NI 43-101 Technical Report
543S Copper Project
Michigan, U.S.A.

Prepared for:

Highland Copper Company
1111 St. Charles St. West, Suite 101
Longueuil, QC J4K 5G4

Effective date: July 5th, 2014
Report Date: October 9, 2014

Prepared by:

G MINING SERVICES INC.
7900 Taschereau Blvd.
Building D, Suite 200
Brossard, Québec
Canada J4X 1C2

NI 43-101 – 543S Copper Project

Michigan, U.S.A.

Highland Copper Company

1111 St.Charles St. West, Suite 101
Longueuil, QC
Canada, J4K 5G4
Telephone: 450.677.2455
Facsimile: 450.677.2601
E-mail**:** info@highlandcopper.com
Web Address: http://www.highlandcopper.com/

G Mining Services Inc.

7900 W. Taschereau Blvd.
Suite D-200 Brossard, Québec
Canada J4X 1C2
Tel: (450) 465-1950 • Fax: (450) 465-6344
E-mail: l.gignac@gmining.com
Web Address: www.gmining.com

Effective date: July 5th, 2014

Prepared by:

___*"Ahmed Bouajila" /signed/*__________ Date: October 9, 2014
Ahmed Bouajila, Eng.,
Vice President, Metallurgy and Ore Processing
G Mining Services Inc.

___*"Réjean Sirois" /signed/*____________ Date: October 9, 2014
Rejean Sirois, Eng.,
Vice President, Geology and Resources
G Mining Services Inc.

General Conditions and limitations

Use of the report and its contents

This report has been prepared for the exclusive use of the Client or his agents. The factual information, descriptions, interpretations, comments, recommendations and electronic files contained herein are specific to the projects described in this report and do not apply to any other project or site. Under no circumstances may this information be used for any other purposes than those specified in the scope of work unless explicitly stipulated in the text of this report of formally interpreted when taken individually or out-of-context. As well, the final version of this report and its content supersedes any other text, opinion or preliminary version produced by G Mining Services Inc.

Table of Contents

List of Figures

List of Tables

List of Appendices

1. EXECUTIVE SUMMARY

G Mining Services Inc. ("GMSI" or "G Mining") has prepared this Technical Report of the 543S Copper Project located in the Upper Peninsula of Michigan (U.S.A.) as mandated by Highland Copper Company Inc. ("HCC" or "Highland") to support the initial resource estimate announced by HCC in a press release issued on August 25, 2014. The purpose of the current Technical Report is to provide an independent Technical Report and Resource Estimate of the copper and silver mineralization present on the 543S Project in conformance with the standards required by Canadian Securities Administrators' National Instrument 43-101 ("NI 43-101") and Form 43-101F. The estimate of mineral resources contained in this Technical Report conforms to the CIM Mineral Resource and Mineral Reserve definitions (May 10, 2014) referred to in NI 43-101 Standards of Disclosure for Mineral Projects. This resource estimate was completed by Réjean Sirois, Eng. Mr. Sirois is an independent "qualified person" as defined in NI 43-101. Geovia® GEMS software was used to facilitate the resource estimation process and Leapfrog Mining® was used for geological modelling needs.

This Technical Report is based on information known to GMSI as of July 5th, 2014. As of the date of signature of this report, GMSI is not aware of material information that would affect the content of this report. GMSI is not obliged to revise this Technical Report and conclusions if additional information becomes available to GMSI subsequent to the signature date of this Technical Report.

The 543S property is in the Keweenaw Peninsula, which is located along the southern portion of the Lake Superior Basin within the Middle Proterozoic Mid-Continent rift system. The 543S copper deposit is located within a zone of chalcocite-dominated copper mineralization that is unique to the Keweenaw Peninsula. The known chalcocite deposits in the Keweenaw region occur in a 30 kilometer-long northeast-southwest trending belt located between the native copper-bearing lodes and the underlying Keweenaw Fault and hosted by the Portage Lake Lava series. Chalcocite mineralization primarily occurs as open space fillings in amygdaloidal and fragmental basalt flow tops. The basalt flows in the area of the 543S deposit are covered by up to 50 meters of glacial till and do not outcrop in the vicinity of the deposit. The flows have an average thickness of approximately 33 meters and are cut by two fine grained sill-like dacitic to andesitic subvolcanic intrusives. More than 99% of the copper occurs in the mineral chalcocite and <1% is present as bornite, chalcopyrite, or as native copper. Traces of native silver are also present. Approximately 80 to 90% of the chalcocite mineralization is concentrated in the flow top breccias and amygdaloids where grades are the highest.

Database validation was performed by G Mining on the files received from Highland. GMSI imported the various files into an MS Access database using Geovia® GEMS software. The database was reviewed and corrected if necessary prior to final formatting for resource evaluation. HCC's QA/QC protocols included the insertion of standards and blanks, as well as umpire assays. GMSI reviewed HCC QA/QC protocols and sampling procedures and they were found to be in compliance with CIM mineral resource estimation guidelines. No red-flags or major problems were found in the course of the data verification and the database was found to be in good condition. Minor errors found by GMSI were promptly corrected by HCC. Core recovery averaging 92% is judged appropriate for the completion of resource estimation.

A.C.A. Howe International first completed historical preliminary metallurgical studies in 1991 at the Institute of Materials Processing of Michigan Technological University on three samples of chalcocite from the 543S deposit. Concentrate grades from conventional flotation tests demonstrated over 40% Cu and recoveries over 90% were achievable at grinds between 200 and 270 mesh when combined with cleaning and re-cleaning of the rougher concentrates. A ball mill grindability work index of a composite of 19.36 KWh/t was also reported. In February 2014, seven flotation tests were conducted on composite samples of drill core from the 543S deposit at SGS Laboratories in Lakefield, Ontario under the supervision of Mr. Ahmed Bouajila, Vice President, Metallurgy and Ore Processing for G Mining. The composite grade was 2.61% Cu and 3.9 g Ag/t. Copper recoveries reported for this work neglect the copper distribution contained in the cleaner tailings. In a continuous circuit the cleaner tailings would be re-circulated back to the rougher and cleaner flotation stages, respectively and a substantial part of it would be recovered in the final concentrate. The effect of this recirculation cannot be determined without running locked cycle tests or continuous pilot plant trials. It is concluded that reasonable expectation from an equivalent optimized and closed circuit would be:

- Recoveries: 90% Cu, 80% Ag;
- Concentrate grades: 44% Cu, 59 g Ag/t ; and
- Mass Pull: 5.5%

GMSI undertook the Mineral Resource estimate based on data provided by HCC on March 8th, 2013. GMSI imported all holes included in the final database, up to CEN487 inclusively. The estimate was conducted in a single block model limited by eighteen mineralized domains interpreted and modelled as 3D wireframes. Capped raw assays were composited into regular 2.5-meter run lengths within each domain. Bulk densities were first estimated in each block based on regressions calculated from the correlation of 1,100 specific gravity measurements with their copper content, for three major rock types (flow-tops, dyke and basalt/host rock). Secondly, blocks within a 50 meter radius from specific gravity measurements, within the same rock type, were interpolated using those samples and were given a higher priority over the densities estimated by regression. This step of density estimation was done after all steps relating to copper interpolation, including grade estimation validation. Resulting estimated specific gravity of blocks inside domains varies from 2.52 g/cm^3 to 3.04 g/cm^3. Overburden density was set to a uniform 2.35 g/cm^3. Isotropic cubic blocks of 2.5 meters were used in the block model. Copper and silver grades were estimated using the Inverse Distance Cube (ID^3) interpolation method in three successive passes. The first and second passes led to Indicated Mineral Resources, whereas the third pass led to Inferred Mineral Resources, all limited within the mineralized domains properly coded. Mineral Resources were classified according to the CIM Definition Standards on Mineral Resources and Mineral Reserves.

After a detailed review of different options, Highland and G Mining have opted to report the mineral resource for potential underground development of the 543S deposit as the base case. Two other scenarios, open pit only and an underground & open pit hybrid, were also assessed in the course of this mandate. The underground only scenario resources were constrained by blocks with a minimum threshold value of 1.9% Cu equivalent, where isolated clusters of blocks were removed and an upper hard boundary was set at 15 meters below the bedrock surface to account for future crown-pillar.

Total underground only Indicated Mineral Resources are reported at 110 M pounds of copper at an average grade of 3.27% Cu and 248,000 oz silver at an average grade of 5.1 g Ag/t. Table 1.1 reports resources for the underground scenario by resource category, for copper and silver. All parameters used in the calculations are presented in the table's notes, as well as the equation used to calculate copper equivalent grades.

Table 1.1: Mineral Resource Estimate (ID^3) for the Underground Scenario

Underground Scenario Only – 1.9% Copper Equivalent Cut-Off Grade – July 5th, 2014

Resource Category	**Cut-Off Grade** Cu Eq. (%)	**Tonnage** ('000 t)	**Grade** Cu Eq. (%)	**Grade** Cu (%)	**Copper** ('000 lbs)	**Grade** Ag (g/t)	**Silver** ('000 oz)
Indicated	1.9	1,518	3.31	3.27	109,514	5.1	248
Inferred	1.9	193	3.12	3.08	13,116	4.8	30

Notes on Mineral Resources

1) Cu Eq. = Cu% + (Ag g/t * 20$/oz * 80% * 90%) / (22.0462 lbs/10kg * 3$/lb * 31.1035 g/oz * 90% * 96.5%)
2) Mineral Resources are reported using a copper price of 3$/lb and a silver price of 20$/oz
3) A payable rate of 96.5% for copper and 90% for silver was assumed
4) Preliminary metallurgical testing suggests recovery of 90% for copper and 80% for silver
5) Cut-off grade of 1.9% Cu Eq. was used
6) Underground mining costs are estimated at 57.27$/t of ore.
7) Production costs are estimated at 37.50$/t of ore: 12.00$/t for processing, 2.50$/t for general and administrative costs, 0.50$/t for tailings and 22.50$/t for ore transportation to White Pine Complex
8) A 5% royalty was used (4.99$/t ore)
9) No mining dilution and mining loss were considered for the Mineral Resources
10) Rock bulk densities are based on rock types, % Cu and proximity to specific gravity measurements
11) Assay capping was applied to some mineralized domains
12) Classification of Mineral Resources conforms to CIM definition
13) The qualified person for the estimate is Mr. Réjean Sirois, eng., Vice President Geology and Resources of G Mining Services Inc. The estimate has an effective date of July 5th, 2014

Following this initial mineral resource estimate, the following work on the 543S deposit is recommended:

- Advancement of metallurgical and ore processing studies.
- Infill drilling on a 15 x 30 m grid on the north-eastern part of the 543S deposit.
- Infill drilling locally to confirm high-grade copper intervals and potentially extend their influence.
- Infill drilling on the northern and the western end of the Main Domain (#20), at depth to potentially transfer some inferred mineral resources into indicated mineral resources.
- Assess regions of potential upgrade in underground mineable mineral resources.

The work proposed herein is aimed at increasing the confidence in the resource estimate, potentially increasing the global copper and silver resources and a better understanding of the ore processing necessary for the 543S Project.

2. INTRODUCTION

2.1 Scope of Technical Report

G Mining Services Inc. ("GMSI" or "G Mining") has prepared this Technical Report of the 543S Copper Project located in the Upper Peninsula of Michigan (U.S.A.) as mandated by Highland Copper Company Inc. ("HCC" or "Highland") to support the initial resource estimate announced by HCC in a press release issued August 25, 2014.

The purpose of the current Technical Report is to provide an independent Technical Report and Resource Estimate of the copper and silver mineralization present on the 543S Project in conformance with the standards required by Canadian Securities Administrators' National Instrument 43-101 (NI 43-101) and Form 43-101F. The estimate of mineral resources contained in this Technical Report conforms to the CIM Mineral Resource and Mineral Reserve definitions (May 10, 2014) referred to in NI 43-101.

The preparation of this Technical Report was in done in collaboration with HCC personnel. The individual scopes of work are enumerated below:

Highland Copper's Scope of Work

- Provide an exploration database of the 543S Project containing drill holes, such as assay results and detailed log data.
- Quality Control and Quality Assurance ("QA/QC") of the exploration database on assay results and proper location of data.
- Produce the geological model and interpretation of the Cu-Ag units on 2D cross-section.
- Bring support on the preparation and completion of this Technical Report.

G Mining's Scope of Work

- Review HCC's exploration procedures and practices.
- Audit exploration data and QA/QC results contained in the resource database.
- Provide technical support to HCC personnel during data collection and process
- Generate 3D wireframes of copper-bearing units to be used in the estimation process.

- Generate statistics and variogram analysis.
- Perform grade interpolation and validation of the results.
- Classification of the mineral resources.
- Perform preliminary metallurgical tests.
- Prepare preliminary inputs (slopes and operation costs) to generate Whittle pits
- Assess different mining scenarios: open pit only, underground only, and open pit – underground hybrid.
- Assess “reasonable prospect for economic extraction” to assist in the preparation of an audited mineral resource statement.
- Preparation of a Mineral Resource Estimate.

This Technical Report is based on information known to GMSI as of July 5th, 2014. As of the date of signature of this report, GMSI is not aware of material information that would affect the content of this report. GMSI is not obliged to revise this Technical Report and conclusions if additional information becomes available to GMSI subsequent to the signature date of this Technical Report.

2.2 Sources of Information

This Technical Report is based in part on internal company technical reports, maps and geological cross-sections, technical reports prepared for and by previous companies relevant to the Project, published government technical reports, company letters and memorandum, and public information listed in Section 27.0 “References” at the conclusion of this Technical Report. GMSI held discussions with technical personnel from HCC regarding pertinent aspects of the project. GMSI has not conducted detailed land status evaluations, and has relied on previous qualified reports, public documents and statements of Highland regarding the Project status and legal title to the Project.

GMSI imported the HCC database into Geovia’s GEMS® software and the database files were reviewed and checked for errors such as missing data and overlapping intervals. No significant errors were detected. GMSI reviewed HCC cross-sections showing the diamond drill hole traces, assays interval lithological intervals, interpreted mineralized zone intervals, and surface and overburden trace.

Logging, sampling and core handling procedures were found to be compliant with industry and NI 43-101 standards. GMSI inspected Accurassay and Activation Laboratories, both located in Thunder Bay, in November 2012. GMSI found the independent preparation and laboratory facilities to be compliant with industry standards. Some irregularities were noted with the Accurassay Laboratories, detailed in Section 12.5.

The authors believe that information and data presented to GMSI by HCC are a reasonable and accurate representation of the 543S Copper Project. GMSI is of the opinion that the drill hole and assay database for the 543S Project is of sufficient quality to permit the completion of a NI 43-101 Mineral Resource Estimate and provide the basis for the conclusions and recommendations reached in this Technical Report.

2.3 Qualifications and Experience

The authors acknowledge the assistance of Mr. Ross Grunwald, M.Sc., Ph.D.Geo., Vice President, Exploration for HCC, Mr. Carlos Bertoni, P.Geo, a consultant to HCC, Frederick T. Graybeal, P.Geo, special consultant to HCC, as well as HCC professional staff that provided information during the preparation of this Technical Report. The authors consider the information to be of good quality and have no reason to believe that any of the information is other accurate.

