1611.8 | 685 | 90 | 0 |
| 26101A | 2900127.8 | 736871.2 | 1613.0 | 320 | 90 | 0 | 99-307B | 2905304.3 | 740009.6 | 1615.8 | 205 | 90 | 0 |
| 26102 | 2910823.8 | 740908.3 | 1598.0 | 1112 | 60 | 327 | 99-308B | 2905123.0 | 739591.8 | 1612.7 | 585 | 90 | 0 |
| 26103 | 2900256.9 | 736031.3 | 1612.0 | 965 | 90 | 0 | 99-309B | 2904767.4 | 739109.6 | 1610.7 | 715 | 90 | 0 |
| 26104 | 2904021.4 | 735635.8 | 1612.0 | 2445 | 90 | 0 | 99-310BC | 2902393.9 | 737520.4 | 1614.9 | 868.5 | 90 | 0 |
| 26105 | 2907752.4 | 740812.4 | 1617.0 | 212 | 45 | 325 | 99-311B | 2901831.7 | 737267.9 | 1606.8 | 705 | 90 | 0 |
| 26106 | 2911527.5 | 739829.6 | 1601.0 | 1875 | 90 | 0 | 99-312B | 2902047.8 | 737567.3 | 1607.0 | 745 | 90 | 0 |
| 26107 | 2909338.9 | 737129.3 | 1579.0 | 2431 | 90 | 0 | 99-313B | 2902746.4 | 738240.5 | 1609.3 | 745 | 90 | 0 |
| 26108 | 2907480.3 | 740611.9 | 1617.0 | 167 | 45 | 325 | 99-314B | 2903068.8 | 739053.1 | 1617.0 | 405 | 90 | 0 |

| ID | East | North | ELEV | TD | DIP | AZ | ID | East | North | ELEV | TD | DIP | AZ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 99-315B | 2903637.6 | 739306.3 | 1610.8 | 365 | 90 | 0 | | | | | | | |
| 99-316B | 2903381.6 | 739093.7 | 1606.8 | 445 | 90 | 0 | | | | | | | |
| 99-317C | 2904072.1 | 739206.7 | 1604.8 | 650 | 90 | 0 | | | | | | | |
| 99-318C | 2903737.3 | 738537.5 | 1608.5 | 910 | 90 | 0 | | | | | | | |
| 99-319B | 2902495.8 | 738127.9 | 1610.4 | 585 | 90 | 0 | | | | | | | |
| 99-320C | 2903377.8 | 738395.6 | 1613.8 | 916 | 90 | 0 | | | | | | | |
| 99-321B | 2902177.5 | 738008.2 | 1610.0 | 665 | 90 | 0 | | | | | | | |
| 99-322B | 2901833.4 | 738515.8 | 1611.8 | 165 | 90 | 0 | | | | | | | |
| 99-323B | 2902072.3 | 738698.4 | 1617.4 | 225 | 90 | 0 | | | | | | | |
| 99-324B | 2902136.9 | 738595.1 | 1616.3 | 305 | 90 | 0 | | | | | | | |
| A4-11 | 2895110.5 | 730758.3 | 1610.0 | 2214 | 90 | 0 | | | | | | | |
| B1-066 | 2918487.5 | 741777.2 | 1600.0 | 2344 | 90 | 0 | | | | | | | |
| B1-199 | 2914259.0 | 742538.5 | 1602.0 | 1259 | 90 | 0 | | | | | | | |
| B1-416 | 2913025.0 | 744192.3 | 1594.1 | 365 | 90 | 0 | | | | | | | |
| BA-3 | 2907892.5 | 731555.4 | 1550.0 | 3588 | 90 | 0 | | | | | | | |
| BA-4 | 2913644.0 | 737367.9 | 1565.0 | 2677 | 90 | 0 | | | | | | | |
| BA-5 | 2919339.5 | 735882.3 | 1580.0 | 3647 | 85 | 315 | | | | | | | |

(ELEV = elevation, in feet; TD = total depth; AZ = azimuth)

## 14. SAMPLING METHOD AND APPROACH

Original USS sampling, generally on 10 foot intervals, honoured some, but not all, the geological boundaries that were encountered. The PolyMet RC sampling transgressed boundaries, though the 5 foot chip samples diminish the opportunity for this to be of any consequence in a bulk mining (15-20 foot bench or greater) scenario.

Sampling of USS core by Geerts, Severson, and Patelke of NRRI at various times usually was on 5 foot samples and seldom crossed any significant geologic boundaries. 2005 sampling by PolyMet on the USS core will generally be on 10 foot intervals, but will not cross any major geologic boundaries and may include many shorter intervals. Future sampling of new in-fill core will use 5 foot samples in the main mineralized zone and 10 foot in the upper zones. This will be adjusted to use smaller intervals in the upper parts with visible mineralization and will not cross geologic boundaries.

Table 8 shows average length of samples in mineralized and unmineralized zones. Approximately 86% of the mineralized zone and about 25% of the unmineralized zone have been sampled (current work will increase these percentages). Percentages are higher in the anticipated area of mining.

**Table 8. Sample lengths**

| | **Average sample length in main mineralized zone (feet)** | **Average sample length in "unmineralized zone" (feet)** |
|---|---|---|
| USS original core | 6.1 | 5.1 |
| PolyMet RC drilling | 5.0 | 5.0 |
| PolyMet core drilling | 5.0 | 5.0 |
| All drilling | 5.6 | 5.1 |

Sampling in Unit 1 (the main mineralized zone) is 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 progress in 2005 will essentially complete the sampling of historic USS core within the area likely to be mined. This broad sampling limits the possibility of bias in the sample set. Currently the upper waste zone is the only part of the planned mining area with less than complete sampling. This has been recognized and is accounted for in the modelling (Section 19).

The author has analysed duplicate sets assays from RC samples that are closely situated (within 50 ft of each other) to core samples. These sets of closely situated holes are listed in Table 9.

**Table 9. Closely situated RC and DD holes**

**Diamond – Diamond Pairs**

| ID | Type | DD Close | Avg Distance (feet) |
|---|---|---|---|
| 26010 | BQ | 26011 | 31.4 |
| 26013 | BQ | 26060 | 24.2 |
| 26038 | BQ | 26044 | 1.3 |
| 26086 | BQ | 26086A | 35.9 |
| 26101 | BQ | 26101A | 48.5 |

**Diamond – RC Pairs**

| ID | Type | RC close | Avg Distance (feet) |
|---|---|---|---|
| 00-357C | NTW | 99-301B | 14.7 |
| 26041 | BQ | 00-325B | 10.2 |
| 26086 | BQ | 98-086B | 35.1 |
| 26086A | BQ | 98-086B | 20.8 |
| 26108 | BQ | 98-108B | 34.3 |
| 26113 | BQ | 98-113C | 29.7 |

This analysis is summarized in Table 10 for DD-RC sample pairs that are at a similar elevation. For comparison, Table 11 shows pairs of closely situated core samples.

**Table 10. Summary of closely situated RC and DD samples**

| | DD Samples | RC Samples |
|---|---|---|
| **Parameter** | **Average (SD)** | **Average (SD)** |
| **Cu%** | 0.22 (1.00) | 0.21 (0.99) |
| **Ni%** | 0.05 (0.80) | 0.05 (0.74) |
| **Co (ppm)** | 61 (0.52) | 69 (0.36) |
| **Au (ppb)** | 31 (1.36) | 30 (2.21) |
| **Pd (ppb)** | 229 (1.21) | 189 (1.28) |
| **Pt (ppb)** | 55 (1.07) | 50 (1.24) |
| **Separation distance / number of pairs** | 17.4 ft / 256 | |

**Table 11. Summary of closely situated DD and DD samples**

| | DD Samples | DD Samples |
|---|---|---|
| **Parameter** | **Average (SD)** | **Average (SD)** |
| **Cu%** | 0.22 (1.10) | 0.23 (1.11) |
| **Ni%** | 0.07 (0.75) | 0.07 (0.76) |
| **Co (ppm)** | 60 (0.30) | 71 (0.44) |
| **Au (ppb)** | 97 (1.39) | 98 (1.48) |
| **Pd (ppb)** | 306 (2.32) | 238 (1.34) |
| **Pt (ppb)** | 62 (1.40) | 56 (1.23) |
| **Separation distance / number of pairs** | 31.3 ft / 98 | |

These results show excellent agreement even for Au, Pd and Pt. The differences between the RC and DD samples are of a similar level to those between adjacent pairs of diamond core samples. These results strongly support the integrity of both the RC samples and their assays.

A further test of the integrity of the RC samples was made by comparing the total interval length of mineralization in adjacent RC and DD samples. In diamond core samples and for cut-offs of 0.1%, 0.2% & 0.3% Cu there are a total of 810 ft, 651 ft & 427 ft of total length. For the adjacent RC samples there are 690 ft, 540 ft and 375 ft of total length for the same Cu cut-offs. This suggests that diamond drill holes resulted in a greater length of mineralization than adjacent RC holes.

There appears, therefore, to be no evidence to exclude assays based on RC samples from resource estimation. Metallurgical holes completed during the winter 2005 drilling program have been designed to provide more data relevant to confirmation of the RC samples.

A summary of intercepts that exceed 0.2% Cu with average grades listed per drill-hole is provided in Table 12.

**Table 12. Summary of mineralized intercepts >0.2% Cu**

| Hole | Length | Cu% | Ni% | Co | Au | Pd | Pt | S% |
|---|---|---|---|---|---|---|---|---|
| 00-325B | 75 | 0.306 | 0.077 | 56.7 | 37.7 | 196.7 | 70.7 | 0.717 |
| 00-326C | 165 | 0.403 | 0.108 | 80.5 | 44.7 | 463.2 | 75.8 | 1.026 |
| 00-327C | 55 | 0.273 | 0.084 | 89.7 | 19.6 | 82.9 | 28.2 | 1.184 |
| 00-328B | 60 | 0.278 | 0.081 | 75 | 27.2 | 216 | 42.5 | 0.876 |
| 00-329B | 35 | 0.388 | 0.094 | 54.1 | 40.3 | 395.4 | 80 | 0.743 |
| 00-330C | 315 | 0.386 | 0.138 | 148.1 | 40.2 | 226.5 | 94.6 | 1.836 |
| 00-331C | 80 | 0.37 | 0.095 | 71.1 | 48.8 | 321 | 94.1 | 0.922 |
| 00-332B | 36 | 0.31 | 0.062 | 45.6 | 81.5 | 167.6 | 45.8 | 1.128 |
| 00-333B | 15 | 0.235 | 0.066 | 58.3 | 22 | 110.7 | 21.7 | 0.67 |
| 00-334C | 190 | 0.49 | 0.132 | 86.5 | 58.2 | 514.8 | 88.9 | 1.323 |
| 00-335B | 155 | 0.339 | 0.103 | 70.5 | 49.2 | 470 | 105.2 | 0.789 |
| 00-336B | 80 | 0.345 | 0.108 | 103.7 | 63.6 | 517.4 | 108.4 | 1.142 |
| 00-337C | 275 | 0.464 | 0.154 | 79 | 66.3 | 525.4 | 131.2 | 0.848 |
| 00-338B | 140 | 0.344 | 0.091 | 71.7 | 57.1 | 303.7 | 92.9 | 0.889 |
| 00-339C | 25 | 0.365 | 0.08 | 69.2 | 86.8 | 487.2 | 182 | 0.672 |
| 00-340C | 225 | 0.365 | 0.113 | 117.8 | 42.1 | 310.9 | 85.1 | 1.656 |
| 00-341B | 90 | 0.384 | 0.095 | 64.8 | 50.4 | 374.4 | 81.7 | 0.836 |
| 00-342B | 50 | 0.259 | 0.08 | 68.5 | 35.2 | 211.2 | 64 | 0.617 |
| 00-343C | 103 | 0.365 | 0.11 | 81.4 | 41.7 | 467.9 | 128.4 | 1.063 |
| 00-344C | 235 | 0.399 | 0.129 | 84.8 | 46.4 | 325.9 | 80.4 | 0.947 |
| 00-345B | 10 | 0.24 | 0.093 | 84 | 38 | 136 | 32.5 | 1.025 |
| 00-346B | 115 | 0.422 | 0.177 | 121.2 | 41 | 261.4 | 100.4 | 1.472 |
| 00-347C | 275 | 0.524 | 0.16 | 102.4 | 60.4 | 541.4 | 120.4 | 0.926 |
| 00-348B | 42 | 0.386 | 0.12 | 87.2 | 35.5 | 211.9 | 79.9 | 0.651 |
| 00-349B | 65 | 0.423 | 0.108 | 67.6 | 31.4 | 283.8 | 99 | 0.823 |
| 00-350C | 100 | 0.382 | 0.117 | 91.3 | 57 | 437.6 | 107.5 | 0.879 |
| 00-351B | 130 | 0.43 | 0.121 | 75 | 46.8 | 361.4 | 78.3 | 0.727 |
| 00-352C | 200 | 0.432 | 0.135 | 108.3 | 52.1 | 378.7 | 118.5 | 2.259 |
| 00-353B | 150 | 0.394 | 0.122 | 79.9 | 46.7 | 314.5 | 86.7 | 1.032 |
| 00-354C | 45 | 0.556 | 0.133 | 96.3 | 64 | 372.2 | 88.1 | 1.262 |
| 00-355C | 130 | 0.349 | 0.124 | 144.4 | 28.3 | 135.9 | 55.4 | 1.79 |
| 00-356B | 200 | 0.525 | 0.142 | 85 | 88.4 | 442 | 104.8 | 0.866 |
| 00-357C | 215 | 0.395 | 0.114 | 73.5 | 50.5 | 445.5 | 108.3 | 1.017 |
| 00-358B | 200 | 0.415 | 0.118 | 77.8 | 37.5 | 299.8 | 73.9 | 0.891 |
| 00-359B | 164 | 0.377 | 0.12 | 88.4 | 32.4 | 227.8 | 60.9 | 0.994 |
| 00-360B | 95 | 0.306 | 0.091 | 70.8 | 35.8 | 215.7 | 63.9 | 0.761 |
| 00-361C | 130 | 0.509 | 0.142 | 82.1 | 88 | 762.2 | 193 | 0.838 |
| 00-362C | 145 | 0.336 | 0.1 | 106.5 | 32.6 | 232.5 | 48.7 | 2.093 |
| 00-363C | 121 | 0.407 | 0.112 | 90.9 | 50.8 | 447.5 | 139.6 | 1.363 |
| 00-364C | 76.4 | 0.361 | 0.11 | 107.3 | 36 | 318.3 | 102.8 | 1.739 |
| 00-365C | 123.5 | 0.435 | 0.112 | 84.3 | 35.4 | 320.3 | 67.5 | 1.123 |
| 00-366C | 110 | 0.508 | 0.142 | 87.6 | 68.3 | 539.3 | 135.7 | 1.11 |
| 00-367C | 20 | 0.334 | 0.07 | 60.5 | 58 | 381 | 81.3 | 0.592 |
| 00-368C | 315 | 0.493 | 0.127 | 77.4 | 59.6 | 515.4 | 106 | 1.225 |
| 00-369C | 30 | 0.498 | 0.12 | 80.2 | 35.3 | 124 | 48.3 | 1.158 |
| 00-370C | 295 | 0.364 | 0.101 | 73.8 | 36 | 288.8 | 72.1 | 1.064 |
| 00-371C | 135 | 0.38 | 0.1 | 66.8 | 35.9 | 395.6 | 103 | 0.693 |
| 00-372C | 295 | 0.361 | 0.112 | 104.5 | 42.9 | 284.4 | 70.4 | 1.619 |