Mr. Réjean Sirois, Eng. (OIQ #38754) is Vice President, Geology and Resources with G Mining Services Inc. He has been practicing his profession continuously since 1985 and has extensive experience in estimating mineral resources in South and North America as well as in Southern and Western Africa.

Mr. Ahmed Bouajila, Eng. (OIQ #106946) is Vice President, Metallurgy and Mineral Processing with G Mining Services Inc. He has been practicing his profession continuously since 1992 and has more than 20 years experience in the mining industry. He provides significant metallurgical expertise.

The responsibilities of each author are provided in Table 2.1.

Table 2.1: Responsibilities of Each Qualified Person

Author	Responsible for Section/s
Mr. Réjean Sirois, Eng.	1,-12, 14-26
Mr. Ahmed Bouajila, Eng.	13

2.4 Site Visit

Mr. Réjean Sirois visited the 543S Project on numerous occasions between April 2013 and November 2013. The purpose of this/these visit(s) was to ascertain the geology of the project area with a specific emphasis on the delimited mineralized zones. Mr. Sirois also examined drill core and visited the drilling area. He also spent time at Accurassay and Activation analytical laboratories located in Thunder Bay, Ontario (Canada). He also examined the sample preparation facilities at the HCC's office.

Mr. Ahmed Bouajila did not visit the 543S Project site.

2.5 Definition and Terms

The currency used for all costs is presented in US Dollars ("US$"), unless specified otherwise. The costs were estimated based on quotes and cost data as of 1st Quarter 2014.

The economic evaluation of the Project is not included in this Technical Report of Mineral Resource. The Technical Report includes technical information which requires subsequent calculations to derive sub-totals, totals and weighted averages. Such calculations inherently involve a degree of rounding and consequently introduce a margin of error. Where these occur, GMSI does not consider them to be material.

2.6 Units of Measure, Abbreviation and Nomenclature

Table 2.2: List of Main Abbreviations

Abbreviations	Full Description	Abbreviations	Full Description
Ag	Silver	ID^3	Inverse Distance Cube
BM	Block Model	k	Kilo (000's)
CoG	Cut-off grade	kg	Kilograms
CoV	Coefficient of Variation	l	Liters
Cu	Copper	lb/s	Pound/s
Cu Eq.	Copper Equivalent	NSR	Net Smelter Return
DD	Diamond drilling	M	Mega or Millions (000,000's)
Ft	Foot	m	Meters
g	Grams	m^2	Square Meters
g/t or gpt	Grams per metric tonne	m^3	Cubic Meters
GSMI	G Mining Services Inc.	OK	Ordinary Kriging
h	Hours	t	Metric Tonne (1000 kg)
ha	Hectares	US$	U.S. Dollar
HCC	Highland Copper Company Inc.	y	Years

3. RELIANCE ON OTHER EXPERTS

3.1 Reliance on Other Experts

This Technical Report has been prepared by G Mining Services Inc. ("GMSI") for Highland Copper Company Inc. ("HCC"). The information, conclusions, opinions, and estimates contained herein are based on:

- Information available to GMSI at the time of preparation of this Technical Report.
- Assumptions, conditions and qualifications as set forth in this Technical Report.

The authors acknowledge the assistance of Mr. Ross Grunwald, M.Sc., Ph.D.Geo., Vice President, Exploration for HCC, Mr. Carlos Bertoni, P.Geo, a consultant to HCC, Mr. Frederick T. Graybeal, P.Geo, special consultant to HCC, as well as HCC professional staff that provided information during the preparation of this Technical Report. The authors consider the information to be of good quality and have no reason to believe that any of the information is other than accurate.

This Technical Report is intended to be filed on SEDAR by HCC with Canadian Securities Regulatory Authorities to support the initial resource estimate announced by HCC in a press release issued on August 25, 2014.

4. PROPERTY DESCRIPTION AND LOCATION

The 543S property is located within the Keweenaw Peninsula, in the northwestern part of the Upper Peninsula of the State of Michigan, U.S.A. Under a Mining Venture Agreement (the "Venture Agreement") with BRP LLC ("BRP"), Highland has an option to acquire from BRP a 65 percent interest in the Keweenaw Copper Project ("Keweenaw Project"), which includes the 543S deposit, the G2 prospect and other target areas which cover a total area of approximately 9000 acres in Keweenaw County as shown in Figure 4.1. The 543S property lies about 21 miles north of Calumet, Michigan, immediately west of Gratiot Lake. The Keweenaw Project hosts numerous chalcocite-bearing copper prospects to the south and east of the historical native-copper mines in the Upper Peninsula of Michigan.

The Venture Agreement was entered into on August 4, 2011 and was amended and restated on April 29, 2013. Under the Venture Agreement, Highland will be entitled to exercise an option to acquire a 65 percent interest in the Keweenaw Project by satisfying the following conditions: (i) spending US$11,500,000 in exploration and development work; (ii) making cash payments to BRP totaling US$750,000; (iii) issuing to BRP a total of 200,000 common shares; and providing a feasibility study on the Keweenaw Project by October 26, 2015. The conditions (i) to (iii) have been fully met.

BRP LLC will retain an interest of 35% in the 543S property and will be entitled to receive a sliding scale net smelter return ("NSR") from production depending on the price per pound of copper with a minimum of 2% NSR for copper priced less than US$1.70 per pound to a maximum of 5% NSR for copper priced US$3.00 and above. The sliding scale royalty is based upon the average quarterly price per pound of copper and is as follows:

- Less than US$1.70 — 2.0% NSR
- Equal to or greater than US$1.70 but less than US$2.00 — 2.5% NSR
- Equal to or greater than US$2.00 but less than US$2.25 — 3.0% NSR
- Equal to or greater than US$2.25 but less than US$2.50 — 3.5% NSR
- Equal to or greater than US$2.50 but less than US$2.75 — 4.0% NSR
- Equal to or greater than US$2.75 but less than US$3.00 — 4.5% NSR
- Equal to or greater than US$3.00 — 5.0% NSR

There are no underlying royalties. Once Highland has earned a 65% interest, both parties must contribute their percentage share to operating and other costs or suffer dilution. If a party is diluted to a less than 10% interest, that party loses all interest and the remaining partner is reduced to zero interest, excepting that BRP retains their royalty interest. The agreement provides that at the end of the earn-in period and as a condition to earning its 65% interest, HCC will produce a feasibility study on the property by an independent consultant selected by the management committee. Highland Copper Company has been appointed as the initial manager of the joint venture with overall responsibilities for operations.

In the State of Michigan, mineral rights are distinct from surface rights. Mineral rights may be sold or retained separately from the surface rights, in which case, the mineral rights are said to be severed. Mineral rights permit unrestricted access to the surface and the right to subside the surface. Surface and mineral rights are located and described with reference to a grid established by the federal government as part of the Public Lands Survey System. Townships are squares of 36 square miles comprising 6 x 6 arrays of 36 sections, named according to distance and direction from a principal meridian and baseline. Sections are one-mile square, and can be divided into quarters, labeled NE, NW, SE, and SW. Each quarter can also be split into halves or quarters, which are labeled according to the side or corner of the quarter section they encompass (e.g., NE 1/4 of the NW 1/4).

BRP owns the mineral rights covering the properties under the Venture Agreement, including the 543S deposit, which are located within the following sections:

T58N-R28W

Section 19: Government Lots 1 & 2

T58N-R29W

Section 23: Entire Section

Section 24: Entire Section

Section 25: Entire Section

Section 26: Northwest Quarter

West Half of the Northeast Quarter

Northeast Quarter of the Northeast Quarter

Northeast Quarter of the Southeast Quarter

Government Lots 1 & 2

Section 27: North Half

West Half of the Southwest Quarter

Northeast Quarter of the Southwest Quarter

Northwest Quarter of the Southeast Quarter

Section 28: East Half

T58N-R30W

Section 26: South Half

Section 27: South Half

Section 32: West Half of the Northwest Quarter, Less and Except 36.1566 Acres more or less in the Northwest Quarter of the Northwest Quarter and the Northwest Quarter of the Northwest Quarter of the Southwest Quarter of the Northwest Quarter all lying outside the AMI.

South Half

Section 33: East Half of the Northwest Quarter

Southwest Quarter

T57N-R30W

Section 4: North Half of the Northwest Quarter

Government Lots 1, 2, & 3

Section 5: Northwest Quarter

North Half of the Northeast Quarter

Section 6: Southwest Quarter

West Half of the Southeast Quarter

Section 7: Entire Section

Section 8: Northwest Quarter of the Northwest Quarter

Government Lots 2 & 3

Section 18: Entire Section

T57N-R31W

Section 1: South Half

Section 2: Southeast Quarter, Less and Except 9 acres being triangular in shape and lying in the Northwest corner of Northwest Quarter of the Southeast Quarter and lying outside the AMI

Section 9: South Half of the Southeast Quarter

Section 10: Southwest Quarter

South Half of the Southeast Quarter

Section 11: North Half

North Half of the Southwest Quarter

Section 12: Entire Section

Section 13: North Half

Section 14: Southwest Quarter

Section 15: North Half

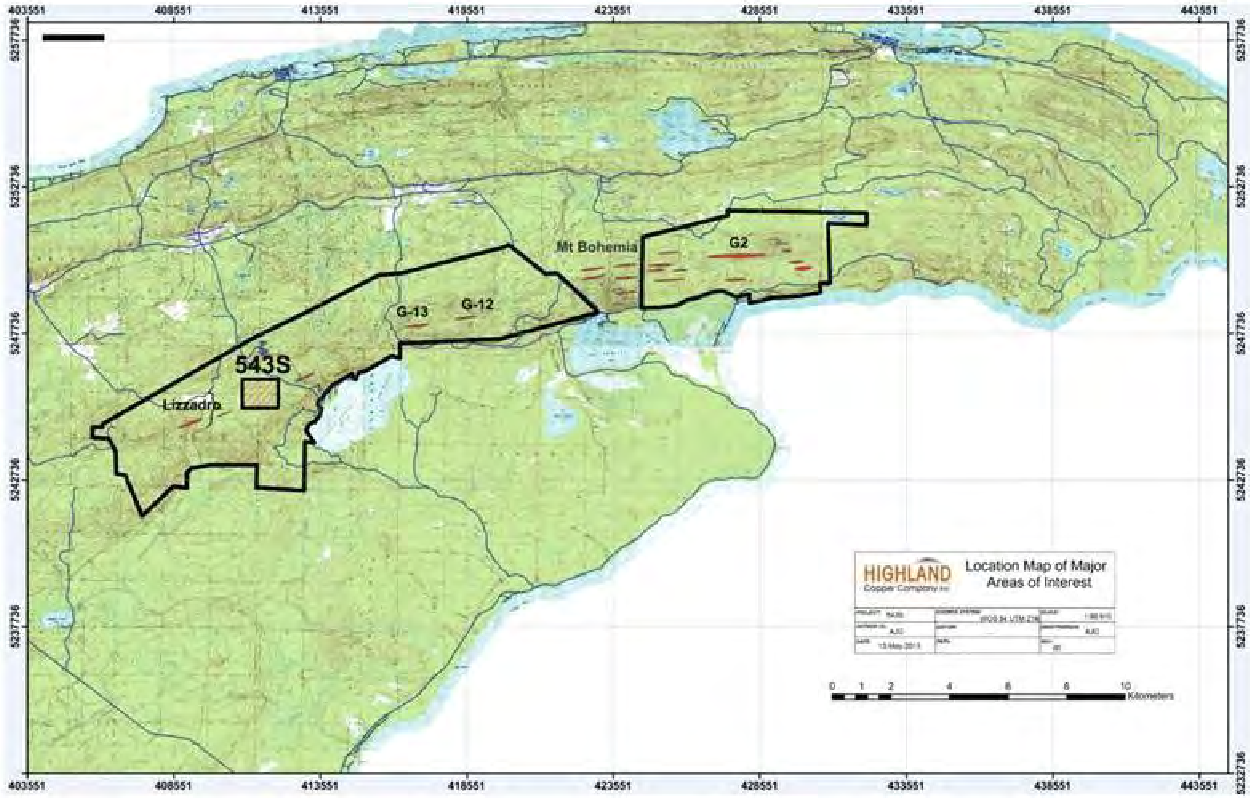
North Half of the South Half

The 543S deposit is located within the following section: Section 12, Township 57 North, Range 31 West and in Section 7, Township 57 North, Range 30 West.

Surface rights over most of the deposit are held by third parties. Compensation to the surface owners, if any, will be negotiated at the proper time.

Neither G Mining Services Inc. ("GMSI") nor the authors have undertaken, nor do they intend to undertake, a title search on the underlying complex ownership situation. GMSI has relied on information provided by Highland. Neither GMSI nor the authors are qualified to express a legal opinion with respect to property titles, current ownership and possible encumbrance status, and therefore disclaim direct responsibility for such titles and property status representations.

Figure 4.1: Outline of the Highland Copper Company-BRP LLC Joint Venture Area of Interest.



5. ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

5.1 Accessibility

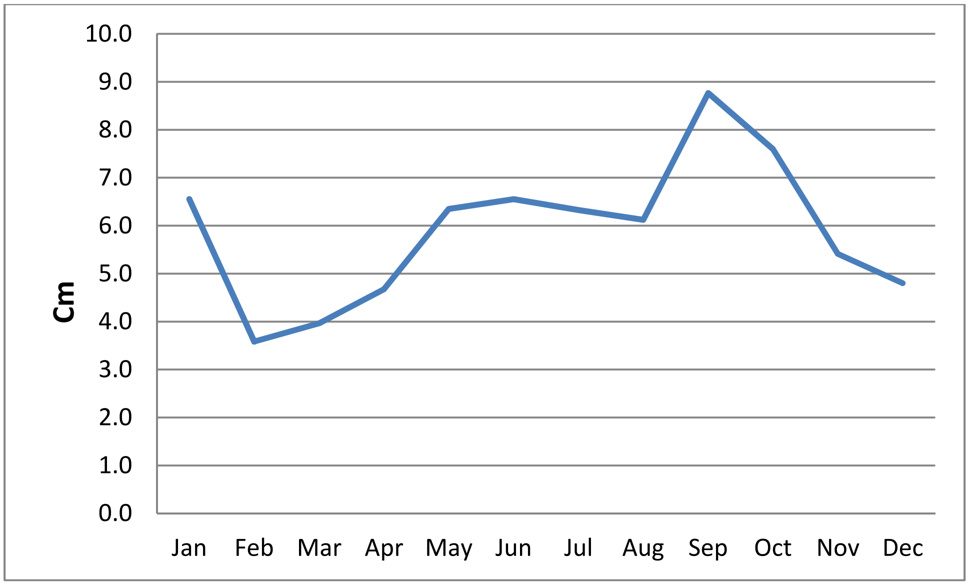
The 543S Property is about one kilometer from Gratiot Lake Road, an all-year paved county road. The access from Gratiot Lake Road is about 6 kilometers southeast of US Highway 41, in Keweenaw County Michigan. The property is about 70 kilometers from Houghton, Michigan. Houghton has an airport with direct flights to and from Chicago. Although the area has a high annual snowfall, the roads are kept open by state and county highway crews. The road into the property from Gratiot Lake Road is gravelled. The other chalcocite prospects are accessible by dirt and gravel roads. They are close to similarly maintained county roads.

5.2 Climate

The climate of the area is dominated by Lake Superior. The lake moderates the temperature in the winter, compared to the nearby inland areas. Temperatures are warmer in the winter and cooler in the summer.

There is a heavy annual snowfall due to “lake effect” snow. The process is caused by the rapid warming and moistening of air masses that move into the area from central Canada. The air moves southwest across Lake Superior, picking up moisture from the lake. This causes an increase in the dew point temperature. The air temperature is increased by the contrast of the unfrozen waters of the lake and the colder air mass from the northwest. The warmed air rises and cools, until it reaches its dew point. The result is “lake effect” precipitation, which in the winter comes in the form of snow.

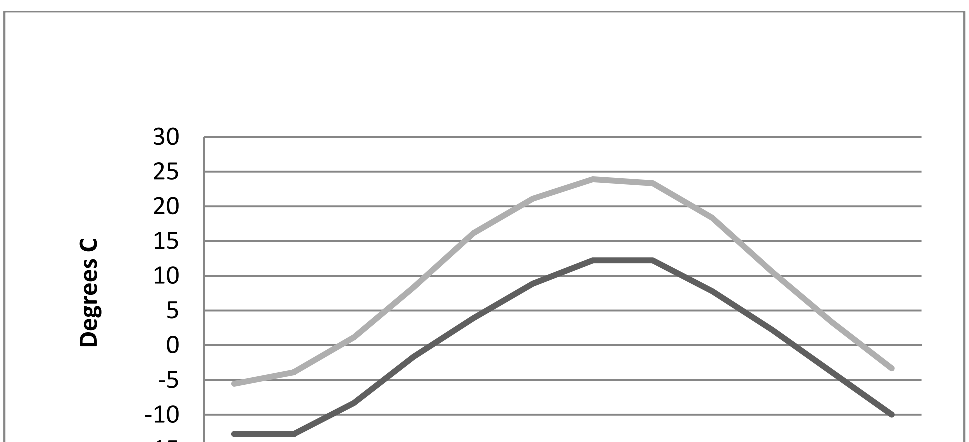
Figure 5.1: Average Precipitation in Keweenaw County, MI (Source weather.com)



The normal annual precipitation for the Keweenaw Peninsula is about 71 centimeters per year. The monthly distribution is shown in Figure 5.1. The average snowfall is over 500 centimeters per year. The largest annual snowfall in Michigan was recorded at Delaware, a small hamlet about 8 kilometers northeast of the property. During the winter of 1978-1979, a total of 995 centimeters was recorded at Delaware.

Average temperatures range from -13° Celsius to 24° Celsius. The average high and low temperature for each month is shown in Figure 5.2.

Figure 5.2: Average Temperatures in Keweenaw County, MI (Source weather.com)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ave Low	-13	-13	-8	-2	4	9	12	12	8	2	-4	-10
Ave High	-6	-4	1	8	16	21	24	23	18	11	3	-3

5.3 Local Resources

The region had an abundance of underground miners when Universal Oil Products closed the mines in 1968. Since there has been no active mining in the area, new miners would need to be trained. Open pit mining is on-going in the Michigan iron-range, about 160 kilometers to the south. There are many small towns in the area with an adequate supply of labor. Michigan Technological University is located in Houghton, Michigan. Many of the engineering and technical positions could be filled by recent graduates.

5.4 Infrastructure

Road access in the area is excellent. U.S. Highway 41 comes within 6 kilometers of the project site. The road from the major highway to the site is a well-maintained county road that is kept open throughout the year. Power to the site is available from Upper Peninsula Power Company. Commercial air service is available at the Houghton-Hancock Regional Airport, located less than 70 kilometers from the project site. The entire area is serviced by various freight trucking companies, Federal Express (FedEx) and United Parcel Service (UPS).

5.5 Physiography

The Keweenaw Peninsula is a thumb-shaped land mass that varies from 10 to 25 kilometers wide, and just out about 110 kilometers into the south shore of Lake Superior. The terrain is relatively flat in the south, and is covered by low rolling hills in the north and west portion. The maximum relief is about 289 meters, from the shores of Lake Superior to the top of Mount Horace Greeley. The elevation of Lake Superior is 183 meters.

The area has been glaciated, leaving bedrock exposure of about 5% of the land surface. The rest has a layer of soil covering the glacial debris. The topography reflects the underlying bedrock geology. The basalts and conglomerates of the Portage Lake Lava series are generally more resistant and form the rolling hills to the north and west. The glacial event caused the formation of numerous wetlands and bogs found in the low areas between ridges. The Jacobsville Sandstone to the south is softer and forms a fairly flat plain.

Most of the area is covered by forest. The forests are dominated by a mix of conifers and hardwoods, including white pine, red pine, jack pine, paper birch, quaking aspen, white spruce, balsam fir, mountain ash, maple and oak. Other vegetation in the area includes scattered shrubs and shrub thickets, and a partial turf of herbs, grasses, sedges, mosses, and lichens.

6. HISTORY

Prehistoric mining of native copper in the Lake Superior region can be traced back at least 5,000 years. Evidence of this prehistoric mining is seen in the ancient pits scattered around the Keweenaw highlands. They contain masses of copper with differing stages of removal as well as many stone tools used in mining. There are also many tools, decorative objects, and ceremonial objects made of copper found within these pits. Copper objects have been traced throughout the upper Midwest, Mississippi Valley and as far as Mexico due to the presence of silver within the copper found in the Keweenaw.

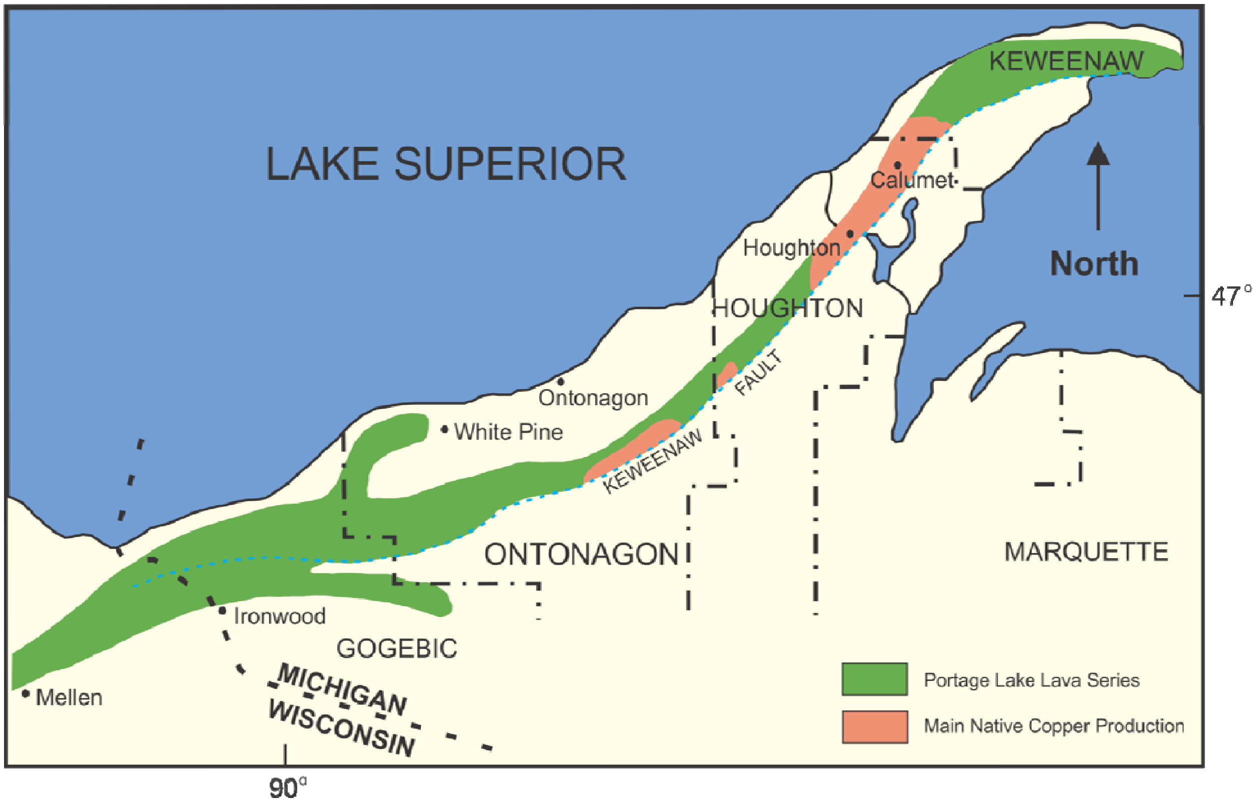
Early explorers of the Lake Superior region published a map of the area and described the copper that they had found along its shores. In 1665, Claude J. Allouez, a French Jesuit Missionary and one of the early explorers, was the first non-native man to discover copper in the Keweenaw. In 1771, Alexander Henry, an Englishman, started the first mining operation on the Ontonagon River. This was sparked by the discovery of a large native copper boulder in the river. This boulder, called “The Ontonagon Boulder”, is currently housed at the National Museum of Natural History, Smithsonian Institution, in Washington D.C. Henry’s mining operation soon failed because the native copper boulder was simply a glacial erratic lying on unmineralized Jacobsville Sandstone.

Michigan’s first State Geologist, Dr. Douglas Houghton, came to the region for the first time in 1830. He published his first report in 1841. A treaty with the Chippewa Indians was signed stating that the country was available for settlement. In 1844 mining permits were issued by the federal government. Then, in 1846, the mining permits were abolished putting all the mining lands for sale.

The Pittsburgh & Boston Mining Co. which organized itself in the Keweenaw in 1844 began operations in Copper Harbor producing a few tons of copper. In 1845, they opened the Cliff Mine, a cross-fissure vein lode, which became the first successful Native Copper mine in the world. Soon after the opening of the Cliff Mine, the Minnesota, National, and Central Mines opened. These were also fissure lodes containing large pieces of mass copper, some estimated at almost 500 tonnes each.

The copper district in the Keweenaw spans approximately 160 kilometers from Copper Harbor to White Pine Mine. The most productive native copper mines were concentrated along a 3 to 11 kilometer wide belt that spans about 50 kilometers.

Figure 6.1: Michigan Native Copper District



The first successful operations on an amygdaloidal lode were at the Quincy Mine in 1846 and the Pewabic Mine in 1853. However, many other mines were opened up that produced from amygdaloidal lodes as well. Michigan's native copper district produced most of the copper used in the United States from the years 1870 to 1910.

As mining progressed, it was consolidated into 2 major companies, Copper Range and Calumet & Hecla (C&H). In the early 1950's, Copper Range focused on the southern end of the district and the strata-bound chalcocite ore bodies at the White Pine Mine. In 1968, C&H merged with Universal Oil Products Company (UOP). Shortly following the merger, UOP operations came to a stop due to union-management disputes. Negotiations over these disputes continued for 2 years with no resolution. This resulted in mine pumps being removed, allowing ground and surface water to flood into and fill the mines. The estimated underground reserves left in the mine by C&H before the strike still remain.

The copper district of the Keweenaw produced from 1845 to 1996, when White Pine shut down operations. During this period approximately 7 billion kilograms of copper were produced from about 345 million tonnes of ore. Along with the copper, a significant amount of silver was produced.

Homestake Mining Company ("HMC") acquired an option from UOP to explore the widespread holdings within the district in 1973. Homestake Copper Company, a wholly owned subsidiary of HMC, entered into the Homestake-Keweenaw joint venture ("HKV") with INCO in April of that year. From 1973 to 1978 HKV led an exploration program in the area of copper sulfide (chalcocite) deposits in the lower zone of the Portage Lake Lava series. No mining had been previously done in these chalcocite occurrences. The HKV discovered 543S, G-2, and other hypogene chalcocite deposits in basalt flow tops. This exploration, however, ended in 1978 due to low copper prices.

In 1990, Great Lakes Minerals ("GLM") acquired a lease for the 543S deposit and drilled 10 fill-in holes in the central/main part of the deposit (Howe, 1991 and Tonto Mining, 1995). Along with the drilling, metallurgical, mining, and feasibility studies were conducted on the deposit. GLM was then issued an operating permit to mine (KEWA, 2008). Their plan for processing was to ship the mined ore to the White Pine Mill which was located 160 kilometers from the site. This operation was terminated before they actually started mining when the mill at the White Pine Mine closed in 1996.

Following GLM's attempts, Stewart Holdings of Calumet came into control of the 543S deposit and also conducted feasibility studies of mining the deposit and shipping the ore to Key Mill in Calumet for processing (Stewart, 1997). This venture also failed due to low copper prices at the time.

6.1 Historic Resources

All "reserves" and "resources" documented by previous workers are considered "historic resources". They were all created prior to February 1, 2001. The estimates, dates, and sources are available within this report. None of the historic data are NI 43-101 compliant.

The terms "indicated, inferred, and possible ore" were common terms used at the time of these historic resources. HKV used "indicated, inferred, and possible ore". The Michigan Copper Company (1989) used "drill indicated mineral inventory". A.C.A. Howe (1991) used "measured, indicated, inferred, and speculative ore reserves". KEWA (2008) used "recoverable, measured, indicated, and inferred mineral resources". All of the aforementioned terms are unacceptable according to NI 43-101 Technical Report guidelines and will only be used as background information.

Cut off values mostly ranged from 0.75% to 1.0% copper. A few higher cut off grades were used. HKV and Resource Exploration Inc. used a tonnage factor of 2.91 grams per cubic centimeter for sulfide resource blocks. A.C.A. Howe, in 1991, used a tonnage factor that varied with the grade of the block for the 543S chalcocite deposit. Some reserves were reported based upon 80% mine recovery and some based upon 100% in-situ resources. They were stated as recoverable metal as well as total mill head grade. Wet percussion drill grades were adjusted down 15% and visual estimates prior to 1975 were increased by 10%. A minimum mining width of 1.5 meters was commonly used, although some areas used 1.8 meters as a minimum.

It is important to note that none of the logging, drill hole surveys, assays, or metallurgical testing was verifiable. None of the historic data, except published records had been verified. This makes the estimates, according to NI 43-101 “historic” and unable to portray economic feasibility. Historic estimates and data cannot be relied upon; however, they can be used to establish valid targets for exploration. The data is realistic and all of the work was done by well known, reputable mining companies.

6.2 Sulfide Zone NI 43-101 Historic Resource

HKV made block model estimates based on diamond drill hole assays and cross sections. Assays were confined to specific stratigraphic horizons and the mineralized blocks were projected halfway to the next section. They used a tonnage factor of 2.91 grams per cubic centimeter.