| Hole | Length | Cu% | Ni% | Co | Au | Pd | Pt | S% |
|---|---|---|---|---|---|---|---|---|
| 00-373C | 225 | 0.385 | 0.11 | 76.2 | 44.8 | 452 | 97.8 | 1.017 |
| 26010 | 135 | 0.543 | 0.115 | 104.3 | 98.8 | 542.1 | 123.6 | 1.947 |
| 26011 | 108 | 0.386 | 0.116 | 130.5 | 37.8 | 156.4 | 125.4 | 4.365 |
| 26013 | 122 | 0.282 | 0.091 | 63.7 | 67.8 | 736.7 | 149.2 | 0.787 |
| 26015 | 160.3 | 0.365 | 0.082 | 55.5 | 61.3 | 388.8 | 93 | 0.698 |
| 26017 | 220 | 0.438 | 0.108 | 71.3 | 44.2 | 435.9 | 109.2 | 1.024 |
| 26021 | 153.3 | 0.403 | 0.101 | 71.3 | 54.1 | 357.8 | 77.5 | 1.618 |
| 26022 | 20 | 0.273 | 0.069 | 61.5 | 33.5 | 109.5 | 39.5 | 0.915 |
| 26023 | 60 | 0.321 | 0.078 | 65.5 | 20.7 | 48.2 | 21.8 | 0.987 |
| 26025 | 166 | 0.356 | 0.093 | 78.4 | 40.8 | 246.9 | 92.6 | 1.399 |
| 26026 | 157.5 | 0.571 | 0.12 | 64.1 | 86.1 | 510.6 | 124.4 | 0.953 |
| 26027 | 210.2 | 0.43 | 0.105 | 82.2 | 53.5 | 340.7 | 96.5 | 1.582 |
| 26028 | 89 | 0.39 | 0.125 | 120.2 | 38.3 | 217 | 63.9 | 2.741 |
| 26029 | 25 | 0.264 | 0.051 | 65.4 | 15.6 | 36 | 10.5 | 0.478 |
| 26030 | 226.5 | 0.408 | 0.111 | 91.5 | 51.6 | 302.2 | 87.6 | 1.11 |
| 26031 | 231.2 | 0.394 | 0.098 | 67.3 | 63.9 | 390.8 | 108 | 1.279 |
| 26032 | 112 | 0.354 | 0.093 | 51.7 | 35.6 | 338.6 | 65 | 0.693 |
| 26033 | 276.5 | 0.398 | 0.112 | 72.9 | 51.1 | 413.2 | 98.9 | 0.961 |
| 26034 | 95 | 0.448 | 0.12 | 58.4 | 52.2 | 436.9 | 122.5 | 1.051 |
| 26036 | 179 | 0.356 | 0.089 | 49.8 | 51.6 | 333.9 | 90.7 | 0.697 |
| 26038 | 53 | 0.415 | 0.108 | 69.3 | 69.5 | 199.4 | 59.3 | 0.936 |
| 26039 | 120.5 | 0.456 | 0.111 | 94.6 | 56.5 | 394.7 | 114.6 | 2.021 |
| 26041 | 112 | 0.296 | 0.07 | 43.7 | 59.5 | 258.5 | 63.9 | 0.713 |
| 26042 | 346.5 | 0.401 | 0.114 | 77.1 | 68.7 | 377 | 143.7 | 0.99 |
| 26043 | 215.5 | 0.48 | 0.16 | 70.7 | 58.6 | 479.6 | 136.1 | 1.14 |
| 26044 | 77.5 | 0.438 | 0.106 | 60 | 59.7 | 329.2 | 88.5 | 1.016 |
| 26045 | 123 | 0.348 | 0.076 | 63.1 | 52.5 | 310.5 | 109.7 | 0.967 |
| 26046 | 127.5 | 0.533 | 0.116 | 86.5 | 60.5 | 456.7 | 108.4 | 2.074 |
| 26047 | 290.5 | 0.356 | 0.116 | 80.9 | 44.6 | 311.1 | 91.4 | 0.749 |
| 26048 | 222 | 0.416 | 0.105 | 60.6 | 55.2 | 530.1 | 126 | 0.765 |
| 26049 | 203.5 | 0.378 | 0.1 | 74.2 | 40.5 | 392.2 | 84.4 | 0.842 |
| 26050 | 127 | 0.476 | 0.134 | 66.3 | 126.8 | 936.9 | 220.1 | 2.136 |
| 26051 | 205 | 0.367 | 0.101 | 57.2 | 68.3 | 495.3 | 127.7 | 0.79 |
| 26052 | 327 | 0.462 | 0.121 | 70.9 | 52.6 | 374.6 | 80.9 | 1.666 |
| 26053 | 243 | 0.514 | 0.109 | 67.6 | 75 | 406.5 | 107.6 | 0.867 |
| 26054 | 328 | 0.504 | 0.102 | 69.6 | 63.1 | 323.8 | 96.1 | 0.966 |
| 26055 | 329 | 0.461 | 0.123 | 73.2 | 81.7 | 528.1 | 170.9 | 0.838 |
| 26056 | 418 | 0.417 | 0.101 | 66 | 67.1 | 386.8 | 165.4 | 0.821 |
| 26057 | 84 | 0.523 | 0.123 | 78.6 | 59.1 | 534.4 | 150.8 | 1.141 |
| 26058 | 65 | 0.504 | 0.106 | 59 | 84.3 | 411.6 | 136.1 | 1.065 |
| 26059 | 258 | 0.398 | 0.094 | 67.4 | 51.4 | 276.2 | 85.3 | 1.316 |
| 26060 | 89 | 0.377 | 0.098 | 62.6 | 97.3 | 542.4 | 125.6 | 0.794 |
| 26061 | 10 | 0.28 | 0.093 | 97 | 23 | 157 | 22.5 | 1.165 |
| 26062 | 208 | 0.379 | 0.087 | 87.2 | 35.8 | 213.8 | 71.4 | 1.669 |
| 26063 | 267 | 0.441 | 0.112 | 73.1 | 62.2 | 479.3 | 111.3 | 1.259 |
| 26064 | 188.5 | 0.306 | 0.079 | 69.6 | 47.4 | 324.4 | 75.4 | 0.758 |
| 26065 | 102 | 0.461 | 0.111 | 77.1 | 56.1 | 479.4 | 134.2 | 0.818 |
| 26066 | 141 | 0.439 | 0.091 | 57.4 | 42.9 | 429.3 | 100.4 | 0.805 |
| 26067 | 44 | 0.551 | 0.13 | 88 | 78.7 | 647.7 | 141.8 | 0.897 |
| 26068 | 172 | 0.402 | 0.117 | 74.3 | 62.9 | 535.5 | 104.1 | 0.894 |
| 26069 | 121 | 0.46 | 0.13 | 64 | 81.8 | 694.5 | 170.6 | 0.897 |