Resource Exploration Inc. came up with an estimation after HKV in 1981 but the details of that estimate are unavailable. A.C.A. Howe prepared an estimate in 1991 after the completion of GLM’s 10-hole drilling program designed to determine the continuity of the main/central ore body at 543S. New cross sections were also generated at a 1:600 scale using both the holes drilled in the 1990 as well as the original HKV holes. Cross sections were made to be, most commonly, 61 meters (200 feet) apart with exception to the center of the deposit where some were 46 meters (150 feet) and even 30.5 meters (100 feet) apart. Plan maps were made every 15 meters (50 feet) from the 274 meter (900 feet) elevation to the 46 meter (150 feet) elevation to determine the continuity of the mineralized flow tops and fracture controlled mineralization. A.C.A. Howe found 14 different mineralized zones. The areas used for every mineralized intercept were drawn on cross section using a block instead of a polygon approach. The areas were then measured in AutoCAD and a digitizing tablet. Average true thickness was found for each resource classification by dividing the total volume by total tons. Assays were projected halfway to the next section unless the intercept was too thin, then the distance was shortened. A minimum drilled length of 1.52-meter (5 feet) was used as a minimum mining thickness with a cut-off grade of 1% copper. Michigan Copper Company’s results for their estimation calculations are included in the report; however there are no details on the methods used.

There are differences between the HKV and A.C.A. Howe 1991 543S resource. These differences are due to the elimination of several large HKV resource blocks after additional in-fill drilling was done by GLM and also due to a change in the tonnage factor. HKV used a tonnage factor of 2.91 grams per cubic centimeter while A.C.A. Howe used a tonnage factor that varied with grade within the block. Table 6.1 summarizes the different resources estimates for the various chalcocite deposits.

Table 6.1: Historical Chalcocite Deposit Resources

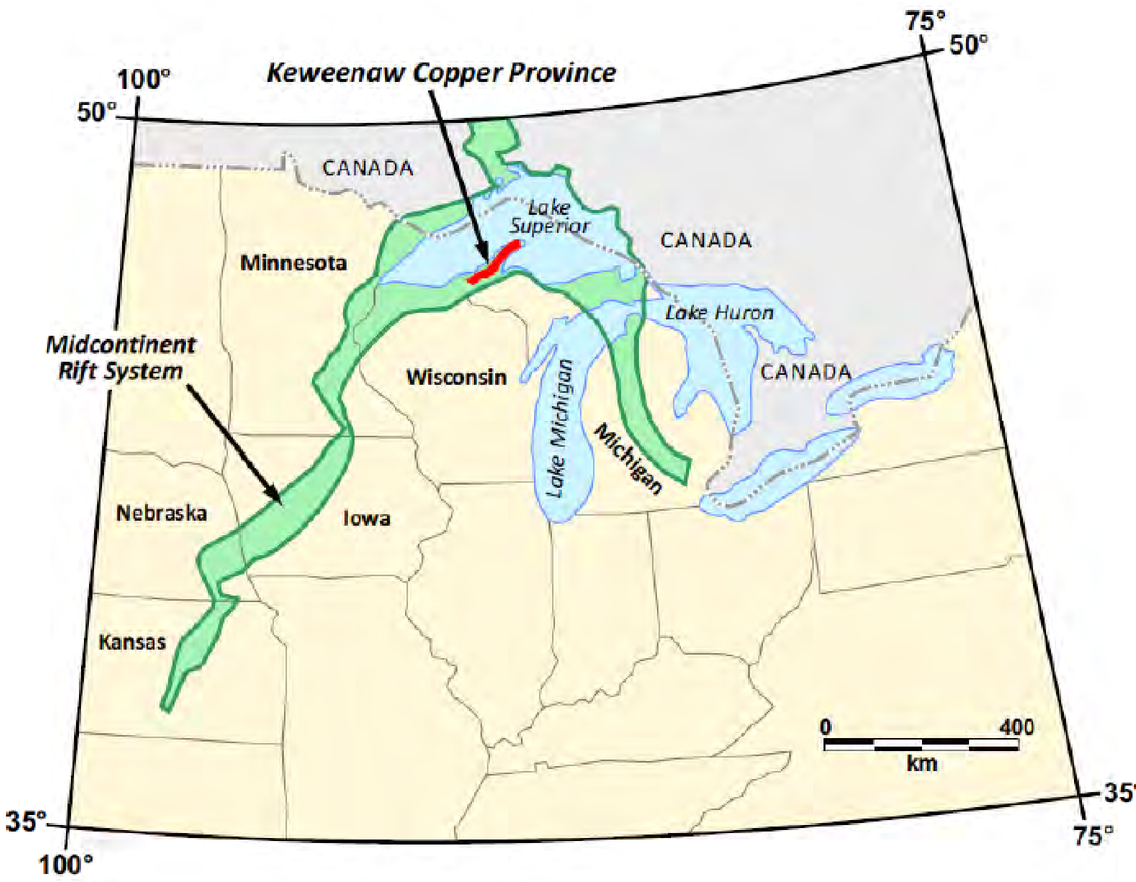
Deposit	HKV(1976)			Resource Exploration Inc. (1981)			Michigan Copper Co (1989)			A.C.A. Howe (1991)		
	Cut-Off Grade	Tons	Grade (%CU)	Cut-Off Grade	Tons	Grade (%CU)	Cut-Off Grade	Tons	Grade (%CU)	Cut-Off Grade	Tons	Grade (%CU)
543S	0.75	4,523,186	2.27	0.75	4,523,186	2.27	0.75	4,523,000	2.27			
	1.00	3,078,567	2.96	1.00	3,078,567	2.96	1.00	3,078,000	2.90	1.00	2,440,953	3.37
	2.00	1,117,472	4.59	2.00	1,117,472	4.59	2.00	1,300,000	4.00			
G-2	1.00	985,000	2.80	1.00	985,000	2.80	1.00	985,000	2.80			
	2.00	520,000	4.00	2.00	520,000	4.00	2.00	520,000	4.00			
Mount Bohemia	1.00	239,252	2.72	1.00	239,252	2.72	1.00	239,000	2.72			
	2.00	150,831	3.92	2.00	150,831	3.92	2.00	151,000	3.90			
West Mount Bohemia	1.00	446,000	2.22	1.00	446,000	2.22	1.00	446,000	2.20			
Lizzadro							0.75	656,000	1.77			
	1.00	656,114	1.77	1.00	656,114	1.77						
G-12	1.00	84,000	2.95	1.00	84,000	2.95	1.00	84,000	2.95			
G-13	1.00	95,000	2.88	1.00	95,000	2.88	1.00	95,000	2.88			

7. GEOLOGICAL SETTING AND MINERALIZATION

7.1 Regional Geology

The Keweenaw Peninsula is located along the southern portion of the Lake Superior Basin within the Middle Proterozoic Mid-Continent rift system (Figure 7.1). The known copper-bearing mineralization in this area lies within the Portage Lake Lava Series ("PLLS"), a sequence of flood basalts that are Keweenawan in age. The thick sequence of lava flows contains minor interbedded conglomerate and sandstone layers. This series is conformably overlain by the Copper Harbor Conglomerate, Nonesuch Shale and the Freda Sandstone. The series is underlain by the younger, Cambrian-aged Jacobsville sandstone.

Figure 7.1: Location of the Keweenaw Copper Province within the Midcontinent Rift System.



Intrusive rocks are not common in the Keweenaw Peninsula and gabbro, felsite and quartz porphyry of likely Kewenawan age are only a minor part of the geology. These intrusive rocks cut through the stratigraphic section and occur mostly in the lower portion of the PLLS. The one notable exception is the Bear Lake Felsite, a rhyolite plug that is intruded into the Freda sandstone north of Hancock.

The PLLS lies on the southeastern flank of a major syncline that dips below Lake Superior. The northwestern limb of the syncline is exposed at the Isle Royale National Park and on the northwest shore of Lake Superior. The base of the PLLS is truncated by a major low- to high-angle reverse fault known as the Keweenaw Fault. The fault is sub-parallel to the strike of the PLLS and thrusts the Keweenawan rocks over the relatively flat-lying Jacobsville Sandstone.

The PLLS contains both native copper and chalcocite mineralization in the Keweenaw Peninsula. The native copper mines in the conglomerates and amygdaloidal basalt flows made the “Copper Country” famous. Chalcocite mineralization in the PLLS has been explored more recently, but has not accounted for any significant copper production in the Keweenaw Peninsula. Chalcocite is the dominant source of the copper produced in the White Pine district 150 kilometers southwest of Calumet. The mineralization is found in the younger Nonesuch Shale and Copper Harbor Conglomerate at White Pine. To date, no significant copper mineralization has been identified in these sedimentary units within the Keweenaw Peninsula.

7.1.1 Regional Stratigraphy

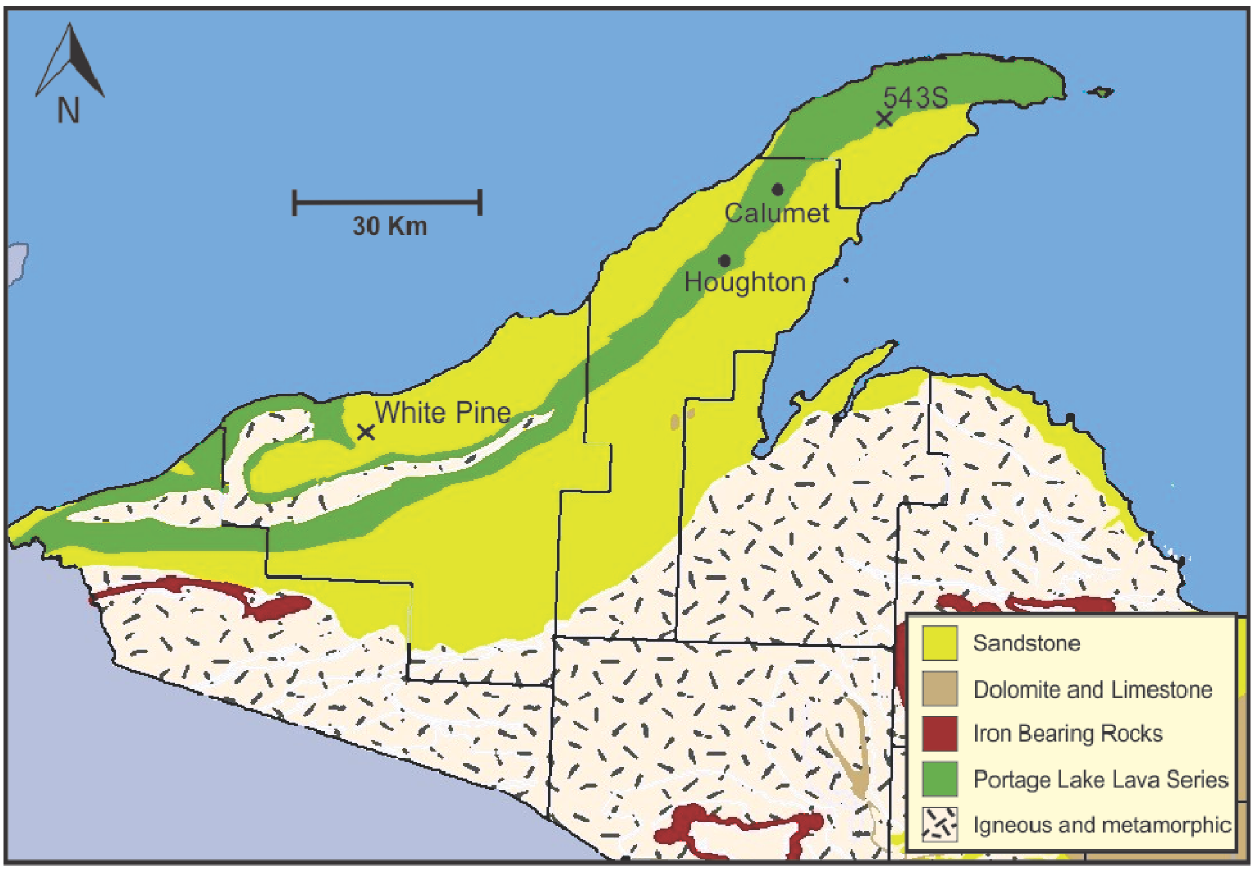
The oldest rocks in the Keweenaw Peninsula are the Keweenawan-aged Portage Lake Lava Series (PLLS). They were erupted over a 2.2-million ± 1.2-million year span at approximately 1095 Ma. The PLLS consists of sub-aerial tholeiitic flood basalts that originated as eruptions from fissures in the axial region of a gradually subsiding rift basin to the northwest. There are over 300 individual lava flows with minor amounts of interbedded sandstone and felsite pebble conglomerate beds. Individual lava flows range in thickness from a few meters to over 500 meters. The strike length can vary from a hundred meters to over 75 km.

Butler and Burbank (1929) divided the Keweenawan-aged stratigraphy into several different groups that can be traced through the mining district. The PLLS is divided into the Bohemian Range Group (±2,900 meters) at the base, which is overlain by the Central Mine Group (1,165 to ±7,600 meters), the Ashford Group (444 to ± 750 meters) and the Eagle River Group (432 to ± 700 meters). Overlying the PLLS is the Copper Harbor Conglomerate (408 to ±2,300 meters), the Nonesuch Shale (107 to 183 meters) and the Freda sandstone (275 to ? meters).

The basaltic lava flows of the PLLS typically consist of a fine-grained base that is commonly oxidized and vesicular. The interior portion of the flow is generally massive. Textures of the flow interiors include ophitic, melaphyric, porphyritic and glomeroporphyritc. The flow tops are broken down into three types. The amygdaloidal or cellular flow tops contain abundant vesicles from the trapped gas bubbles during the cooling phase of the lava flow. Fragmental flow tops are formed by breaking up of lava during the solidification process. The top becomes brecciated with fragments that range from millimeter size to usually less than 20 centimeters. "Scoriaceous" flow tops contain the same type of volcanic fragments as the fragmental flow tops, but they have a matrix of fine sandy or silty material.

The PLLS contain interbedded sediments, usually conglomerates and minor amounts of sandstone. The pebbles in the conglomerate are mostly siliceous, including mainly felsites and quartz porphyry. The matrix has the same general composition as the pebbles. The thickness ranges from very thin to over 10 meters and some individual conglomerate units have been traced for over 80 kilometers. The conglomerates can contain lenses of sandstone.

Figure 7.2: Geology of the western Upper Peninsula of Michigan. Chalcocite mineralization is found around the White Pine District and the 543S occurrence.