| Hole | Length | Cu% | Ni% | Co | Au | Pd | Pt | S% |
|---|---|---|---|---|---|---|---|---|
| 26073 | 119 | 0.538 | 0.115 | 65.7 | 96 | 715.7 | 176.5 | 0.773 |
| 26074 | 31 | 0.355 | 0.081 | 47.8 | 102.6 | 477.4 | 113.6 | 0.487 |
| 26075 | 112 | 0.671 | 0.132 | 76 | 94 | 852.9 | 211.3 | 0.916 |
| 26076 | 231 | 0.303 | 0.077 | 56.1 | 41 | 328 | 73.7 | 0.714 |
| 26077 | 83 | 0.281 | 0.067 | 43.9 | 47.5 | 199.3 | 53.5 | 0.522 |
| 26078 | 151 | 0.426 | 0.095 | 62.3 | 50.8 | 401.3 | 114.5 | 0.732 |
| 26079 | 183.5 | 0.414 | 0.09 | 67.6 | 40.2 | 308 | 76.4 | 0.912 |
| 26080 | 88 | 0.333 | 0.082 | 58.2 | 73 | 633.5 | 200.9 | 0.49 |
| 26081 | 30 | 0.378 | 0.115 | 108.3 | 50 | 377.7 | 101 | 0.54 |
| 26082 | 66 | 0.26 | 0.073 | 60.4 | 19.8 | 74.3 | 36.5 | 1.001 |
| 26083 | 141 | 0.279 | 0.067 | 67.8 | 26.7 | 70.4 | 25.7 | 1.141 |
| 26084 | 10 | 0.242 | 0.076 | 57.5 | 24 | 34 | 25 | 0.775 |
| 26085 | 53 | 0.403 | 0.071 | 51.5 | 45.2 | 483.5 | 119.3 | 0.488 |
| 26086 | 332 | 0.506 | 0.124 | 68.8 | 66.2 | 528.9 | 138.7 | 1.245 |
| 26086A | 265 | 0.467 | 0.123 | 88.5 | 53.7 | 435.6 | 89.8 | |
| 26087 | 221 | 0.599 | 0.137 | 65.6 | 94.1 | 710.6 | 140.3 | 1.105 |
| 26090 | 427 | 0.473 | 0.109 | 78.5 | 73.8 | 516.5 | 163.5 | 0.896 |
| 26091 | 92 | 0.366 | 0.084 | 67.5 | 32.6 | 175.3 | 81.2 | 1.023 |
| 26092 | 84 | 0.384 | 0.081 | 57.6 | 26.2 | 238.8 | 63.9 | 0.799 |
| 26093 | 202 | 0.38 | 0.088 | 75.1 | 46.7 | 259.8 | 107.2 | 0.86 |
| 26094 | 163 | 0.423 | 0.105 | 73 | 44.5 | 330.7 | 83.4 | 0.794 |
| 26095 | 127 | 0.315 | 0.079 | 53.8 | 40.3 | 290.3 | 87.1 | 0.58 |
| 26096 | 167 | 0.464 | 0.099 | 54.5 | 46.5 | 524.4 | 115.3 | 0.806 |
| 26097 | 47 | 0.269 | 0.069 | 83.3 | 15.7 | 75.3 | 23.4 | 1.103 |
| 26098 | 152 | 0.55 | 0.122 | 63 | 82.3 | 746 | 168 | 0.811 |
| 26099 | 151.5 | 0.506 | 0.108 | 53.5 | 90.4 | 631.7 | 152.7 | 0.785 |
| 26100 | 232 | 0.529 | 0.114 | 83.5 | 47.4 | 343.9 | 105.3 | 1.108 |
| 26101 | 242 | 0.45 | 0.094 | 65.7 | 66.8 | 451.4 | 129.5 | 0.834 |
| 26101A | 140 | 0.609 | 0.137 | 79.9 | 94.1 | 679.1 | 159.7 | |
| 26103 | 198 | 0.554 | 0.116 | 66.9 | 79.7 | 490.1 | 142.4 | 0.885 |
| 26104 | 134 | 0.522 | 0.126 | 78.2 | 67.1 | 439.4 | 131.4 | 0.886 |
| 26105 | 81 | 0.497 | 0.128 | 80 | 48.6 | 456.3 | 113.3 | 1.628 |
| 26106 | 236 | 0.334 | 0.106 | 75.1 | 38.1 | 297.9 | 66.1 | 0.961 |
| 26107 | 117 | 0.613 | 0.102 | 64 | 67.8 | 556.6 | 108 | 1.002 |
| 26108 | 65 | 0.451 | 0.123 | 89.8 | 51.2 | 448 | 68.9 | 1.631 |
| 26109 | 117 | 0.362 | 0.079 | 62.8 | 44.1 | 255.5 | 78.8 | 1.165 |
| 26110 | 43 | 0.42 | 0.095 | 68.5 | 33.4 | 334.3 | 85.3 | 0.924 |
| 26111 | 112 | 0.445 | 0.108 | 57.6 | 59.2 | 559.3 | 122.2 | 0.877 |
| 26112 | 160 | 0.425 | 0.11 | 68.5 | 53.1 | 423.9 | 133.5 | 1.191 |
| 26113 | 157 | 0.407 | 0.104 | 60.8 | 48.5 | 381.2 | 95.9 | 1.042 |
| 26114 | 146 | 0.474 | 0.144 | 59.5 | 57.6 | 534.1 | 136 | 1.184 |
| 26115 | 176 | 0.457 | 0.115 | 76 | 43 | 331.7 | 149.6 | 1.091 |
| 26116 | 156 | 0.594 | 0.109 | 70.1 | 89.9 | 619.5 | 190.5 | 1.048 |
| 26117 | 135 | 0.41 | 0.088 | 72.1 | 49 | 331.7 | 71.9 | 0.789 |
| 26118 | 237 | 0.395 | 0.104 | 78.3 | 68.2 | 307.3 | 99.7 | 1.233 |
| 26119 | 107 | 0.407 | 0.113 | 58.6 | 47.3 | 344.6 | 107.1 | 0.95 |
| 26120 | 13 | 0.486 | 0.099 | 73.5 | 34.3 | 98 | 39.6 | 1.928 |
| 26121 | 351 | 0.567 | 0.133 | 72 | 93.7 | 642.8 | 183.4 | 0.94 |
| 26122 | 115 | 0.566 | 0.116 | 79.4 | 184.7 | 816.2 | 173.6 | 0.858 |
| 26123 | 242 | 0.42 | 0.099 | 59.6 | 44.7 | 317.1 | 107.7 | 0.788 |
| 26124 | 351 | 0.425 | 0.09 | 53.1 | 48.6 | 320.1 | 84.3 | 0.846 |

| Hole | Length | Cu% | Ni% | Co | Au | Pd | Pt | S% |
|---|---|---|---|---|---|---|---|---|
| 26125 | 81 | 0.518 | 0.119 | 50.9 | 85.4 | 792.6 | 140.6 | 0.748 |
| 26127 | 132 | 0.396 | 0.095 | 52.4 | 61.7 | 394.7 | 93.2 | 0.872 |
| 26128 | 290 | 0.491 | 0.112 | 63.9 | 65.5 | 560 | 119.4 | 0.829 |
| 26141 | 465.5 | 0.449 | 0.106 | 62.1 | 80.3 | 511.9 | 139.4 | 0.826 |
| 26142 | 206 | 0.439 | 0.105 | 63.1 | 75.7 | 539 | 154.8 | 0.691 |
| 26143 | 363 | 0.397 | 0.085 | 72.5 | 43.9 | 231 | 72.4 | 0.981 |
| 98-086B | 245 | 0.496 | 0.141 | 79.4 | 82.1 | 468.3 | 115 | 1.24 |
| 98-105B | 130 | 0.37 | 0.118 | 99.8 | 49.4 | 251.4 | 78.4 | 1.558 |
| 98-108B | 85 | 0.377 | 0.126 | 69.2 | 57.1 | 374.2 | 91.2 | 1.061 |
| 98-113B | 165 | 0.439 | 0.133 | 94.8 | 54.9 | 319 | 82.1 | 1.45 |
| 98-113C | 215 | 0.343 | 0.128 | 99.6 | 37.5 | 291.1 | 77 | 1.354 |
| 98-114B | 345 | 0.432 | 0.128 | 87 | 54.4 | 402.7 | 100.2 | 1.091 |
| 98-201C | 255 | 0.447 | 0.128 | 72.8 | 76.8 | 487.9 | 96.2 | 0.999 |
| 98-203C | 315 | 0.47 | 0.147 | 94.8 | 57.1 | 363.6 | 95.9 | 1.35 |
| 98-204C | 165 | 0.34 | 0.118 | 87.1 | 35.7 | 306.3 | 73.3 | 1.117 |
| 98-205C | 235 | 0.349 | 0.113 | 90.1 | 48.2 | 269.4 | 62.1 | 1.164 |
| 98-206C | 195 | 0.379 | 0.119 | 88.1 | 41.1 | 293 | 75.4 | 1.285 |
| 98-207C | 165 | 0.428 | 0.117 | 75.8 | 66.3 | 500.4 | 105.8 | 0.919 |
| 98-208C | 210 | 0.503 | 0.143 | 78.9 | 64 | 511 | 108.8 | 0.957 |
| 99-301B | 240 | 0.363 | 0.117 | 101.4 | 44.9 | 319 | 85.5 | 1.196 |
| 99-302B | 95 | 0.282 | 0.09 | 72.3 | 31.4 | 271.8 | 70.3 | 0.623 |
| 99-303B | 95 | 0.38 | 0.103 | 83.5 | 37.3 | 234.4 | 82.6 | 1.08 |
| 99-304BC | 250 | 0.627 | 0.142 | 88.3 | 112.8 | 702 | 121.6 | 1.315 |
| 99-305BC | 45 | 0.337 | 0.09 | 67.7 | 92.2 | 464 | 117.2 | 1.222 |
| 99-306B | 85 | 0.299 | 0.104 | 71.4 | 52.2 | 289.9 | 82.6 | 0.659 |
| 99-307B | 86.5 | 0.445 | 0.136 | 86.6 | 36.6 | 426.5 | 93.1 | 1.123 |
| 99-308B | 120 | 0.409 | 0.137 | 105.9 | 44.1 | 341.3 | 80 | 1.073 |
| 99-309B | 80 | 0.347 | 0.099 | 81.7 | 68.3 | 367.3 | 88.4 | 0.699 |
| 99-310BC | 190 | 0.542 | 0.151 | 87.2 | 98.8 | 465.6 | 103.3 | 1.125 |
| 99-311B | 55 | 0.419 | 0.131 | 90 | 48.5 | 412.9 | 122.3 | 1.492 |
| 99-312B | 180 | 0.479 | 0.125 | 82.2 | 44.2 | 372.8 | 83.3 | 1.105 |
| 99-313B | 170 | 0.441 | 0.117 | 79.9 | 59 | 547.5 | 93.4 | 0.956 |
| 99-314B | 45 | 0.258 | 0.078 | 76.8 | 20.4 | 93.1 | 40.6 | 0.903 |
| 99-315B | 55 | 0.299 | 0.085 | 69.2 | 27.8 | 320.7 | 62.7 | 0.635 |
| 99-316B | 30 | 0.277 | 0.101 | 81.5 | 30 | 147.5 | 58.5 | 0.705 |
| 99-317C | 195 | 0.302 | 0.097 | 76.4 | 32.6 | 231.2 | 55.8 | 0.746 |
| 99-318C | 240 | 0.403 | 0.114 | 72 | 55.8 | 531.3 | 120.6 | 0.69 |
| 99-319B | 65 | 0.299 | 0.085 | 62.1 | 47.5 | 427 | 72.3 | 0.588 |
| 99-320C | 255 | 0.408 | 0.151 | 112.9 | 47.4 | 351.5 | 94 | 1.131 |
| 99-321B | 185 | 0.498 | 0.138 | 89 | 60.5 | 432 | 91.8 | 1.2 |
| 99-322B | 15 | 0.255 | 0.061 | 64 | 37.3 | 168.7 | 45 | 0.42 |
| 99-323B | 5 | 0.248 | 0.065 | 64 | 14 | 100 | 35 | 0.64 |
| 99-324B | 67 | 0.306 | 0.081 | 74.4 | 33.9 | 178.5 | 55.7 | 0.882 |
| **Summary** | **29828.4** | **0.427** | **0.112** | **77.2** | **57.1** | **404.8** | **105.1** | **1.073** |

(values for Pd, Pt & Au are in ppb, the rest are in ppm except those with %)

# 15. SAMPLING PREPARATION, ANALYSES AND SECURITY

Bright (2000) summarized the sample preparation history of the project, the following is an extract from his summary.

> *Pre-1996, Lerch Brothers, and State of Minnesota crushed in a jaw crusher to about 1/4 inch and pulverized about 250g in a Bico type plate pulverizer to about -100 mesh (149 microns). Bondar Clegg also did some work on the project, crushing about the same, but pulverizing in a ring mill to -106 microns.*
>
> *In 1997, samples were sent directly to Acme Laboratories, where they crushed to finer than 1/4 inch and pulverized to about 149 to 106 micron range.*
>
> *In 1998, Lerch Bros. crushed and pulverized about 250g in an older ring mill to finer than 149 microns and sent to Acme.*
>
> *In 1999, Lerch Bros. prepped as in 1998, but sent to Chemex for analysis. Early on in the project, I requested a finer grind out of Lerch Bros, and they accomplished it. (-106 mic). Also in 1999, some drill cuttings and core were directly picked up by ALS Chemex. This is what we did in Thunder Bay:*
>
> *3.5-4kg of RC or percussion samples were dried and split to obtain two splits of each sample. Core samples of 2.5-3kg were crushed to pass >70% -2 mm, 200-300g were split out. Both r.c. cuttings and crushed core were shipped to Toronto for pulverizing in a ring mill to >95% -106 microns (-150 Tyler mesh).*
>
> *We also took selected core samples and crushed to -1/2 inch and put in a poly bottle, purged with nitrogen, and capped and sealed for special met / enviro work.*

In summary (Gatehouse 2000a), recent drilling has been prepared in either of two ways depending on drill type or on the work load of Lerch Bros in Hibbing.

- **5' of 6" RC chips**
  - 1/16 split using an Eklund rotary Splitter (3-4kg)
  - Jaw crush >> Gyratory Crusher >> Rolls crusher
  - 1/16 split to 200-250gms for pulverizing to 109micron (some data poorly pulped to 150micron)
- **5' of 1/2 core (1.65" & 2.2" diameter, BTW, NTW)**
  - **Chemex**
  - Rhino (Jaw) Crush to 2mm
  - Split 200-250gms for pulverizing to 109micron

  - **Lerch Bros.**
  - Jaw Crush >> Gyratory Crusher
  - Split 200-250gms for pulverizing to 149 micron

The following discussion is derived largely from Patelke and Geerts (2005), an internal company report on the compilation and history of the newly revised PolyMet drilling database.

There are seven generations of sample preparation and analyses that contribute to the overall project assay database (dates are approximate):

1) Original USS core sampling, by USS, 1969-1974;

2) Re-assaying of USS pulps, 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) in 1999-2001.

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

USS took about 2,200 samples, mostly ten feet in length, and assayed for copper, nickel, sulfur, and iron. Assays were done at two USS laboratories in Minnesota, the “Applied Research Laboratory” (ARL) in Coleraine (now the NRRI mineral processing laboratory), and the “Minnesota Ore Operations laboratory” (MOO) at the MinnTac Mine in Mountain Iron. Most of the original USS samples have been superseded by ACME and Chemex re-assays which included many more elements.

Analytical method at these USS laboratories is uncertain (AAS?). 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.

There are less than 200 sets of USS copper-nickel values that remain in the database. PolyMet used 63 coarse reject USS samples, weighing from five to seven pounds each, to create three standards in 2004. The 2004 assay results are consistent with estimates based on original USS assays of drill core. The ALS-Chemex results are shown in Table 13. Averages are based on twenty samples of each standard with 4-acid assays completed in 2004. In all cases the USS results are slightly understated relative to the Chemex values.

**Table 13. ALS-Chemex assays compared with 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 |

The re-assaying of USS pulps and sampling of previously unsampled core completed in 1989-1991 was sponsored by Fleck Resources and partially involved cooperative work with the NRRI in Duluth. A large number of pulps and coarse reject 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 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 standards used at ACME, though it is certain that they used some duplicates. There is relative agreement between the ACME assays done on pulps and rejects and the original USS work. PolyMet is using the USS sulfur value for most of these intervals. Sample preparation for all this work is thought to have been done by ACME.

The two NERCO BQ core holes (1991, 162 samples) were analyzed by the same methods.

There are 5,324 analyses from the RC drilling in the current 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. It is not certain that all samples were prepared at Lerch.

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.

Table 14 details the distribution and source of the assays for the RC drilling.

**Table 14. Assaying of RC samples**

| | Number of samples in database |
|---|---|
| **ACME** | 1,107 |
| **Chemex** | 2,122 |
| **Chemex re-run (chosen over ACME or Chemex)** | 1,916 |
| **Unclassified** | 179 |

The PolyMet core drilling was all assayed by ALS-Chemex. A matrix problem was discovered on some copper and nickel assays. The method was rectified and affected samples were re-assayed (including some RC samples). Sample preparation was done at Chemex, though some may have been done at Lerch—various original laboratory certificates show both "received as pulp" and give grind directions. ACME ran the check assays on these samples.

Sample intervals were five feet. 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 standards and blanks were inserted into the sample stream.

Table 15 details the distribution and source of assays for PolyMet core drilling.

**Table 15. Assaying of samples from core drilling**

| | Number of samples in database |
|---|---|
| **Acme** | 2084 |
| **Chemex** | 8933 |
| **Chemex re-run** | 756 |
| **USS** | 116 |
| **Unclassified** | 685 |

Samples (collected by Severson et al., 1999-2000 and Patelke, 2000-2001) of previously unsampled USS core were assayed by ALS-Chemex. Samples were sawn at the Coleraine laboratory by University of Minnesota employees. At various times samples were prepared at the Coleraine laboratory, Lerch, and probably by ALS-Chemex.

Assays were by 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 standards and blanks were inserted into the sample stream.

Samples were generally five feet in length, with some adjustments to avoid crossing geologic boundaries. 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.

PolyMet is currently continuing this process of assaying previously unsampled USS core, with about 7,600 feet located in the preliminary pit outline scheduled for assay in the spring of 2005.

Table 16 shows previously unsampled intervals of USS core that were sampled by Severson et al (1999-2000) and Patelke (2000-2001).

**Table 16. Details of Sampling of USS core by PolyMet.**

| | Number of samples in database from each laboratory | Minimum number of duplicates and/or re-runs |
|---|---|---|
| **Chemex (post re-run)** | 5,032 | 229 |

Specific gravity determinations were done on 1,039 samples in 1999-2000 by Severson et al. This work included formal Jolly balance determinations on smaller pieces and duplicate measurements of displacement and weight ("graduated cylinder method") on larger core pieces. 162 duplicate Jolly balance – cylinder determinations were completed. The average value for the Jolly balance was 2.97 and 2.94 for the cylinder method. Future work by PolyMet will include systematic measurements at the assay laboratory, as well as a larger number of the "graduated cylinder method" on site by PolyMet employees. All intervals tested by the laboratory will be tested on site to establish a comparison between methods.

A constant value of 2.95 has been used to convert volume to tonnage. Work is in progress to compile the SG database in order to enable an analysis of any relationship of density with grade. A preliminary analysis of approximately 50 newly received densities by ALS-Chemex indicates that the value of 2.95 is appropriate.

Density measurements to date have been made on core that has not been oven dried and has not been sealed. This is likely to have resulted in a small (~1%) overstatement due to the inclusion of moisture that would normally be driven off at 105 – 110°C. It is recommended that approximately 50 samples be selected and the weight loss after drying for the same temperature and duration as used by the assay laboratory be determined.

The USS core has been, 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 locked buildings within a fenced area that is locked at night where a key must be checked out. The NERCO BQ size core is also stored at this facility.

The 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 on the Cliffs-Erie property in Hoyt Lakes. Access has been limited to PolyMet employees.

No sieve tests are available for previous work. These are now being performed for samples from the current (2005) drilling program.

## 16. DATA VERIFICATION

Data verification by PolyMet has involved the checking of digital data against that in the paper records and also establishing the quality and source of that data.

All tables in the drill hole database (header, survey, lithology, assay) were checked by PolyMet staff against the completely re-organized original paper data. Known discrepancies were addressed and corrected. In the assay data file, erroneous or suspect data was not removed, but was flagged to prevent its inclusion in the "accepted values" file used for evaluation. The criteria for exclusion of these are currently being re-assessed.

A generalized first-pass review list was assembled by PolyMet for finding any database errors or suspect assays as well as facilitating further sorting and analysis. This occurred during and after assembly of the current PolyMet drill database and prior to the finalization of an "accepted values" assay data file for project evaluation. Suspect values were either corrected or flagged for exclusion from the final "accepted values" file.

This review by PolyMet included the following steps:

- Confirmation that paper records for each hole are complete and that the assay certificates are the final versions,
- Checking of drill hole numbers for correct format.
- Checking of drill hole length against data in PolyMet database header file. Any assay depths recorded as below the length of the hole were assessed,
- Checking depth to overburden against lithological logging, many RC samples in particular show as having been collected in the overburden, these are then isolated and rejected.
- Sorting of the master file as a whole and by each element in every laboratory group. Use the data filter in Excel to inspect and check the lowest and highest value samples. Lowest values were checked against detection limits for that period. Check, and correct or flag all discrepancies,
- Designation of all assays below detection limit with "less than symbols (<)". All "<" were corrected to the detection limits listed by the laboratories for that time as shown in their "schedules of services". It was found that ACME did not show the "<" values in their digital data, these had to be entered manually,
- Where LECO furnace sulfur has been run, compare with the ICP scan sulfur, if one or other seems out of range, investigate and correct if possible. If not reconcilable, flag as not to be used,
- Copper and nickel PPM values are converted to percent for the final step before export of data for resource estimation,
- Copper "overlimits", where the original copper value was above the upper detection limit of the method and was re-run, were be merged into the copper percent data.
- Noting whether duplicates are field duplicates (two 1/4 core samples), or sample preparation duplicates (laboratory duplicates) where a crushed and/or ground sample is split at the laboratory. These duplicates were considered to have been assayed at about

the same time. Copper and nickel values are compared; assess those that do not reasonably match or remove both samples from consideration for final data set in their entirety.

- Where there are multiple “good” assays for copper, nickel, i.e., USS and ACME, or ACME and Chemex, (generally done at different times) compare the values; for those that do not match, try to resolve or, if not, remove both samples from consideration for final data set in their entirety,
- Do same for ACME and USS nickel, should be proportional,
- Obvious laboratory typographical errors or inconsistent data are checked and either corrected or flagged. These include simple laboratory errors such as double decimal points,
- Plotting of copper, nickel, sulfur, platinum, palladium, gold as a function of time to highlight clusters of data well above or below the average for the group,
- Plotting duplicate results by USS in 1970s, to determine any discrepancies,
- Checking of all “check assays” as duplicate pairs, where the samples are not in agreement, flag both sampled for possible exclusion,

Three formal steps of duplicate checking were completed after this general quality checking and reconciliation of the digital data with assay certificates. This was intended to help eliminate some of the mis-ordered pairs.

The **first step** was to sort the data into subsets by laboratory and time.

The **second step** was to compare all the “intentional duplicate pairs”, i.e., all pulp duplicates and quarter core duplicates done by the same laboratories at (more or less) the same time. PolyMet calculated a copper:copper ratio for these pairs, sorted from lowest to highest, graphed these, and discarded pairs where the copper:copper ratio values were beyond the inflection point of the sigmoidal graph. This somewhat depended on the geologist’s view of the quality and size of the sample group, but usually this was any difference greater than about 10% to 15% of the pair. Experience in the data set, as well as some other ratio tests, were also used to see if numbers were reasonable. Only a single sample from each pair that PolyMet believed matched duplicate and original was used.

The **third step** was to compare pairs or multiple samples on the same interval by different laboratories at different times (USS and ACME, ACME vs Chemex vs Chemex rerun etc.) The same approach was used, graphing copper:copper ratios and eliminated those pairs outside some range determined by inspection of the graph, which again was group by group dependent. This was more subjective. The goal here is to find mis-numberings or mis-orderings, not to quantify the quality of the data. Other ratio tests were also applied to identify if values were within expected ranges.

As a result of this review, about 1,800 intervals were flagged as suspect and filtered out of the “accepted values” data used for this evaluation.

**Conclusion.** The author has undertaken several assessments of the database and has advised PolyMet of a number of minor issues. These have either been or are being addressed. He has also undertaken spot checks of the digital data by comparing it with assay certificates. In addition, Mr. S. Gatehouse, now an employee of Hellman & Schofield Pty Ltd, had undertaken a detailed review of sampling and QA/QC aspects whilst in the previous employ of a major Australian mining company. Although a number of concerns were identified, these did not relate to the possibility of overstatement of grade but, rather, highlighted the conservative nature of the assays.

A study of 205 coarse blanks submitted by PolyMet with drill samples in 2000 shows only three samples exceeding 70 ppm Ni. These three samples appear to have resulted from transcription errors. PolyMet has, however, identified some samples that were incorrectly labelled and has deleted these from the database. There is negligible cross contamination for Cu, Au and Pt as evidenced by the rest of the data set. Approximately 2% of samples have Pd in excess of 20 ppb which may suggest either some cross-contamination during sample preparation or a variable background content in the blank. In another sampling program in 2000-2001 there were negligible values above lower detection limits for Au, Pd and Pt for 82 submitted blanks. The use of pulp blanks, as well as coarse blanks, may help to resolve any future issues regarding higher than expected values.

It is clear that PolyMet staff have made an enormous commitment to the geological and assay database and have, as far as is possible, produced a database that is complete, well documented and traceable.

The author regards the sampling, sample preparation, security and assay procedures as adequate to form the basis of resource estimation.

## 17. ADJACENT PROPERTIES

There are no adjacent properties that PolyMet is proposing to explore or drill as part of the planned in-fill drilling program or as part of the definitive feasibility study.

## 18. MINERAL PROCESSING AND METALLURGICAL TESTING

There is no new material development in this section since the filing on SEDAR of the “Technical Update of the NorthMet Project Incorporating the established Cliffs-Erie crushing/milling/concentration facilities with the Hydrometallurgical processes described in the May 2001 Pre-feasibility study.” by P. Downey and Associates, in July 2004.

## 19. MINERAL RESOURCE AND MINERAL RESERVE ESTIMATES

### *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 a major review and reconstruction of the database by PolyMet.

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

A surface defining the base of till was modeled outside of areas of mapped outcrop. The tops of Units 1 – 7 and 20 were modeled as gridded surfaces using the summary lithological logs supplied by PolyMet. Unit 1 is the main host of potentially economic mineralization. Figure 2 illustrates a typical cross-section showing modeled tops of Units 1-7 and 20. 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).