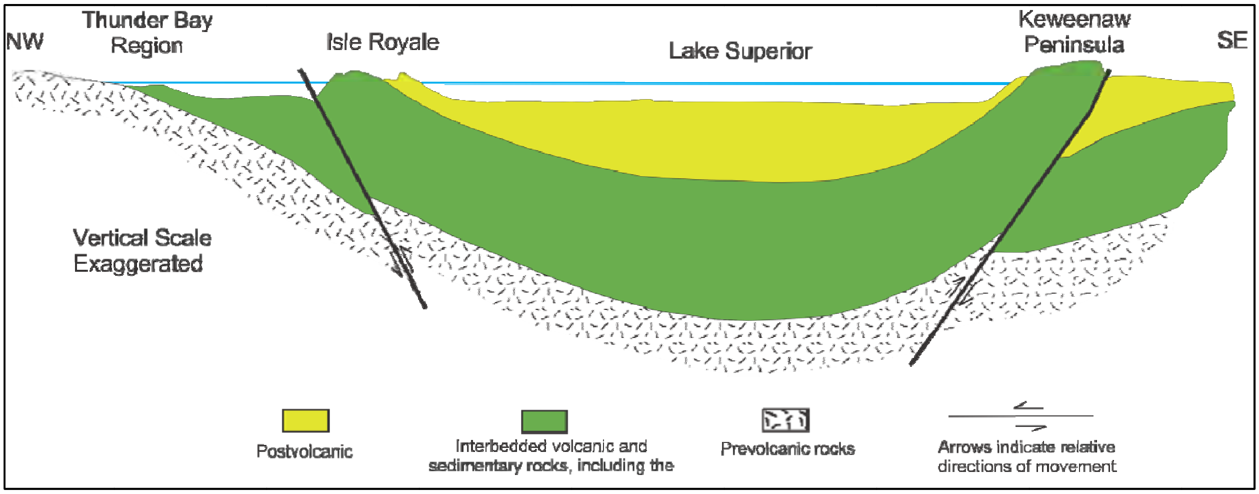


7.1.2 Regional Structure

The dominant structural feature in the region is the Lake Superior Syncline. The Keweenaw Peninsula lies on the southeastern limb of the structure. The axis of the syncline lies within Lake Superior. The rocks dip north to northwest toward the axis of the syncline. The northwestern limb of the syncline outcrops in

Isle Royale and along the northwest shore of Lake Superior as seen in Figure 7.3. The strike of the stratigraphy on the southeast limb mimics the shape of the Keweenaw Peninsula, as seen in Figure 7.4. On the eastern edge of the peninsula, the strike is East-West to slightly southeast. To the south, the strike is about N30°E. The rocks dip north to northwest at 25° to almost 90°.The steeper dips are found near the base of the PLLS, proximal to the Keweenaw Fault. The dips shallow as they extend into Lake Superior.

Figure 7.3: Cross section of Lake Superior Geology.



The other major structure in the region is the Keweenaw Fault. It is a reverse fault that parallels the Lake Superior Syncline. The fault is the boundary where Keweenawan rocks have been thrust over the younger Cambrian Jacobsville sandstone. The dip of the fault is nearly parallel to the strike of the Keweenawan rocks (Figure 7.4). That dip is 20° to 70° to the north-northwest. The fault can be traced from the eastern tip of the peninsula southwestward for about 150 km. Similar faults are found along the extension of the rocks into Wisconsin. Zones of imbricate faulting are evident proximal to the Keweenaw Fault boundary, including the vicinity of the 543S deposit. Some of the mafic dikes/sills in the area may be controlled by this faulting. While Keweenaw Fault is not known to be mineralized anywhere in the district, some of the structures related to the fault may be mineralized.

The southeastern limb of the Lake Superior syncline is modified in this region by a series of minor transverse folds. In the northern part of the district most of these folds have a mild curvature that plunges north-northwest. Numerous faults and fissures associated with these folds strike parallel to the nearest fold axis. Some of the mines in the region are found within these fissures, including the Cliff, Central, Phoenix, Delaware and Copper Falls. In the southern part of the district, many of the fissure zones are generally parallel to the stratigraphy, but are more steeply dipping.

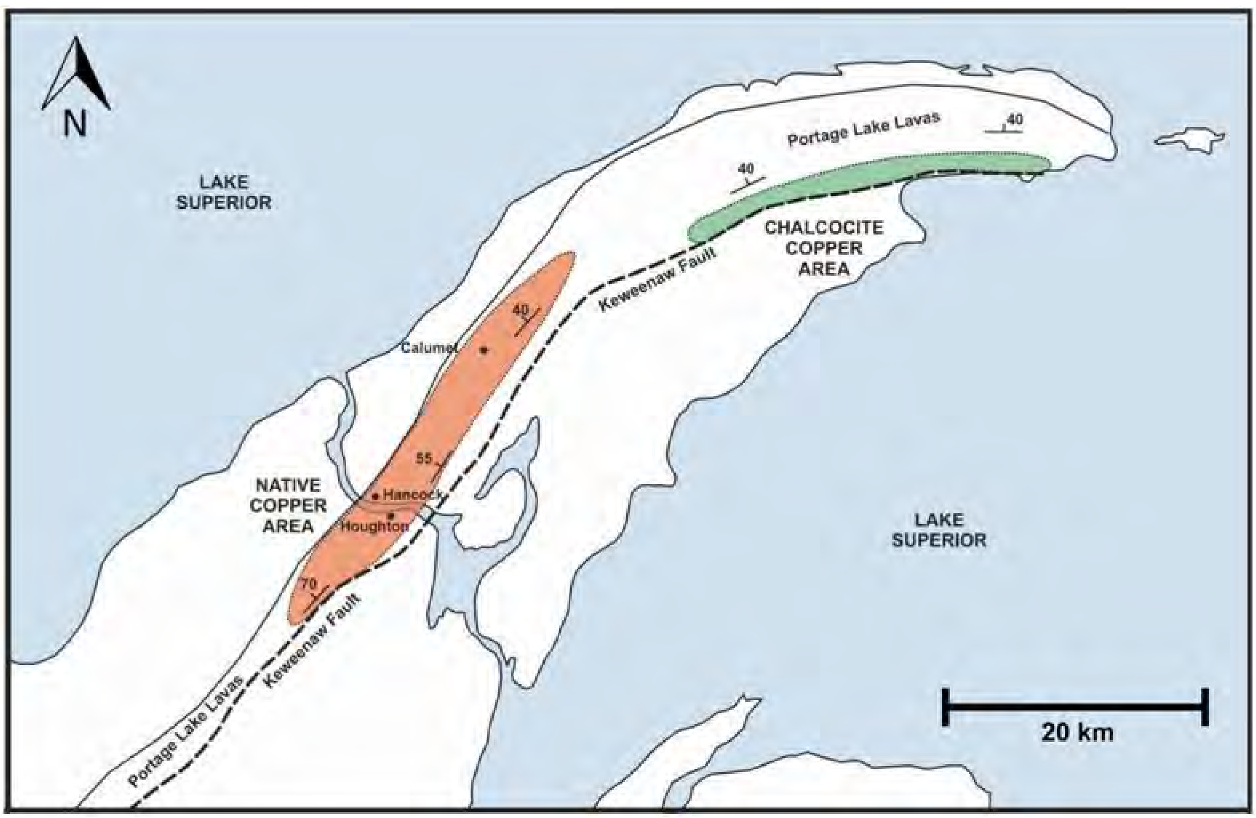
7.1.3 Regional Alteration

Outside of the ore deposits of the region, the most common alteration seen is hematization. This alteration is found throughout the flow tops of the PLLS. Butler and Burbank (1929) conclude that the hematite was due to the action of H_2O and CO_2 gases given off during the time of the lava extrusion.

7.1.4 Regional Mineralization

Although the PLLS is exposed over a 250 kilometer belt, most of the historic copper production occurred in a 45 kilometer section. About 96% of the native copper production came from a zone stretching from the Mohawk Mine on the north to the village of Painesdale on the south (Figure 7.4). Exploration to the north and south of this zone was conducted over the years with little success. The physical and chemical characteristics of the ore-bearing horizons are similar to rocks outside this zone. The same gangue mineralogy is found, however, only minor amounts of copper are present.

Figure 7.4: Location of Primary Native and Chalcocite Copper Provinces in the Keweenaw Peninsula



7.1.5 Native Copper Deposits

Native copper was actively mined from this area between 1845 and 1968. The average recovered grade of the copper mined was 1.47%, including the copper recovered from stamp mill sands. The native copper deposits were known for their continuity, both laterally and at depth, as well as their consistency in grade. The largest producer, the Calumet and Hecla conglomerate lode, was mined over a strike length of 3.25 kilometers, to a depth of about 2,800 meters. Native copper from the Kearsarge Amygdaloid lode was mined over a strike length of 11 kilometers to a depth of 2,200 meters.

Silver has been produced along with native copper in this area. In the upper levels of the mines, silver occurs as native metal associated with copper. At depth, silver is usually amalgamated with native copper. Silver was recovered in some cases, but it was generally incorporated in “fire-refined” copper when it was smelted.

The two major types of deposits mined in the native copper district are lodes and fissures. Lode mineralization in the conglomerates occurs primarily as replacement in the matrix of the conglomerate. Mineralization in the “Amygdaloid” lodes is found as replacement and disseminations in the cellular, fragmental and scoriaceous tops of the basalt flows. The fissure deposits consist of disseminated concentrations and masses of native copper that either cross cut or parallel the stratigraphy. The fissures in the northeastern part of the district generally crosscut the stratigraphy. At the southwestern portion of the district, most of the fissures strike parallel to the stratigraphy, but crosscut it with a steeper dip.

Although the conglomerates make up only a small percentage of the PLLS, they are an important host for native copper mineralization. Over twenty separate conglomerate horizons have been mapped in the mining region. The conglomerates are composed primarily of red felsite pebbles in a fine-grained sandy matrix of the same material. The sandy lenses in the conglomerate provided the channels for the mineralizing solutions. The most common alteration feature of this ore is the bleaching caused by the removal of hematite. Alteration minerals associated with the native copper deposition include adularia, epidote, pumpellyite, calcite, quartz and chlorite.

The amygdaloid lodes are in the tops of the basalt flows of the PLLS. The flow tops include the cellular, fragmental and scoriaceous types. The fragmental is the most common type. The brecciated nature of this type allows better permeability for the mineralizing solutions. In addition to the same alteration minerals found in the conglomerates, the amygdaloid lodes commonly contain prehnite, datolite, analcite, and laumontite. Apophyllite is less commonly found. As with the conglomerate lodes, the amygdaloid lodes can be traced for kilometers along strike and to thousands of meters deep.

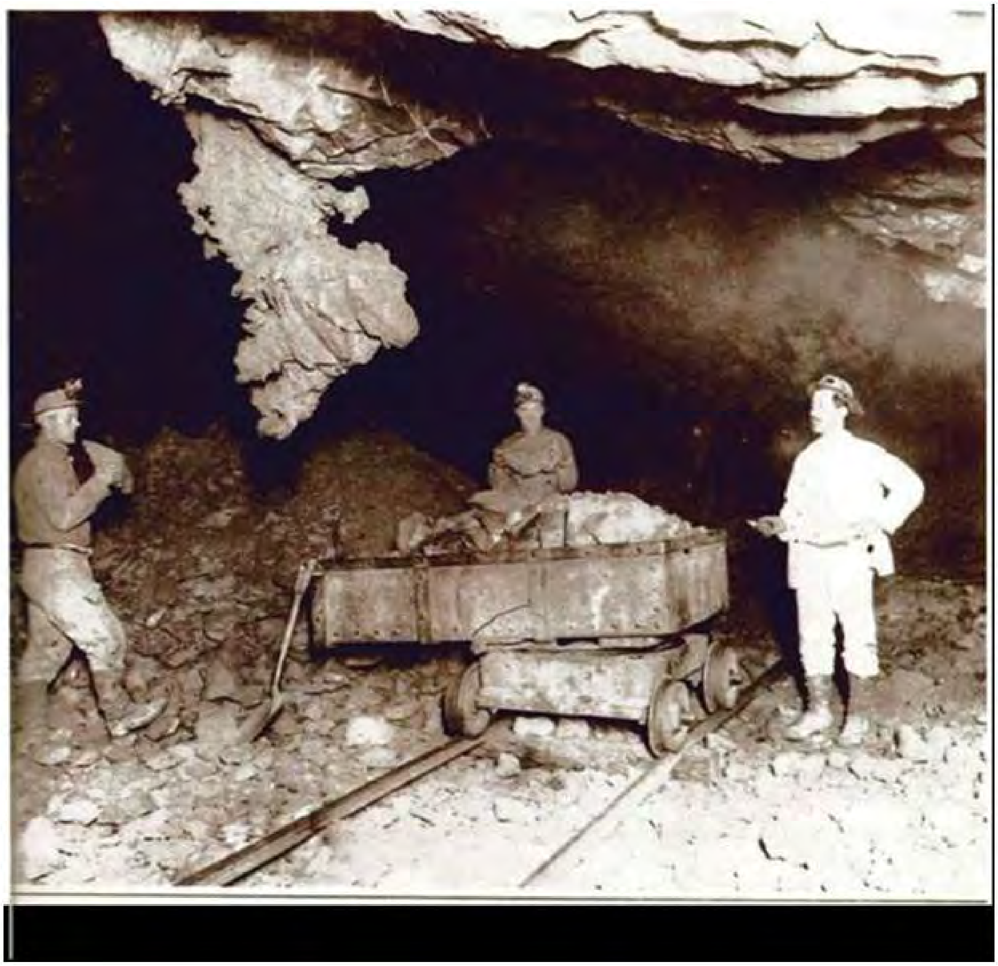
The fissure lodes are commonly found along structures that cross cut the stratigraphy. These structures developed as tension fractures on anticlinal folds that are transverse to the Lake Superior Syncline. Some of the fissures in the southern end of the district do not the cross cut stratigraphy. They are nearly parallel to stratigraphy and dip only slightly steeper than the bedding. Butler and Burbank (1929) suggest that these fissures may be related to the Keweenaw Fault. These lodes were the first ones that were mined and are famous for the large masses of copper. Individual masses of several hundred tonnes have been found. Figure 7.5 shows an example of the massive copper.

7.1.6 Chalcocite Deposits

Chalcocite mineralization tends to occur near the base of the PLLS, north and east of the native copper belt (Figure 7.4). Historically, this mineralization has not been a major exploration target. Most of the drilling by the Calumet and Hecla Company in the chalcocite zone was completed in the 1960's. Exploration continued in the 1970's by the Homestake Keweenaw Venture and work was done by Great Lakes Minerals in the early 1990's. The 543S deposit is the largest chalcocite occurrence found to date, but exploration in this zone has not been nearly as extensive as in the native copper area.

Mineralization in the chalcocite zones is mostly found in the basalt flows of the PLLS. Most of the mineralization occurs in the flow tops, similar to the native copper amygdaloid lodes. The fragmental flow tops are the most common host, but ore-grade mineralization is also found in the scoriaceous and cellular flow tops.

Figure 7.5: Large mass of fissure copper hanging from the back of a stope in the Baltic Mine, Ca 1890 (Source: Michigan Technological University Archives, Houghton Michigan).