Many intervals, especially those from Units 2 – 7, have not been sampled. Composited intervals with no assays were assigned zero grades 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 criteria. This resulted in intervals within mineralization having missing assays. In some cases, unsampled intervals are clearly within mineralization but, as yet, remain unsampled. Both these issues are being addressed by PolyMet with approximately 8,000 ft of previously unsampled core being earmarked for assaying. Re-incorporation of some excluded assays and the addition of assays from newly sampled intervals is considered to have a positive effect on confidence categorization as well as on grade estimates.

Drill hole assays were composited to 10 foot lengths within their appropriate lithological units, prior to grade estimation. A summary of assays, by geological unit, is provided in Table 17 and a summary of ten foot composited data in Table 18. Units 1 – 7 are within the Duluth Complex (see Table 5 for a description), Unit 10 is the glacial till, Unit 19 is Unit 1 material undercutting the Virginia Formation (only found in holes 26127 & 26036) and Unit 20 is the Virginia Formation.

Units 1 to 7 are the main units of interest. These are within the Duluth Complex and are illustrated in plan view in Figure 3 and in sectional view in Figure 4.

To aid variography and resource modelling, the data was rotated by 40 degrees around the Z axis (ie a true azimuth of 50 becomes 90) and 25 degrees around the X axis (ie the dip of the mineralization now becomes horizontal). Figure 7 shows a north-south section (equivalent to a section along a 326 deg true azimuth) through the rotated data (Cu%).

**Table 17. Summary of Raw Assays**

| UNIT | AG | AS | AU | CD | CO | CR | CU% | MN |
|---|---|---|---|---|---|---|---|---|
| **-** | - | - | - | - | - | - | - | - |
| **1** | 0.78 | 6.4 | 26.5 | 0.84 | 61 | 97 | 0.21 | 637 |
| **2** | 0.32 | 2.9 | 16.1 | 0.61 | 57 | 113 | 0.076 | 770 |
| **3** | 0.27 | 3.8 | 11.6 | 0.46 | 45 | 105 | 0.061 | 580 |
| **4** | 0.58 | 4.9 | 30 | 0.91 | 51 | 99 | 0.141 | 582 |
| **5** | 0.72 | 5 | 34.2 | 0.97 | 51 | 69 | 0.157 | 624 |
| **6** | 0.92 | 5.5 | 45.4 | 1.52 | 60 | 69 | 0.239 | 768 |
| **7** | 0.31 | 2.9 | 30.1 | 2.15 | 83 | 46 | 0.059 | 1179 |
| **10** | - | - | - | - | - | - | - | - |
| **19** | 0.56 | 5.6 | 22.2 | 0.9 | 47 | 85 | 0.156 | 511 |
| **20** | 0.35 | 31.1 | 3 | 1.35 | 25 | 190 | 0.023 | 239 |
| **Avg** | **0.67** | **6.5** | **23.8** | **0.81** | **58** | **102** | **0.176** | **634** |

| UNIT | MO | NI% | PB | PD | PT | S% | ZN | N |
|---|---|---|---|---|---|---|---|---|
| **-** | - | - | - | - | - | - | - | 266 |
| **1** | 1.7 | 0.064 | 4.4 | 187.1 | 49.7 | 0.629 | 81 | 12407 |
| **2** | 1 | 0.04 | 2.3 | 104.9 | 29.6 | 0.167 | 83 | 2114 |
| **3** | 1.3 | 0.027 | 2.5 | 58.7 | 24.3 | 0.185 | 63 | 1469 |
| **4** | 1.4 | 0.046 | 4.6 | 143.3 | 44.8 | 0.402 | 69 | 439 |
| **5** | 0.8 | 0.043 | 7.5 | 169.4 | 75.6 | 0.305 | 70 | 139 |
| **6** | 0.6 | 0.06 | 7.3 | 303 | 99.9 | 0.372 | 80 | 145 |
| **7** | 2.2 | 0.043 | 1.8 | 151.1 | 36.1 | 0.096 | 107 | 18 |
| **10** | - | - | - | - | - | - | - | 194 |
| **19** | 1.9 | 0.048 | 5.5 | 137.3 | 39.2 | 0.571 | 71 | 89 |
| **20** | 9.9 | 0.014 | 5.7 | 12.6 | 4 | 1.862 | 241 | 613 |
| **Avg** | **1.8** | **0.056** | **4.2** | **162.2** | **44.5** | **0.573** | **84** | |

(values for Pd, Pt & Au are in ppb, the rest are in ppm except those with %)

**Table 18. Summary of 10 Foot Composites Assays**

| UNIT | AG | AS | AU | CD | CO | CR | CU% | MN |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.78 | 6.4 | 26.5 | 0.84 | 62 | 97 | 0.21 | 637 |
| 2 | 0.31 | 2.9 | 15.7 | 0.59 | 57 | 113 | 0.074 | 770 |
| 3 | 0.27 | 3.7 | 11.6 | 0.45 | 45 | 106 | 0.059 | 582 |
| 4 | 0.58 | 4.7 | 29.7 | 0.91 | 52 | 98 | 0.14 | 580 |
| 5 | 0.68 | 5.5 | 31.9 | 0.91 | 52 | 69 | 0.146 | 625 |
| 6 | 0.93 | 5.4 | 45.7 | 1.53 | 60 | 70 | 0.241 | 767 |
| 7 | 0.26 | 2.5 | 27 | 2.19 | 86 | 50 | 0.052 | 1206 |
| 19 | 0.58 | 5.1 | 22.8 | 0.91 | 47 | 83 | 0.165 | 516 |
| 20 | 0.36 | 31.2 | 3 | 1.36 | 26 | 190 | 0.023 | 237 |
| **Avg** | **0.67** | **6.5** | **23.7** | **0.81** | **59** | **102** | **0.175** | **634** |

| UNIT | MO | NI% | PB | PD | PT | S% | ZN | Count |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.7 | 0.064 | 4 | 186.556 | 49.478 | 0.63 | 81 | 8349 |
| 2 | 1 | 0.04 | 2 | 102.421 | 29.047 | 0.164 | 83 | 1693 |
| 3 | 1.3 | 0.027 | 2 | 59.732 | 24.186 | 0.177 | 63 | 2579 |
| 4 | 1.4 | 0.046 | 5 | 141.488 | 44.16 | 0.401 | 70 | 1477 |
| 5 | 0.7 | 0.042 | 7 | 156.37 | 69.713 | 0.281 | 69 | 1285 |
| 6 | 0.6 | 0.06 | 7 | 302.776 | 100.253 | 0.372 | 80 | 1391 |
| 7 | 2.3 | 0.046 | 2 | 131.625 | 30.313 | 0.096 | 108 | 664 |
| 19 | 1.7 | 0.05 | 6 | 149.017 | 41.366 | 0.534 | 71 | 72 |
| 20 | 10 | 0.014 | 6 | 12.625 | 4.011 | 1.877 | 242 | 1797 |
| **Avg** | **1.8** | **0.056** | **4** | **161.413** | **44.264** | **0.573** | **85** | |

(values for Pd, Pt & Au are in ppb, the rest are in ppm except those with %)

### *Variography and modeling*

Variography was completed for Cu, Co, Ni, Au, Pt, Pd and S. Grades for these were estimated by Ordinary Kriging. Variogram models are provided in Table 20 and examples of modeled variograms (for Cu) are given in Figure 5 and Figure 6.

Estimates for As, Ag, Mo, Cd, Zn, Pb, Mn and Cr as well as check estimates for Cu and Ni were completed using Inverse Distance Squared weighting. All estimates were completed by the author.

A Net Smelter Return ("NSR") value for each block was calculated using assumed metal prices ($0.95/lb Cu, $4.20/lb Ni, $12/lb Co, $350/oz Au, $600/oz Pt and $250/oz Pd), metallurgical recoveries and revenues. A constant density of 2.95 was used for all rock types. This is based on approximately 1200 determinations by NRRI using Jolly Balance and Graduated Cylinder determinations. Recently received results confirm this value. Future resource estimations will model density to take into account variation within units and with grade.

Four confidence categories were assigned to the estimate blocks on the basis of proximity to drill hole data. The highest confidence blocks are classified as Indicated, these result from at least 12 data points (i.e. 24 original 5 ft samples) and are within a search ellipsoid with dimensions 360 x 480 x 72 ft with the long axis corresponding to a northeast direction. Inferred estimates result from a more relaxed search of 450 x 600 x 90 ft and a minimum of 8 data (i.e. 16 original 5ft sampled intervals). Indicated blocks correspond to estimates that derive from searches 1 & 2 (Table 21), Inferred blocks result from search 3.

Details of the block model are given in Table 19. The base of the block model is at 10 feet elevation (see limit of estimate Unit 1 blocks in Figure 2).

**Table 19. Summary of Block Model Limits**

| | | | | | |
|---|---|---|---|---|---|
| Lower-left X coord: | 2898200 | Column size | 200 | Number | 98 |
| Lower-left Y coord: | 729130 | Row size | 200 | Number | 32 |
| Top Z coord: | 1610 | Level size | 20 | Number | 80 |
| Baseline azimuth: 56.00 | | | | | |

**Table 20. Summary of Variogram Models**

| Element | Model | Gamma | Range 050 | Range 140 | Range Z |
|---|---|---|---|---|---|
| Au | NUG | 0.1 | | | |
| | SPH | 0.12 | 83 | 97 | 8 |
| | SPH | 0.51 | 139 | 160 | 27 |
| | SPH | 0.27 | 905 | 805 | 205 |
| Co | NUG | 0.1 | | | |
| | EXP | 0.37 | 70 | 79 | 38 |
| | SPH | 0.36 | 357 | 345 | 164 |
| | SPH | 0.17 | 805 | 960 | 464 |
| Cu | NUG | 0.1 | | | |
| | EXP | 0.48 | 130 | 195 | 75 |
| | SPH | 0.35 | 840 | 1205 | 300 |
| | SPH | 0.07 | 840 | 1205 | 600 |
| Ni | NUG | 0.1 | | | |
| | EXP | 0.39 | 112 | 205 | 48 |
| | SPH | 0.4 | 531 | 952 | 219 |
| | SPH | 0.11 | 1605 | 1530 | 600 |
| Pd | NUG | 0.08 | | | |
| | EXP | 0.76 | 230 | 210 | 76 |
| | SPH | 0.16 | 985 | 1091 | 200 |
| Pt | NUG | 0.15 | | | |
| | EXP | 0.66 | 138 | 147 | 50 |
| | SPH | 0.19 | 680 | 1171 | 207 |
| S | NUG | 0.1 | | | |
| | EXP | 0.45 | 52 | 54 | 42 |
| | SPH | 0.27 | 132 | 173 | 180 |
| | SPH | 0.18 | 1085 | 708 | 223 |