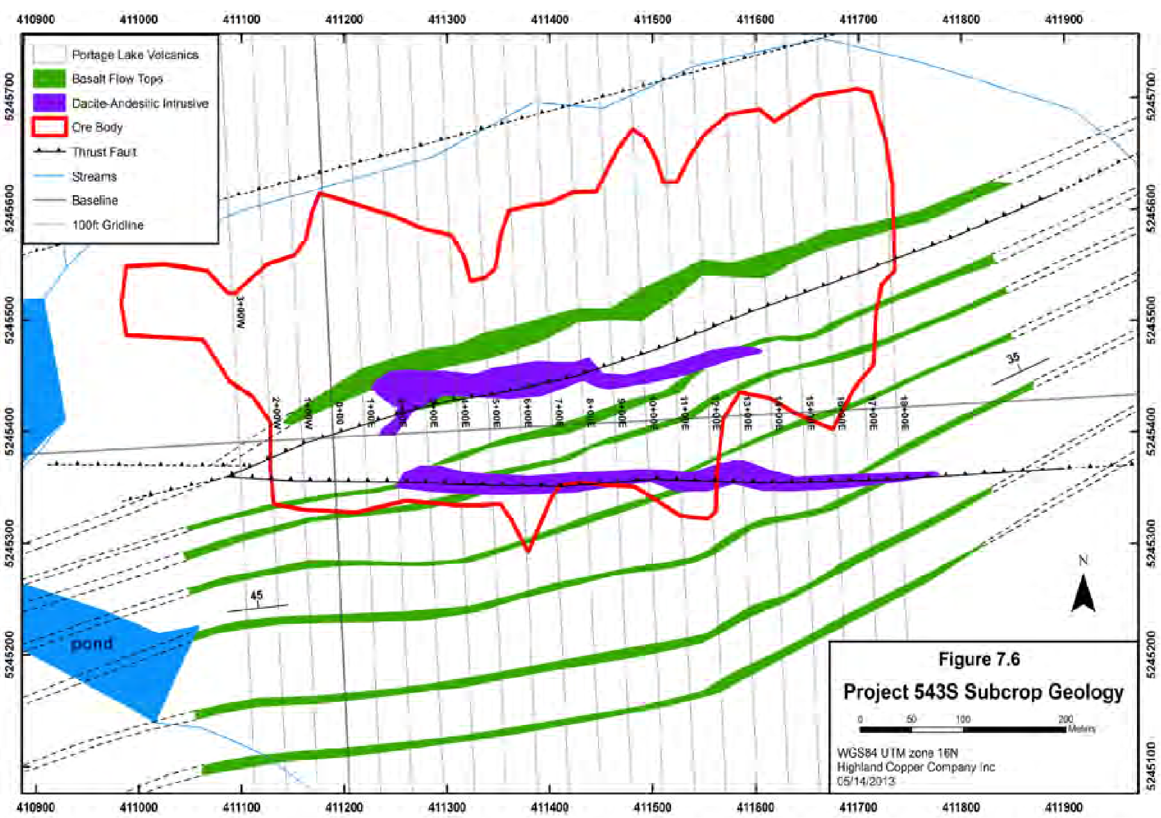


Faulting appears to play an important part in the distribution of mineralization. Besides being a common occurrence in flow tops, chalcocite mineralization is also found in and around fractures in massive basalt. There also appears to be a spatial relationship with dacite and andesite dikes. The dikes may be following the same structures that provided channels for the mineralizing fluids. The faulting that controls the mineralization includes both cross-cutting fault zones and imbricate faulting associated with the Keweenaw Fault.

7.2 Property Geology

The 543S deposit encompasses a 21 hectare area underlain by basaltic flows of the 1.1 Ma Portage Lake Volcanic Series. The flows are covered by 1 to 50 m of glacial till and do not outcrop in the vicinity of the deposit. Overburden is thinnest in the southern part of the property and thickens to the north. Because of the overburden cover, the subcrop geology shown in Figure 7.6 has been totally interpreted from drill holes.

Figure 7.6: Project 543S Subcrop Geology



Within the deposit area, seven separate basalt flows have been identified. The flows have an average thickness of approximately 33 m and are cut by two notable fine grained sill-like dacitic to andesitic subvolcanic intrusives.

On the western side of the deposit, flows strike at an azimuth of 075° to 085° and dip 45° to the north. Slight flexures in the central part of the property change the strike to an azimuth of approximately 065°-075° and dip of 35° to the north. Although the deposit has locally undergone significant reverse faulting, particularly in the mineralized zone, no major stratigraphic offset is apparent. The lack of any notable offset is probably because the faults strike and dip subparallel to the flows. The overall effect is that basalt flows within the fault are highly fractured, rather than notably displaced.

Dike (sill) emplacement was controlled by faults. On individual geology cross-sections they appear to be conformable, however, on a property scale (Figure 7.6) it is apparent that the faults and dikes strike slightly more east-west and gradually cut the basalt flow stratigraphy.

For drill core logging purposes the volcanic stratigraphy has been broken into three major units – flow interiors, flow tops and dikes. The major units have been further divided on the basis of composition and textures. Each of these distinctive rock types is described below.

7.2.1 Flow Tops

Flow tops refer to the upper part of individual flows where degassing and flow brecciation have produced a chaotic mix of amygdaloidal and fragmental textures. On the 543S property flow top units pinch and swell and may vary from less than 1 to over 12 meters thick. On the basis of textures, distinctive amygdaloidal, fragmental and scoriaceous flow top types have been identified.

Amygdaloidal Flow Tops

Amygdaloidal flow tops are fine to very fine grained basalts with a high density (up to 40%) of subrounded vesicles that are up to 1.5 cm in diameter (Figure 7.7). Vesicles occasionally remain vuggy, but in most cases they are variably filled by epidote, chlorite, calcite, quartz, pumpellyite and, in mineralized zones, chalcocite. Lower contacts can vary from gradational to quite sharp, while upper contacts are abrupt.

Figure 7.7: Amygdaloidal Flow Top with Calcite and Epidote Filling Amygdules (Drill Core)

Fragmental Flow Tops

Fragmental flow tops are chaotic clast and matrix supported breccias with 80-95% angular to subangular basalt clasts (ophitic, amygdaloidal and melaphyric). The clasts, which range from less than 1 cm to over 20 cm in diameter, lie in a fine grained to aphanitic matrix commonly altered to calcite, epidote, chlorite and laumontite (Figure 7.8). Upper contacts are sharp, but lower contacts are often slightly gradational.

Figure 7.8: Fragmental Flow Top with Predominantly Calcite-Epidote Matrix (Drill Core)

Scoriaceous Flow Tops

“Scoriaceous Flow Tops” is an historical term used to describe flow tops with clasts supported in an apparently sedimentary matrix. At the 543S deposit it has been applied to flow top breccias with 50 – 70% clasts supported in a fine grained volcanic-sediment matrix (Figure 7.9). Thin section studies of the matrix have shown that it is immature and primarily composed of very fine lithic and crystal fragments (Carlson, 2013). Clasts are primarily poorly sorted angular to subrounded amygdaloidal flow top with diameters ranging from less than 1 cm to over 1 meter. Matrix sediment is typically light brown and fine to very fine grained. Locally, scoriaceous flow top breccias may be overlain by up to one meter of polymicitic conglomerate and/or massive to laminated tuffaceous wacke.

Figure 7.9: Scoriaceous Flow Top with Amygdular Clasts and Thick Interstitial Laminated Tuffaceous Sediment (Drill core)

7.2.2 Flow Interiors

Ophitic Basalts

The term “ophitic basalt” has been historically used to describe flow interiors throughout the Keweenaw Peninsula. Ophitic flow interiors frequently have a characteristic mottled appearance with light grey subrounded “spots” up to 1 cm in diameter in a fine grained to aphanitic greenish grey matrix (Figure 7.10). Grain size increases toward the middle of individual flows and thick flows can be coarse grained in the interior.

Figure 7.10: Ophitic Basalt in Flow Interior (Drill Core)

The mottled appearance is produced by glomeroporphyritic plagioclase laths embayed in clinopyroxene. Microscopic studies of ophitic basalts from the 543S deposit have shown that textures actually vary from sub-ophitic to ophitic, or, are technically non-ophitic (Carlson, 2013).

Although amygdules are considered to be a flow top characteristic, they are not uncommon in flow interiors. Chlorite, calcite and epidote are the most common minerals filling amygdules in flow interiors and flow tops.

Melaphyric Basalt

Toward the margins of flows, mottled ophitic basalts grade into dark grey, fine grained to aphanitic melaphyric basalts with no discernible textures other than rare amygdules filled by chlorite, calcite and epidote.

7.2.3 Dikes

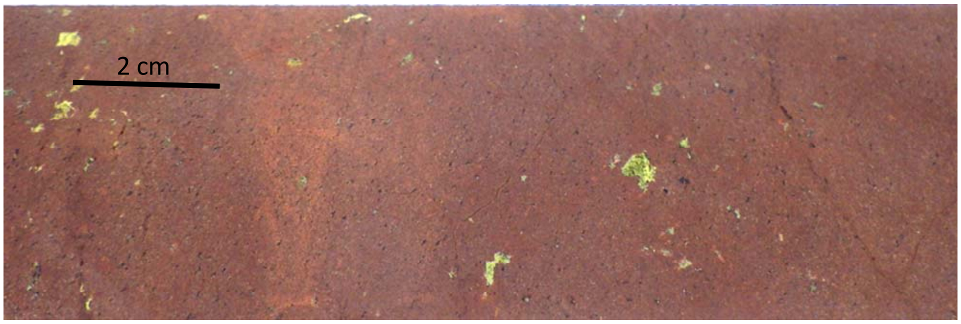
Although they have historically been referred to as dikes, the subvolcanic intrusives that interfinger with basaltic flows are more sill-like and do not abruptly cross-cut the volcanic stratigraphy. On the property geology map (Figure 7.6) two dikes strike approximately 80^o across the property.

The intrusives are fine grained to aphanitic and typically two to five meters thick, although locally they may be up to 20 m in thickness. Due to the fine grain size and absence of textures, dikes can be difficult to differentiate from melaphyric flows. In drill core, dike contacts with mafic flows are sharp and range from apparently conformable to cross-cutting and slightly brecciated. Chilled margins are usually not evident. On the basis of grain size and color, dikes are logged as andesitic or dacitic.

Dacite Intrusives

Dacitic intrusives are predominantly reddish brown, very fine grained and massive (Figure 7.11). Locally, they can have small (<3 mm) amygdules commonly filled by calcite or epidote. In microscopic thin sections, fine feldspar laths are evident in trachytic flow textures (Carlson, 2013). There has been some debate about whether these dikes are actually dacitic or simply altered andesites. The thin section studies revealed primary k-feldspar and quartz in the groundmass and, therefore, the reddish brown intrusives are dacites.

Figure 7.11: Reddish Brown Dacite Dike with Epidote Filling Amygdules (Drill Core)



Andesite Intrusives

Andesitic intrusives are grey to reddish grey, massive, and fine to locally almost medium grained (Figure 7.12). They are differentiated from dacite intrusives on the basis of darker color and slightly larger grain size.

Figure 7.12: Dark Grey Andesitic Dike (Drill Core)

7.3 Structure

The dominant structural features of both the region and the property are the Lake Superior Syncline and the Keweenaw fault.The property is located on the southeastern limb of the Lake Superior Syncline as described in the regional geology section above.

The southeastern limb of the Lake Superior Syncline on the Keweenaw Peninsula dips to the northwest below the lake. In the 543S property area, the basalt flows of the PLLS strike at an azimuth of 065° to 080° and dip 35° to 45° NW. On the western side, the strike and dip are 080° and 45° NW. The strike and dip changes to 065°E and 35° NW on the eastern side through gentle flexures as seen in Figure 7.13. Regionally, the southeasten limb is modified by transverse folds with a mild curvature and steeply dipping transverse faults. On the property, the scale is too small to determine if the flexure in the bedding represents one of these transverse folds.

The other major structural feature in the region is the Keweenaw Fault. This fault is a reverse fault that roughly parallels the axis of the Lake Superior Syncline. It marks the contact between the older Keweenawan PLLS and the younger Jacobsville Sandstone. The fault lies 1000 to 1200 meters to the southeast of the deposit as seen in Figure 7.13. There are imbricate faults associated with the Keweenaw Fault that appear to have an influence on the geometry of the geology and mineralization within the project area. There is abundant faulting and shearing in the hanging wall of the mineralized zone. Some of the faulting is at oblique angles to the bedding of the basalt flows.

The dacite to andesite dikes/sills appear to be controlled by faulting. The southernmost dike zone strikes almost east-west, crosscutting the basalt flows. This dike zone has a close spatial relationship with the mineralization. The other dike zone is stratigraphically higher and lies about 75-100 meters to the north at the surface (Figure 7.6). This hanging wall dike zone is not as continuous as the dike zone to the south.

On the western side of the property, this hanging wall dike zone parallels the southern dike and pinches out by section 1W. East of section 6E, the dike loses continuity, tending to pinch and swell. East of section 13E, the hanging wall dike zone disappears.

At the western edge of the deposit, the main dike zone thins and plunges to the northwest. The mineralization, which follows this dike, also thins and plunges to the northwest. At the eastern end, the dike thins and flattens. Only trace mineralization is found.

7.4 Alteration

Throughout the Keweenaw Peninsula, basalts of the Portage Lake Lava Series have undergone low to very low grade burial metamorphism (< 300^{o}C). Epidote, chlorite and pumpellyite concentrated in permeable flow tops are evidence of this early metamorphic event.

Secondary alteration occurs in areas like the 543S deposit where faults channeled hydrothermal fluids that produced more intense alteration and, locally, copper mineralization. Within the deposit area, alteration intensity is largely dependent on permeability created by original flow textures and/or later faults and fractures.

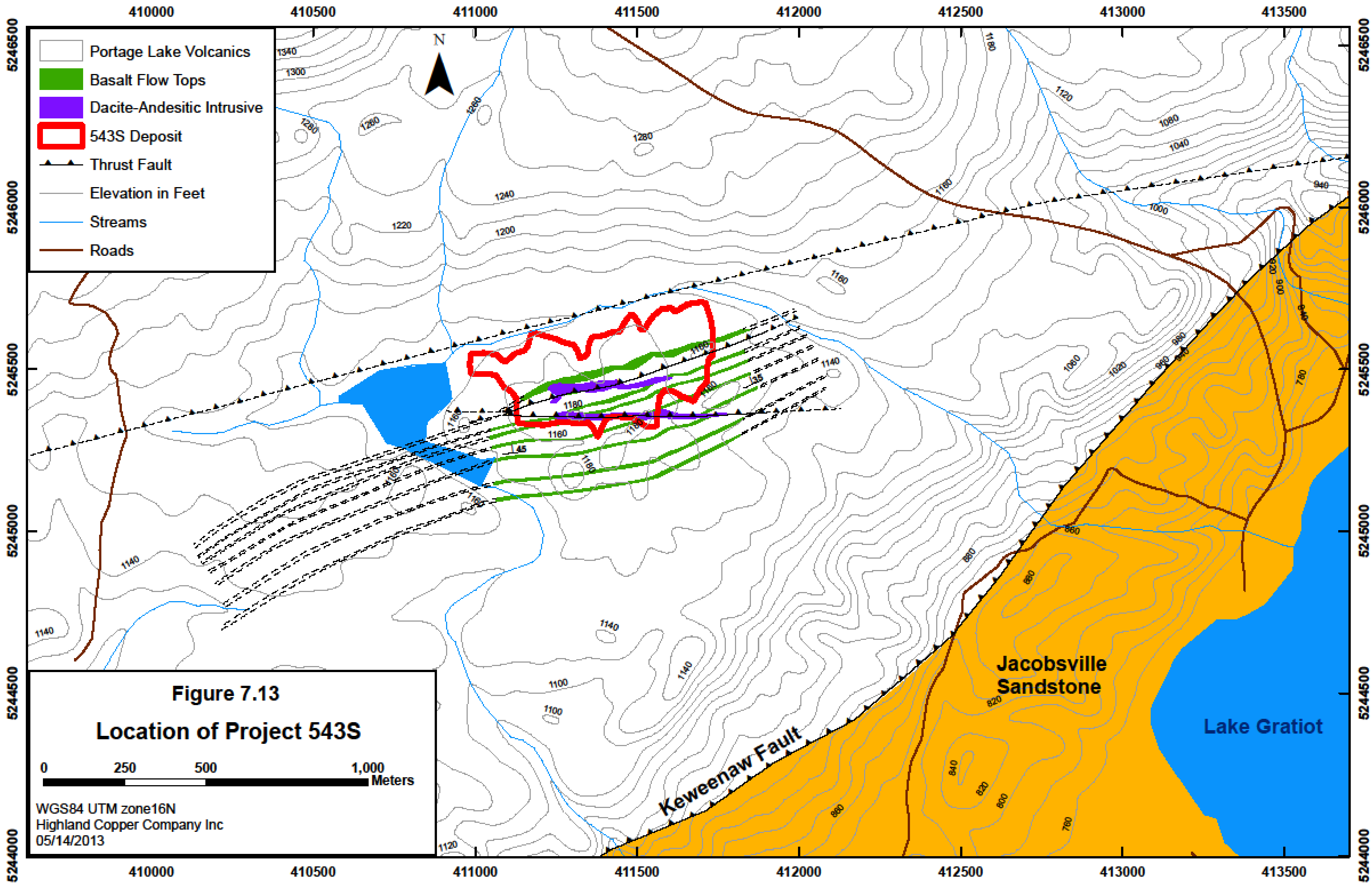
Flow top amygdules and fragmental breccias provided primary channelways for secondary hydrothermal fluids. Amygdules and the matrix of fragmental breccias are frequently filled by chlorite, calcite, epidote, hematite, and to a lesser extent, quartz, prehnite, pumpellyite, and potassium feldspar. Alteration is most intense where flow tops are cut by structures. In these areas, clasts and amygdular basalts have undergone more pervasive alteration.

Ophitic basalts in flow interiors are typically relatively fresh with weak saussuritization of plagioclase and chlorite-epidote in amygdules as the only notable alteration. In more heavily fractured zones, alteration is much more intense and reddish brown hematization is pervasive. Fractures are filled by chlorite, adularia, calcite, hematite and quartz.

Based on mineral relationships, Maki (1999) interpreted the paragenetic sequence of the major alteration minerals. According to his interpretation, chlorite, epidote, quartz and potassium feldspar predate chalcocite deposition, hematite is contemporaneous, and calcite and laumonite are late.

Within the 543S deposit area there is no apparent correlation between alteration style or intensity and chalcocite mineralization. Mineralized and unmineralized flow tops have epidote, chlorite, calcite, hematite and laumontite filling amygdules, fractures and interstities between clasts. The only obvious difference is that in mineralized zones chalcocite occurs with, and possibly replaces, earlier alteration minerals. Pervasive hematization may be more common in mineralized zones, but this observation needs to be studied before a definite correlation is confirmed.

Figure 7.13: Location of Project 543S



7.5 Mineralization

At the 543S copper deposit, at least 99% of the copper content occurs in the mineral chalcocite and < 1% is present in bornite, chalcopyrite or as native copper. Although at least trace chalcocite can occur almost anywhere in drill holes, most of the mineralization is concentrated in a more highly fractured and faulted zone that probably served as a preferential conduit for mineralizing fluids. To date, drilling programs have defined the zone of potentially ore grade chalcocite mineralization from grid lines 2W to 17E, a strike length of approximately 600 m (Figure 7.6). The zone varies from less than 1 to over 45 meters in true thickness and has a known down-dip extent of up to 300 m.

The geometry of the mineralized zone appears to be primarily controlled by dikes because the southern dike acts as a sharp footwall, while the northern dike is the approximate hangingwall. The cross-section in Figure 7.14 is a good illustration of chalcocite mineralization concentrated between the two dikes. At the eastern and western margins of the deposit, the dikes thin and mineralization diminishes.

Figure 7.14: Cross-section of Drill Holes on Grid Line 4+00E

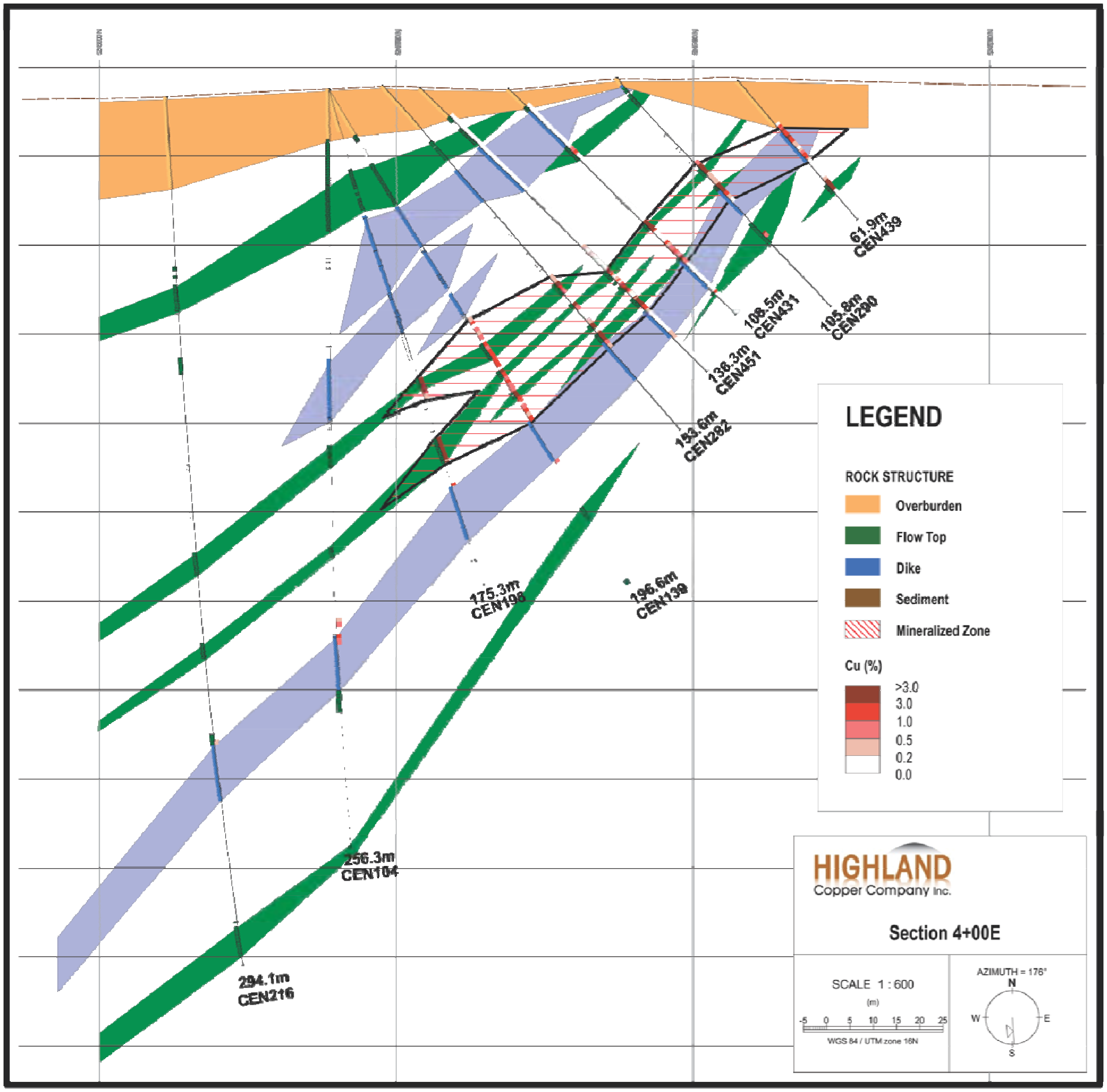


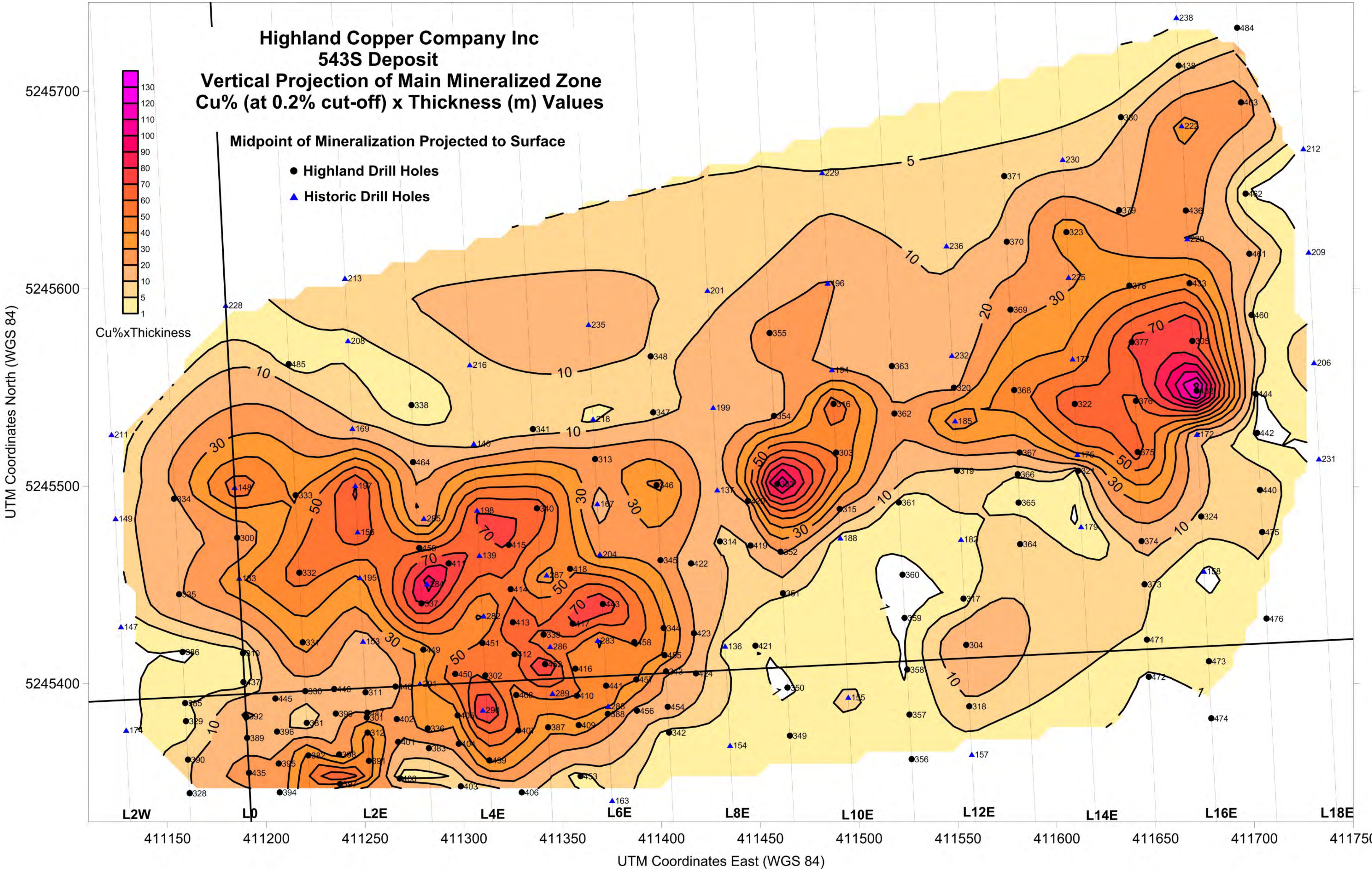
Figure 7.15 is a Cu Grade (%) x Thickness (m) contour diagram with the center points of mineralized zones projected vertically to surface. The diagram shows chalcocite mineralization concentrated in western and eastern zones separated by weaker mineralization located in the vicinity of the minor flexure located between grid lines 7E and 8E (Figure 7.6).

The western mineralized zone strikes east-west for approximately 300 m and extends at least 300 m down-dip. Within the western zone, higher grade mineralization subcrops over 200 m of strike length and continues for approximately 200 m down-dip. Although the western zone strikes approximately east-west, zones with higher Cu grade x thickness values have a more east-northeast orientation that may reflect the strike of permeable flow tops.

The Cu grade x thickness diagram shows that there is no significant north-south offset in the vicinity of grid line 8E, but to the east, mineralization is concentrated down-dip in thick zones with limited vertical extent. The reason for the change in geometry is unknown, but it could possibly reflect a change in the attitude of faults controlling mineralization.

At the eastern end of the deposit the down-dip extent of the mineralized zone increases to 200 meters before it abruptly thins in drill holes on grid line 18E. The contour map also shows that toward the eastern end of the deposit mineralization plunges down-dip to the north-northeast and remains open at depth.

Figure 7.15: Contoured Cu% x Thickness (m) Diagram for the Main Mineralized Zone at the 543S Deposit



7.6 Styles of Chalcocite Mineralization

Approximately 80 to 90% of chalcocite mineralization is concentrated in flow top breccias and amygdules. The remaining 10 to 20% occurs in dikes and flow interiors adjacent to flow tops. Each mineralization style is described below and shown in photos.

7.6.1 Flow Top Chalcocite Mineralization

Fragmental Flow Top Breccias

Flow top fragmental breccias typically consist of 80-95% basalt clasts and 5-20% interstitial space filled by alteration minerals such as calcite, chlorite, epidote and laumontite. In mineralized zones the breccia matrix is variably filled by disseminated to massive chalcocite (Figure 7.16). In addition, chalcocite fills veinlets, solution cavities, and amygdules in breccia clasts. The combination of mineralization styles produces copper grades that locally can be up to 15%.