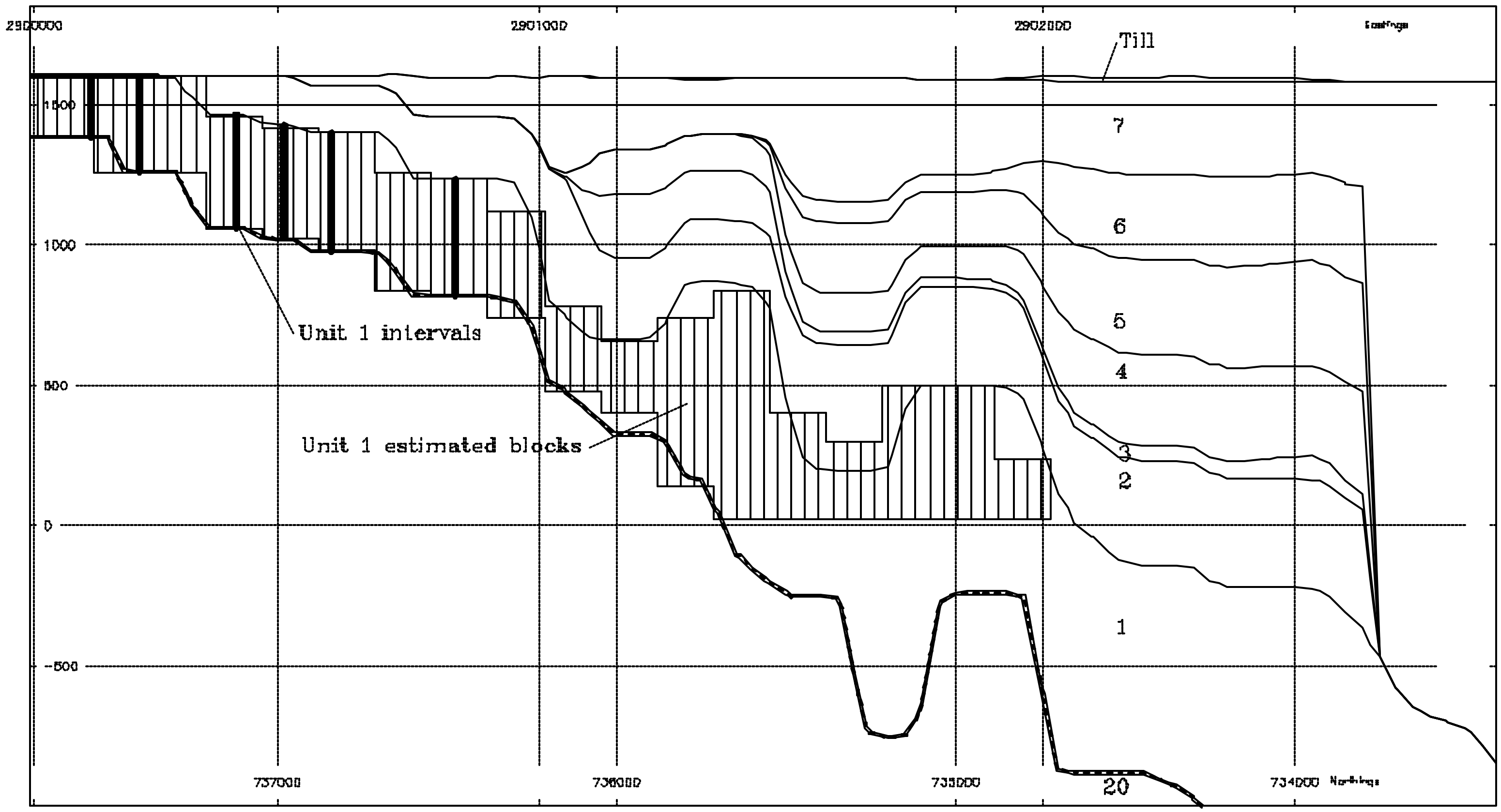


**Figure 2. Typical cross-section showing modelled surfaces and modelled unit 1 blocks**

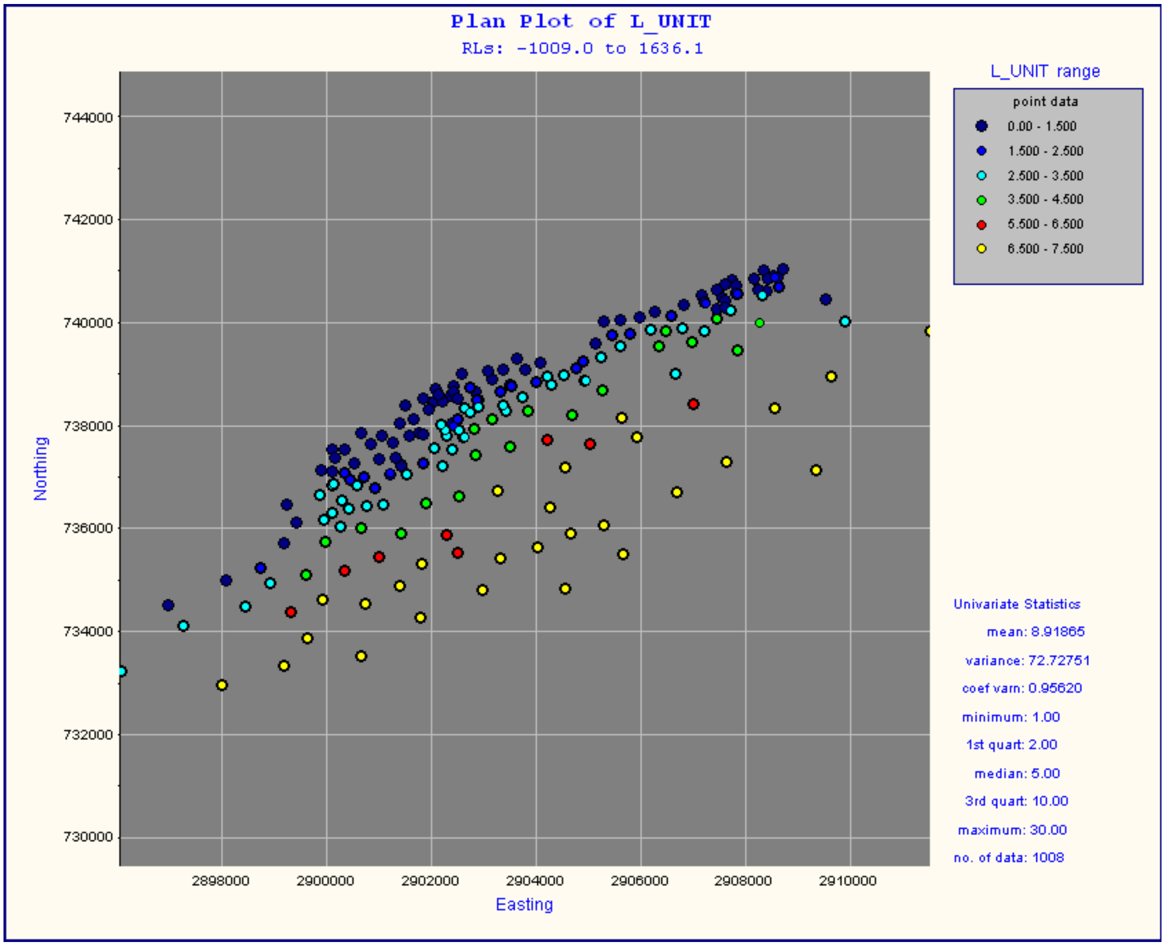


**Figure 3. Plan view of Units 1 – 7**

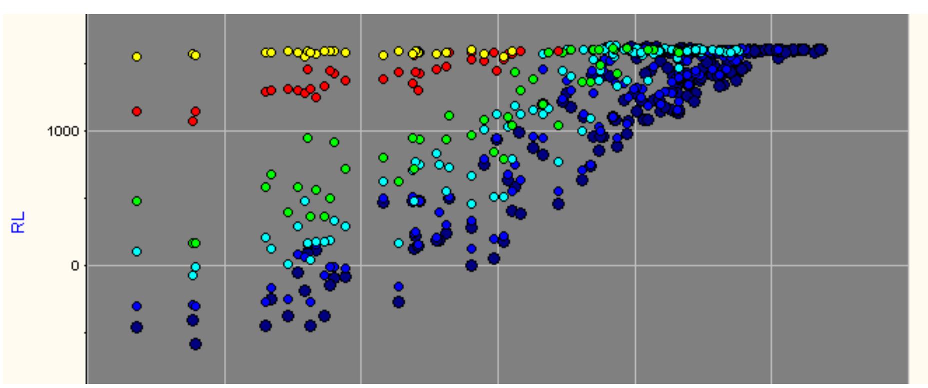


**Figure 4. North-south cross section (rotated data) of Units 1 -7 (legend as for Figure 3)**

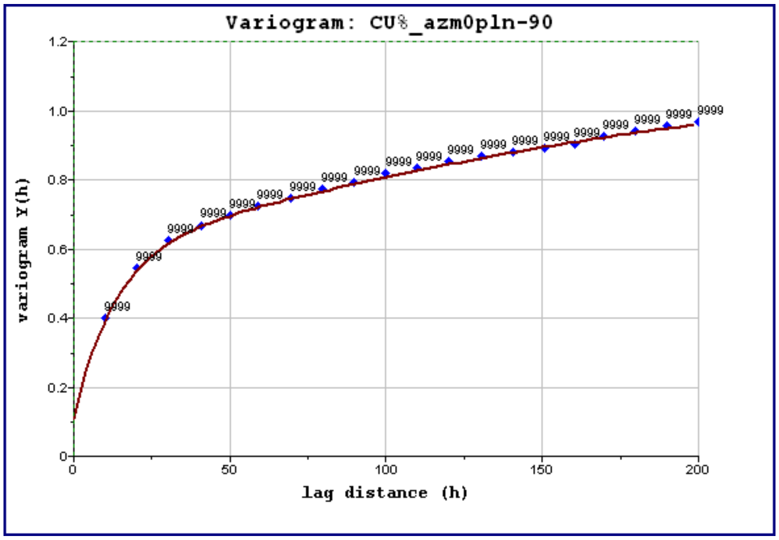


**Figure 5. Down hole variogram with model for Cu, all data**

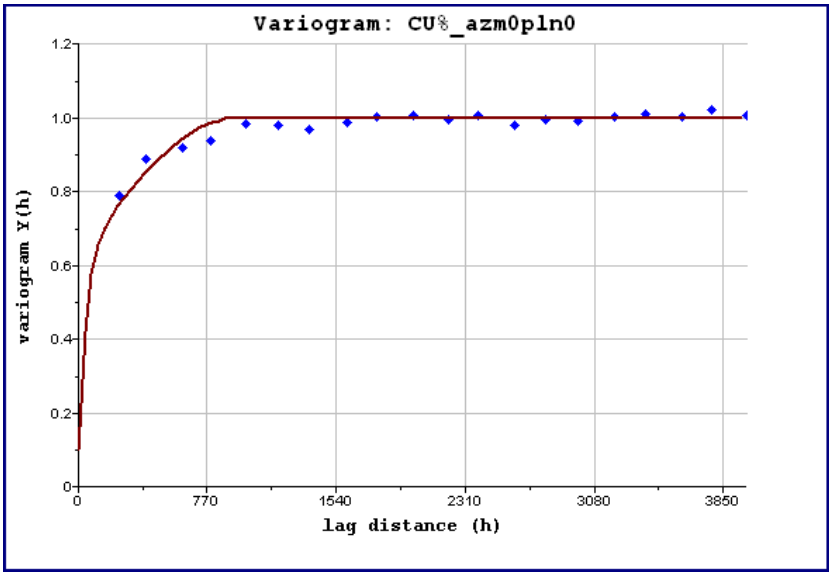


**Figure 6. East – west variogram (Cu, rotated data)**

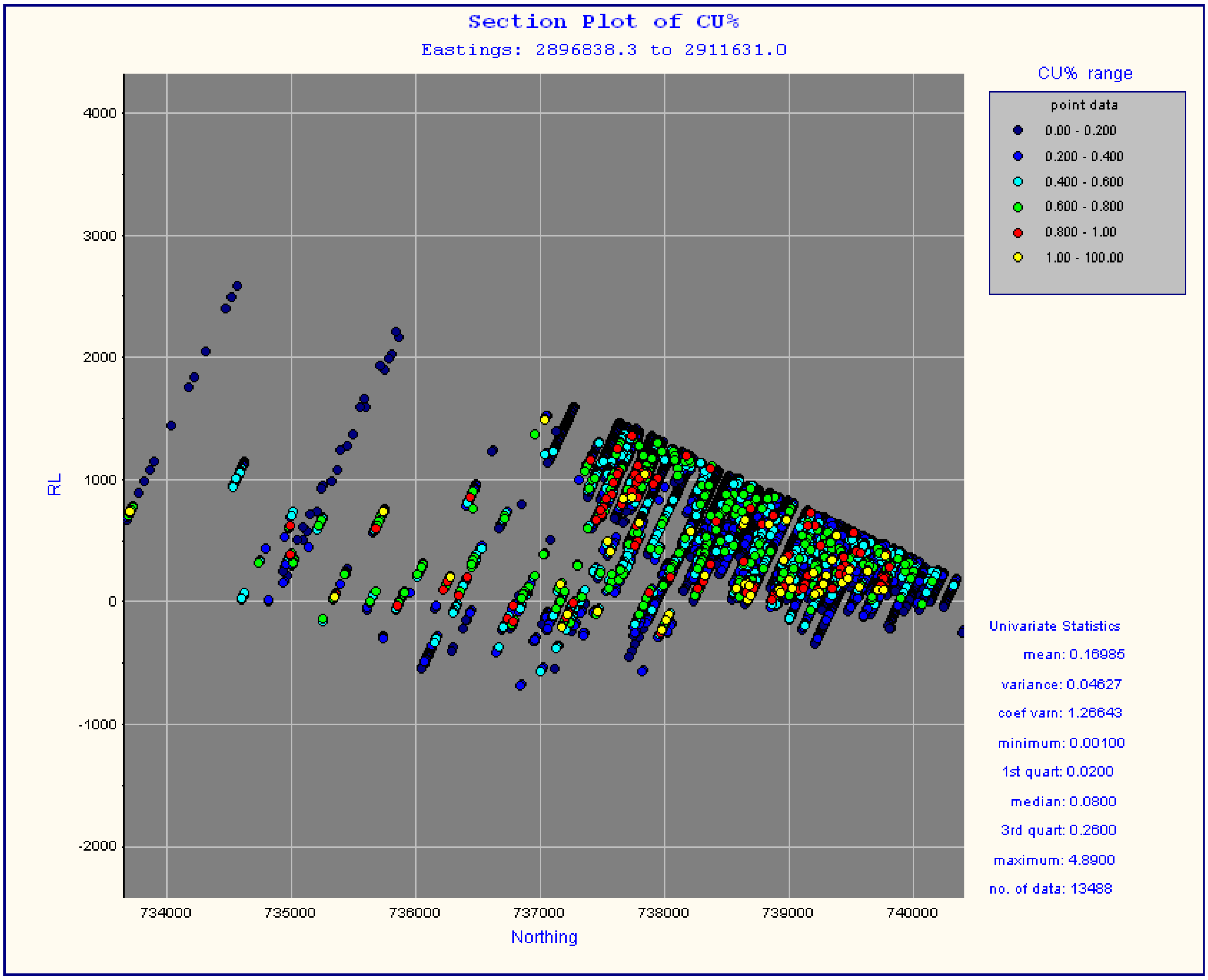


**Figure 7. North-south Section through rotated data (Cu%)**

Estimation search strategies and resulting confidence categories are summarized in Table 21 (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.

**Table 21. Search parameters (distances in feet)**

| Category | Search 050 (ft) | Search 140 (ft) | Search Z (ft) | Min Data | Max Data |
|---|---|---|---|---|---|
| 1 | 400 | 300 | 60 | 12 | 32 |
| 2 | 480 | 360 | 72 | 12 | 32 |
| 3 | 600 | 450 | 90 | 8 | 32 |
| 4 | 8000 | 6000 | 1200 | 4 | 32 |

Provided there are no material issues relating to criteria such as QA/QC, completeness of data, geological understanding, etc, categories 1, 2 & 3 would approximate Measured, Indicated and Inferred categories. It is expected that Measured Resources will be able to be reported once a retrospective assaying program on unsampled core has been completed, the reconstruction of the assay database has been finished and an analysis of closely paired 2005 metallurgical core – RC holes completed.

A summary of modeled grades, is given in Table 22. For comparison, averages for 10 ft composites are also given in Table 22 (details are in Table 18).

**Table 22. Summary of Modeled Grades**

| UNIT | Ag | As | Au | Cd | Co | Cr | Cu% | Mn |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.72 | 5.9 | 24.33 | 0.9 | 58 | 87.5 | 0.193 | 631.2 |
| 2 | 0.47 | 2.7 | 21.734 | 0.8 | 56 | 98 | 0.111 | 692.2 |
| 3 | 0.56 | 3.3 | 23.768 | 0.8 | 55 | 88.9 | 0.124 | 638.7 |
| 4 | 0.4 | 3.5 | 17.204 | 0.7 | 47 | 101.3 | 0.074 | 565.6 |
| 5 | 0.64 | 5 | 25.175 | 0.9 | 51 | 99.2 | 0.111 | 604.6 |
| 6 | 1.05 | 5 | 35.466 | 1.2 | 55 | 105.9 | 0.136 | 692.6 |
| 7 | 1.1 | 4.8 | 41.678 | 1.3 | 57 | 105.4 | 0.109 | 750.6 |
| 20 | 0.33 | 27.4 | 3.221 | 1.2 | 24 | 210.2 | 0.032 | 228.9 |
| **All** | **0.62** | **9.4** | **21.45** | **1.0** | **48** | **122** | **0.107** | **556** |
| **Comps** | **0.67** | **6.5** | **23.7** | **0.81** | **59** | **102** | **0.175** | **634** |

| UNIT | Mo | Ni% | Pb | Pd | Pt | S% | Zn | Count |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.7 | 0.059 | 5 | 169.724 | 44.966 | 0.58 | 81 | 23738 |
| 2 | 1 | 0.044 | 4 | 128.102 | 40.222 | 0.232 | 76 | 10550 |
| 3 | 1.1 | 0.045 | 4 | 135.486 | 43.349 | 0.285 | 71 | 15623 |
| 4 | 1.2 | 0.034 | 4 | 90.578 | 32.869 | 0.266 | 64 | 18548 |
| 5 | 0.9 | 0.041 | 5 | 154.961 | 45.164 | 0.303 | 69 | 15160 |
| 6 | 0.8 | 0.045 | 5 | 239.382 | 63.084 | 0.261 | 77 | 19231 |
| 7 | 0.8 | 0.042 | 5 | 280.141 | 68.957 | 0.203 | 80 | 10627 |
| 20 | 9.5 | 0.05 | 5 | 14.544 | 4.4 | 1.759 | 222 | 31118 |
| **All** | **2.9** | **0.045** | **5** | **135** | **38** | **0.343** | **106** | |
| **Comps** | **1.8** | **0.056** | **4** | **162** | **44** | **0.573** | **85** | |

(values for Pd, Pt & Au are in ppb, the rest are in ppm except those with %)

Figure 2 illustrates a typical cross-section from the southern part of the deposit at 735,000N. It shows the modeled tops of Units 1 and the footwall Virginia Formation. The scale is shown by easting and elevations. A vertical exaggeration of 2:1 has been used to show more detail in the vertical dimension.

High confidence blocks (categories 1 & 2) are shown as solid boxes, blocks with Inferred estimates (category 3) are marked with dense cross-hatches and potential mineralization is shown by less dense hatching. Drill hole traces are shown and a preliminary pit shell (heavy dashed line) bottoms out at about 900ft elevation on this section. To maintain consistency with previous studies, only blocks that exceed a NSR value of US$7.42 have been shown. This NSR value approximates a lower cut-off of 0.2% Cu and 0.06% Ni with no credits for Au, Pt and Pd.

### *Results*

Resource estimates are tabulated in Table 23 for resources above 840 ft elevation (as used in previous studies). Preliminary pit optimization was completed by AMDAD Pty Ltd using conservative metal price assumptions (in US$) of $0.95/lb Cu, $4.20/lb Ni, $12/lb Co, $350/oz Au, $600/oz Pt and $250/oz Pd provided by PolyMet. Recoveries based on Phase 1 pilot plant results (SGS-Lakefield Laboratories, Ontario) for Cu, Ni, Co, Au, Pt & Pd of 93.7%, 77.5%, 50%, 77%, 76% & 76%, respectively were applied with assumed toll treatment charges of US$10/oz for Au, Pt & Pd. Co and Ni were assumed to be 75% payable to allow for hydroxide treatment charges. Input parameters and costs for this optimization used were: pit slope of 50 degrees, mining cost of US$1 -2/ton, no dilution or mining loss, processing cost of US$6.57/ton.

Preliminary pit optimization by AMDAD suggests a pit base of 650 ft elevation. Accordingly, resources are reported above 840ft in Table 24 to provide an indication of resources that may reasonably be regarded as potentially accessible by an open pit if higher metal prices were used as the basis of pit optimization. Table 23 reports resources above an elevation of 500ft. These two tables use an NSR value of US$7.42, derived from the metal prices and recoveries above, as a lower cut-off. Significant figures used do not imply precision.

Results for 0.1% and 0.2% Cu cut-offs are provided in Table 25 and Table 26 for the two elevations.

**Table 23. January 2005 Mineral Resource Estimates, above 840 ft elevation and NSR cut-off of US$7.42**

| CATEGORY | Million Tonnes | NSR (US$) | Cu% | Ni% | Co | Pd | Pt | Au |
|---|---|---|---|---|---|---|---|---|
| **Indicated** | 273 | 12.4 | 0.26 | 0.08 | 70 | 250 | 70 | 35 |
| **Inferred** | 122 | 12.2 | 0.25 | 0.07 | 60 | 270 | 80 | 40 |

(Cut-off is US$7.42/t NSR and > 840ft elevation, grades are rounded, values for Pd, Pt & Au are in ppb)

**Table 24. January 2005 Mineral Resource Estimates, above 500ft elevation and NSR cut-off of US$7.42**

| CATEGORY | Million Tonnes | NSR (US$) | Cu% | Ni% | Co | Pd | Pt | Au |
|---|---|---|---|---|---|---|---|---|
| **Indicated** | 325 | 12.5 | 0.26 | 0.08 | 70 | 250 | 70 | 35 |
| **Inferred** | 180 | 12.3 | 0.25 | 0.07 | 60 | 260 | 80 | 40 |

(Cut-off is US$7.42/t NSR and > 500ft elevation, grades are rounded, values for Pd, Pt & Au are in ppb)

**Table 25. January 2005 Mineral Resource Estimates, above 840 ft elevation**

| Cut-off | Category | M Tonnes | Cu% | Ni% | Co | Pd | Pt | Au |
|---|---|---|---|---|---|---|---|---|
| **0.1% Cu** | Indicated | 355 | 0.23 | 0.07 | 64 | 212 | 57 | 30 |
| **0.1% Cu** | Inferred | 167 | 0.22 | 0.06 | 59 | 217 | 68 | 35 |
| **0.2% Cu** | Indicated | 177 | 0.31 | 0.09 | 69 | 298 | 77 | 41 |
| **0.2% Cu** | Inferred | 72 | 0.32 | 0.08 | 62 | 328 | 102 | 50 |

(grades are rounded, values for Pd, Pt & Au are in ppb)

**Table 26. January 2005 Mineral Resource Estimates, above 500ft elevation**

| Cut-off | Category | M Tonnes | Cu% | Ni% | Co | Pd | Pt | Au |
|---|---|---|---|---|---|---|---|---|
| **0.1% Cu** | Indicated | 422 | 0.23 | 0.07 | 64 | 211 | 57 | 30 |
| **0.1% Cu** | Inferred | 240 | 0.22 | 0.06 | 59 | 217 | 66 | 35 |
| **0.2% Cu** | Indicated | 215 | 0.31 | 0.09 | 69 | 296 | 77 | 41 |
| **0.2% Cu** | Inferred | 110 | 0.32 | 0.08 | 63 | 319 | 96 | 49 |

(grades are rounded, values for Pd, Pt & Au are in ppb)

### *Comparison with bulk samples*

Modelled grades in blocks were compared to samples in close proximity (within 50 ft) to USS bulk samples (discussed in Section 8).

**Table 27. Bulk samples compared to modeled grades**

| | Model | Pit 1 | Pit 2 – Sample 1 | Model | Pit 2 – Sample 2 |
|---|---|---|---|---|---|
| **Cu%** | 0.36 | 0.39 | 0.40 | 0.46 | 0.58 |
| **Ni%** | 0.07 | 0.14 | 0.13 | 0.13 | 0.22 |
| **S%** | 0.39 | 0.50 | 0.97 | 1.30 | 0.98 |
| **Unit** | 3 & 4 | | | 1 | |

Given the uncertainties of bulk sampling and assaying, these results are encouraging. Modeled grades of Cu and Ni are close to those in the bulk samples.

### *Potential Mineralization*

The potential tonnage and grade of mineralization contained within the interpreted mineralized units was estimated by using large search distances. This potential mineralization above 840 ft elevation is between 500 and 1100Mt of a grade approximately

20% less than that identified as Indicated and Inferred resources. The tonnage of potential mineralization above 500 ft elevation is between 500 and 1500Mt.

Potential mineralization does not constitute a Mineral Resource but portions of it may be upgraded to Mineral Resource status if further drilling is successful. It was derived by using a large search in order to provide estimates in all blocks as part of PolyMet's obligations to produce a model of all analysed elements for environmental purposes.

## 20. OTHER RELEVANT DATA AND INFORMATION

### Geological logging.

The approach to geological logging can be improved by the introduction of a more comprehensive log that is based on the assayed intervals. This is in addition to drill-run based geotechnical logging which is not addressed in this report.

Core recovery, which is a direct measure of sample quality, is currently not being recorded for holes drilled for metallurgical samples. US Steel did record core recovery, this information remains to be entered into the database. The author has inspected selected core intervals and concurs with PolyMet's observations that recovery is high. However, it is mandatory that this be quantified in order to be able to provide quantified summaries of any variation of recovery with grade in the different mineralized units.

### QA/QC and Sampling Issues.

A number of issues were raised by Gatehouse (2000a,b) and Smee (2004) chiefly relating to QA/QC issues and the quality of historic sampling. The author has carefully examined these and is satisfied that there are no material issues that will negatively impact upon the resource estimates. Gatehouse undertook a detailed review of the assaying and sample preparation procedures in 2000 whilst an employee of North Ltd. He completed a check assay program as part of that review. Gatehouse now works as a consultant geochemist with Hellman & Schofield Pty Ltd and has reviewed this report.

#### RC Samples (1998-1999 PolyMet Drilling)

It is clear that the RC samples should be used for resource calculation purposes (refer to Section 14 for details). 5145 RC intervals with assays occur in the current database that total 25,657 feet from 55 holes (52 RC holes and 3 RC/DD holes).

Gatehouse (2000) summarizes the sampling and assaying of the RC samples:

> *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.*
>
> *In the 1999-2000 drilling and prior to February 2000, PolyMet sampling of 5' intervals of ½ BTW core was prepared at Lerch Bros Hibbing as above and assayed using Acme. One in ten samples were sent to Chemex as the check laboratory. Subsequently, for no*

> *apparent technical reason, Chemex were made the primary laboratory and Acme was used as a check. Analytical techniques remained the same.*

### US Steel Assays (1960s & 1970s)

US Steel assays are derived from old records which are incomplete in terms of QA/QC details. There are, however, less than ~200 US Steel assays remaining in the database that have not been replaced by more recent assays.

Gatehouse (2000a) summarizes the US Steel sampling and assaying:

> *USX 'bx' diameter drilling and 10' intervals (late60s-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.*

There are 1790 Acme aqua regia re-assays of samples previously assayed by US Steel. Averages for US Steel and Acme, respectively are: Cu 0.39% and 0.39%; Ni 0.14% and 0.09%. 217 check assays by Chemex are available. Averages for US Steel and Acme, respectively, are: Cu 0.25% and 0.25%; Ni 0.11% and 0.08%. Thus US Steel Cu assays match, on average, both those by Acme and Chemex. Ni appears high in the US Steel assays which may partly be a result of a more total digestion used. Acme's acid digestion was weaker than that used by Chemex.

### Status of Ni assays

Gatehouse (2000b) summarizes the status of the Ni assays:

> *Against Genalysis ICP (4B), Chemex partial aqua regia assays are strongly biased as should be expected. On average, the Chemex preferred assays used for the resource calculation are biased low by 5-6% against Genalysis totals. The clear conditional bias in this data is also as expected and consistent with Lakefield metallurgical reports of a proportion of the nickel resident in silicates. Bias changes from about 20% at 500-600 ppm to no recognizable bias at greater than about 0.3% Ni. This pattern is consistent with higher proportions of Ni being resident in sulphide at higher grades. Lakefield metallurgical reports suggest that Ni in silicates is variable between 200 and 700ppm. This is also consistent with Co results.*
>
> *In summary, the Northmet Ni resource is based on partial digest results. At worst the average bias would be 5% lower than total results. This does not necessarily alter the economics of the project as it may eventuate that Lakefield head assays on which recoveries have been predicated may prove themselves similarly biased.*

### Status of Cu assays

Gatehouse (2000b) summarizes the status of the Cu assays:

> *On average, preferred Chemex aqua regia assays are biased low by about 2% against Lakefield XRF results (2A) , by 5% against Genalysis total acid digest ICP (2B) and by 1-2% against Chemex total digest ICP(2C). Such results are consistent with the low partitioning of Cu into silicates and represent a limit of a tolerable assay outcome. Biases of much greater than 5% are not acceptable and require improved assay.*
>
> *Given the notionally total nature of Genalysis and Lakefield assays it is probable the Chemex aqua regia used in the resource data is low biased from an accurate result by*

*less than 5% on average. This bias is conservative and would have no negative impact on resource figures.*

### Status of Co assays

Gatehouse (2000b) summarizes the status of the Co assays:

*The Chemex aqua regia digestions are significantly low biased, on average about 20%, against Genalysis total assays. The bias is conditional and significantly increases with lower grade. Though the number of samples is smaller, the same effect can be seen between Chemex aqua regia and Chemex total digest ICP.*

*Cobalt forms a very small portion of the value of the resource and, for economic purposes and factoring through metallurgical recoveries, its resource value is likely to be currently underestimated by around 20%. A small upside exists on the value of the resource by virtue of underestimated resource cobalt being related to total cobalt used in metallurgical calculations.*

### Status of Pd assays

Gatehouse (2000b) summarizes the status of the Pd assays:

*On average, Chemex is biased about 2% high against both Genalysis and Lakefield. Bias is not conditional against Lakefield. Chemex bias is conditional against Genalysis' NiS assay and increases with grade. It is not considered significant given the nugget imprecision between assay types due to sub-sampling and signified by the large dispersion in the …scatter points. However, this situation should be monitored with ongoing quality control in the event that it might become significant with changing mineralized domain.*

### Status of Pt assays

Gatehouse (2000b) summarizes the status of the Pt assays:

*On average, Chemex is biased low against both Genalysis NiS assays(6B) and Lakefield lead oxide fire assays(6A). Further a conditional bias against Genalysis is similar to that of palladium and similar ongoing monitoring is recommended.*

### Status of Au assays

Gatehouse (2000b) summarizes the status of the Au assays:

*As with Platinum, gold by virtue of its low abundance is subject to significant sub-sampling nugget effects. Though biases are apparent, the low contribution of Au to economic value means they are not significant at this time. However, quality control monitoring should be continued.*

*Against Becquerel NAA (7C), a very good reference technique for gold analyses, Chemex gold is biased low by 20%. The low levels (50ppb) and severe nugget effects render this insignificant. On average, Chemex is biased low against both Genalysis NiS assays and Lakefield lead oxide fire assays. Further a conditional bias against Genalysis is similar to that of palladium.*

*Extraction of Au into NiS during fire assay is inefficient. The low bias of Genalysis against Chemex (7B) is expected and not relevant.*

*The low bias of Lakefield against Chemex is largely a function of assay imprecision at very low grades and is not significant…*

### Summary - Copper, Nickel, Cobalt

Gatehouse (2000b) summarizes the status of the Cu, Ni and Co assays:

> *Chemex aqua regia assays, on which the Cu Ni Co resources are based, are biased low by a small amount. The total economic impact will be less than 5%, which is acceptable for resource assays. Never the less, it is highly probable that there remains an inherent bias.*

Initial results for a limited number (54) of samples from the recent metallurgical drilling program support Gatehouse's prediction. Co and Ni assays from 4-acid digestions being 14% and 5%, respectively, higher than assays based on aqua regia. Cu values are similar.

A number of batches assayed in 2000 had included PolyMet standards (N1-3). Some of these have Ni assays that report approximately 10 to 20% above the recommended value though significantly more batches understate Ni. Cu values were largely accurate.

**Summary - PGEs and Gold**

Gatehouse (2000b) summarizes the status of the PGE and Au assays:

> *Though some evidence for conditional biases exist between lead oxide and NiS fire assay for PGEs the low level is acceptable for lead oxide fire assay to be used for ongoing resource assessment. Though of lesser economic significance, the strong negative bias of gold in NiS analyses and its greater cost and expertise required for good assays, strongly mitigates against the NiS technique. However, NiS fire assay for PGEs should be used for quality control monitoring as an ongoing precaution against the potential for significant bias in different mineralized domains at Northmet.*

## 21. INTERPRETATION AND CONCLUSIONS

Data adequacy is reflected in the confidence classifications used to report the resource estimates. The chief area of uncertainty relates to the optimal drill spacing required to bring the project to Reserve status. Information derived from the 2005 drilling program will be used to formulate a final recommended drilling density. Studies on spatial variability to date suggest that a drill spacing of approximately 400 ft will be adequate to define Indicated Resources with possibly a 200 – 300 ft spacing required for Measured Resources. This assumes a cut-off grade of 0.1% to 0.2% Cu. Mining at higher cut-offs will require a higher density of drilling. It is likely that one or two detailed areas will require detailed drilling to determine the detailed spatial variability in areas of higher grade or complex geology.

# 22. RECOMMENDATIONS

Recommendations relating to the resource evaluation of NorthMet include:

- Integration of new geological interpretations resulting from the current drilling program;
- Completion of assaying of previously un-sampled intervals that are unlikely to contain economic mineralization in order to be able to assign low values for environmentally significant elements, this is work in progress
- Re-assessment of previously excluded assays with a view to re-instatement into the assay database on the basis of a consideration of geology and neighbouring assays.
- Compilation of core recovery data
- Improvement of current geological logging sheets
- Compilation of densities and integration into the geological and assay database
- Determine the typical moisture loss that occurs during drying at the assay laboratory to assess the impact on the densities that are determined on undried samples.
- Assessment of possible correlation of density with grade.
- Select, for check assaying, a representative number of samples from previous batches that have been identified as having poorly performing assay results for submitted standards or blanks. Sieve tests should also be performed. Batches that have assays from standards that report at the high and low end should be chosen to test whether these apparent biases apply to the unknowns. If bias is confirmed, a more comprehensive retrospective re-assay program should be initiated. It is clear from the extensive aqua regia – 4-acid checks available that the overall effect on grade will be positive for at least Ni and Co. Water soluble Cu would be a good check for the presence of post-sampling oxidation.
- The use of pulp blanks is recommended in order to provide information relating to laboratory hygiene as opposed to potential contamination derived during sample preparation.

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## 24. DATE

The effective date of this report is 8 June, 2005.

## ACKNOWLEDGEMENTS

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## GLOSSARY OF TERMS[8]

| | |
|---|---|
| AAS | Atomic absorption spectroscopy |
| Co | Cobalt |
| Cu | Copper |
| DFS | Definitive Feasibility Study |
| CUPREX | Proprietary hydrometallurgical extractive process |
| DNR | The Minnesota Department of Natural Resources |
| EIS | Environmental Impact Statement |
| Fleck | Fleck Resources |
| Ga | Geological unit of time – $10^9$ years |
| ICP-AES | Inductively coupled plasma atomic emission spectroscopy |
| kHz | kilohertz |
| Lakefield | Lakefield Research Limited |
| LTVSMC | LTV Steel Mining Company |
| MW | mega watts |
| NERCO | NERCO Minerals Company |
| NI | National Instrument |

[8] Taken from Hammond, 2005

| | |
|---|---|
| Ni | Nickel |
| North | North Mines Limited |
| NSR | Net Smelter Return |
| PGE | Platinum Group Elements |
| PRI | Partridge River intrusion |
| PolyMet | PolyMet Mining Corp. |
| RC | Reverse Circulation Drilling |
| SEDAR | "System for Electronic Document Analysis and Retrieval" at www.sedar.com |
| The Company | PolyMet Mining Corp. |
| The Project | NorthMet Project |
| USS | US Steel |
| | |
| BQ, BX, BTW NTW, PQ | Nomenclature describing diamond bit diameters. |

# CERTIFICATE OF QUALIFICATION

I, Phillip Hellman, FAIG, do hereby certify that:

1. I am a Director of:

   Hellman & Schofield Pty Ltd
   Suite 6, 3 Trelawney St,
   EASTWOOD NSW 2119
   AUSTRALIA

2. I graduated with a BSc(Hons) degree in geology from University of Sydney in 1973. In addition I have obtained a PhD in geochemistry and petrology from Macquarie University in 1979 and a Diploma of Education from Sydney University in 1974.

3. I am a Fellow of the Australian Institute of Geoscientists

4. I have worked as a geologist for a total of 28 years since my graduation from university.

5. I have read the definition of “qualified person” set out in National Instrument 43-101 (“NI 43-101”) and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfill the requirements to be a “qualified person” for the purposes of NI 43-101.

6. I am responsible for the preparation of the technical report titled Resource Update of the Project, (the “Technical Report”) and dated May 2005 relating to the Property. I visited the Property for ten days in September 2004 and May 2005.

7. I have had an involvement in the Property since September 2004. The nature of this involvement includes resource estimation and general consulting in relation to QA/QC, geological logging and database assembly.

8. I am not aware of any material fact or material change with respect to the subject matter of the Technical Report that is not reflected in the Technical Report, the omission to disclose which makes the Technical report misleading.

9. I am independent of the issuer applying all of the tests in section 1.5 of National Instrument 43-101.

10. I have read National Instrument 43-101 and Form 43-101F1, and the Technical report has been prepared in compliance with that instrument and form.

11. I consent to the filing of the Technical Report with any stock exchange and other regulatory authority and any publication by them for regulatory purposes, including electronic publication in the public company files on their websites accessible by the public, of the Technical Report.

Dated 8 June, 2005

________________________

Signature of Qualified Person

**Phillip L Hellman, FAIG PhD**

________________________

Name of Qualified Person