Figure 7.16: Fragmental Flow Top with Interstitial Chalcocite

7.6.2 Scoriaceous Flow Top Breccias

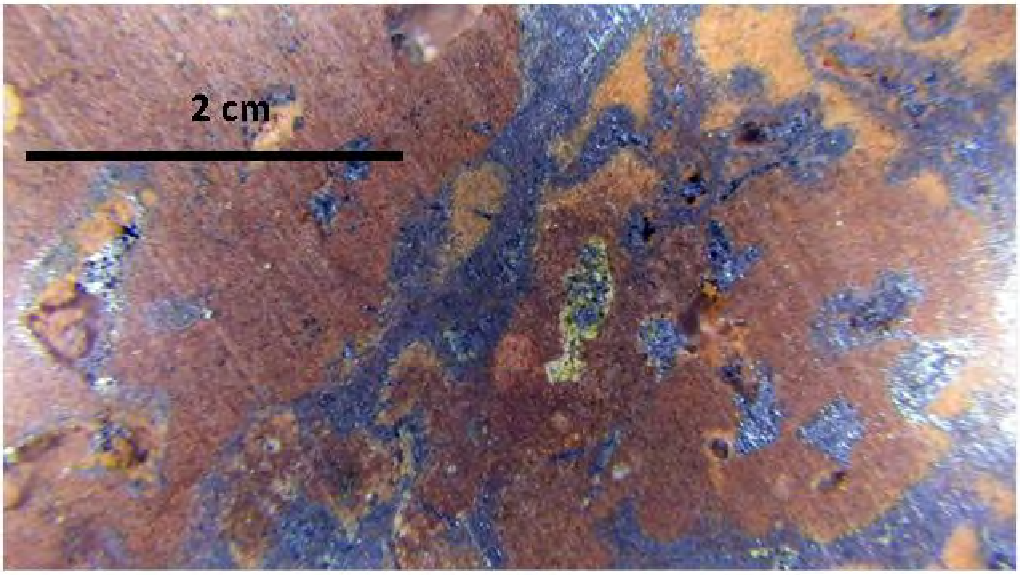
Scoriaceous flow top breccias typically have 60-70% basalt clasts supported in a fine grained volcanic-sedimentary matrix. In copper-enriched breccia zones chalcocite mineralization rims clasts, fills interstities between clasts and fills veinlets, vugs and vesicles within clasts (Figure 7.17). In sediment dominated sections chalcocite occurs in blebs and clots, fine disseminated grains and in fine veinlets.

Figure 7.17: Scoriaceous Flow Top with Interstitial and Fracture-filling Chalcocite. CEN 353, 113.7-114.2m (10.5% Cu)

Amygdaloidal Flow Tops

In less brecciated flow tops chalcocite mineralization is primarily concentrated in amygdules (Figure 7.18) Additional chalcocite occurs in fractures, gashes and fine disseminated grains.

Figure 7.18: Amygdaloidal flow top with chalcocite filling amygdules and fractures.



7.7 Mineralization in Flow Interiors and Dikes

Ophitic and Melaphyric Flows

Although flow tops are the primary host for chalcocite mineralization, in drill holes with thick ore-grade intersections chalcocite mineralization extends into adjacent ophitic and melaphyric flows. In flow interiors, chalcocite occurs in fine disseminated grains, coarse blebs, veins (Figure 7.19) and distinctive very fine spider web-like stringers (Figure 7.20). Typically, chalcocite mineralization is less obvious and lower grade in flow interiors, but copper grades can be up to 10% in zones with spider web style mineralization.

Figure 7.19: Thin Chalcocite Vein Cutting Ophitic Basalt. CEN 353, 124.2-124.7 m (0.7% Cu)

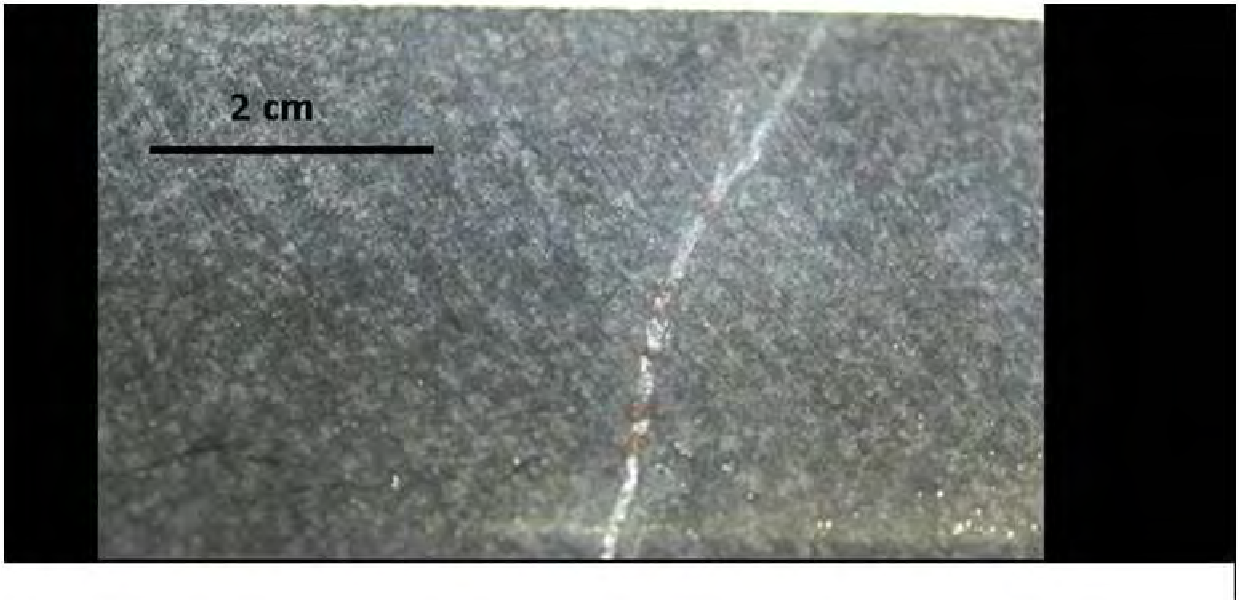
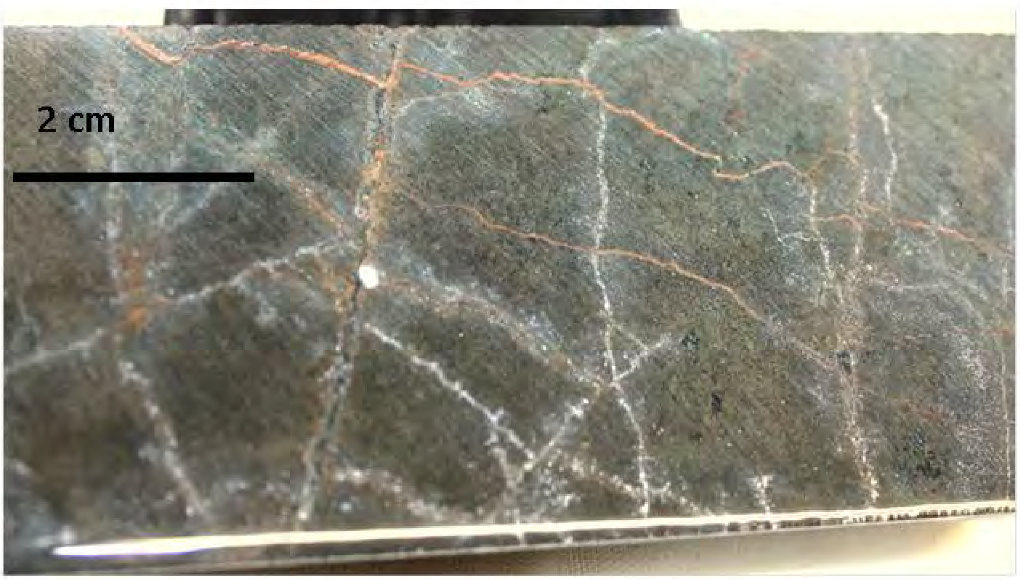


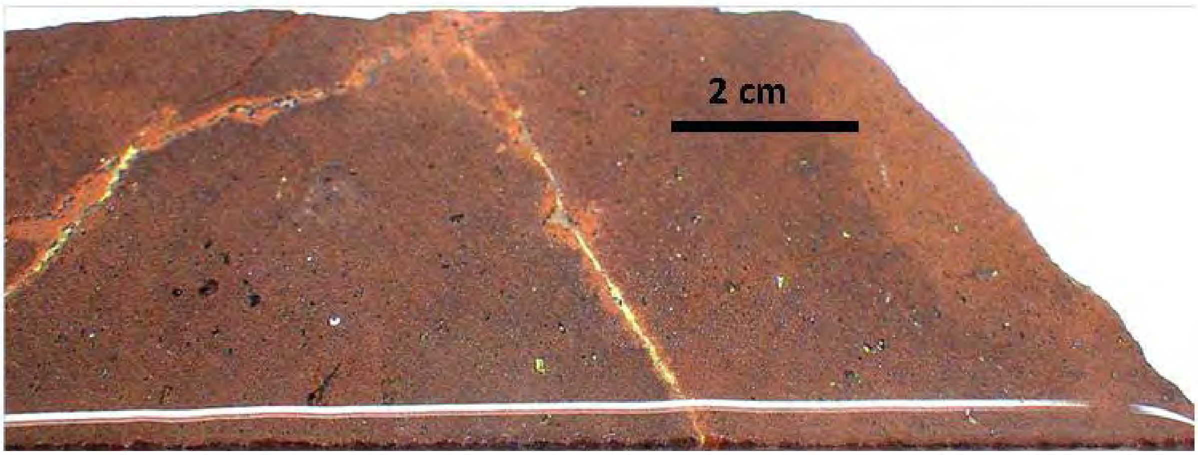
Figure 7.20: Fine Chalcocite Veins Cutting Melaphyre. CEN 353,121.7-122.2 m (10.5% Cu))



Dikes

In dikes chalcocite mineralization occurs in fine disseminated grains and fills rare amygdules and veins that can be up to two cm thick (Figure 7.21). Relative to the other rock types, dikes appear to be a preferential host for native copper and silver. Locally, copper grades can be quite high, but predominantly are less than 1%.

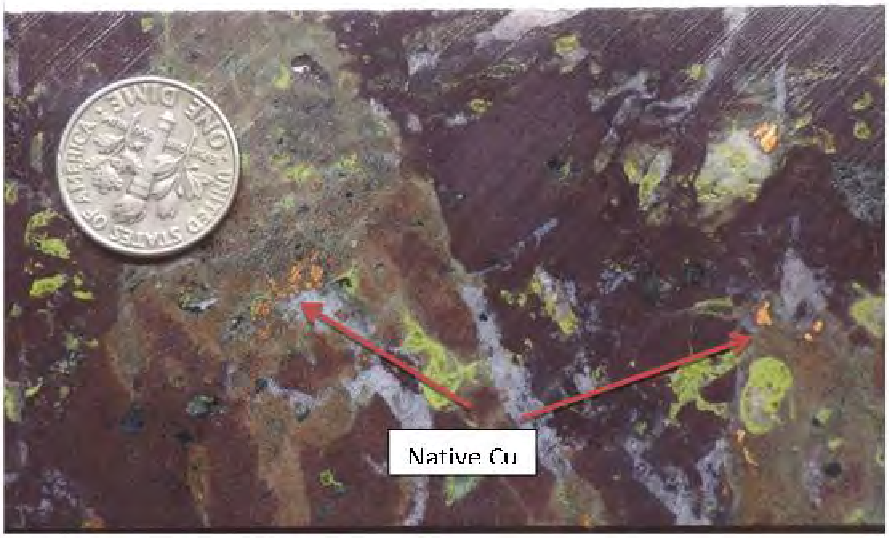
Figure 7.21: Dacite Dike with Chalcocite in Disseminated Grains and Filling Fine Fractures. CEN 353, 129-130 m (1.11% Cu)



7.8 Native Copper Mineralization

Although more than 99% of the 543S copper content occurs in chalcocite, small blebs of native copper are not uncommon. Most of the native copper is associated with thin calcite veins (Figure 7.22) and fractures in dikes.

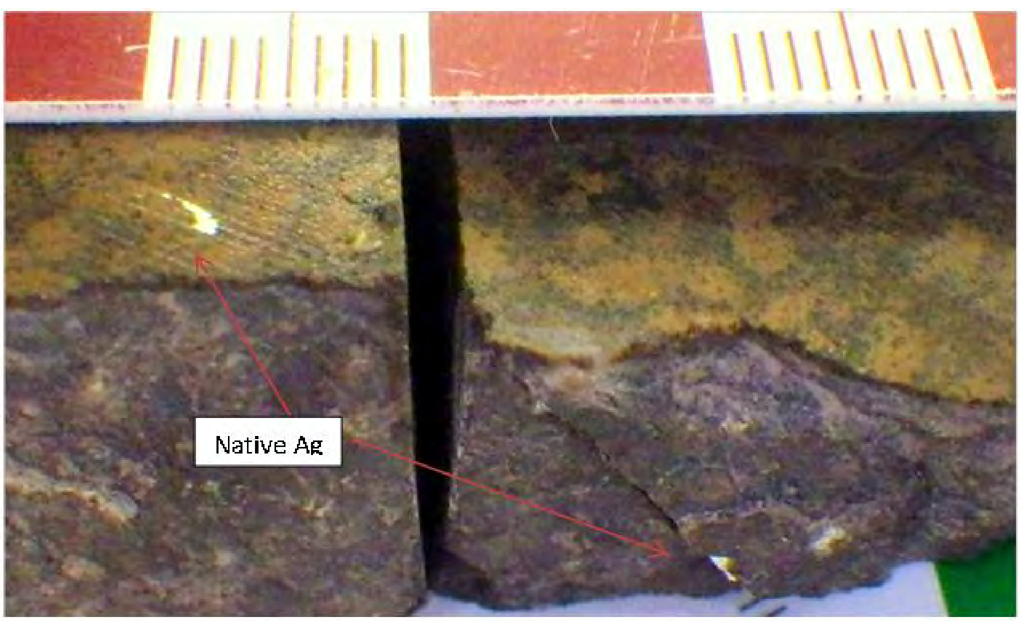
Figure 7.22: Native Copper in Amygdaloidal Dike



7.9 Native Silver Mineralization

The 543S deposit has an average silver grade of approximately 2 gpt. Silver minerals have not been identified but native silver is evident in chalcocite mineralized zones and in dikes and basalts with little or no chalcocite mineralization. Native silver grains are predominantly less than 2 mm in diameter and fill fine fractures and veins (Figure 7.23).

Figure 7.23: Native Silver Filling Very Fine Fractures in Amygdaloidal Basalt



8. DEPOSIT TYPES

As mentioned, historic copper production in the Keweenaw district came from fissure deposits with masses of native copper that cross-cut mafic flows and lode deposits where stratiform native copper mineralization is confined to flow-top amygdaloidal breccias and conglomerate horizons. Chalcocite was noted in many of the native copper deposits but was not mined.

Chalcocite deposits occur in a distinct 30 kilometer northeast-southwest trending belt located between the native copper deposits and the Keweenaw Fault. Chalcocite mineralization primarily occurs as open space fillings in amygdaloidal and fragmental flow tops; native copper and other copper sulfides are rare. Historically, the chalcocite deposits were ignored by mining companies and, to date, no copper has been mined from them.

8.1 Geologic Model for Native Copper Mineralization

The Keweenaw district native copper deposits are unique because in almost all other copper deposit types native copper occurs only as an alteration product of other copper minerals. Because of the uniqueness of the Michigan native copper deposits, the genetic model of deposition has long been a topic of discussion.

Butler and Burbank (1929) discussed in detail all of the hypotheses of the time that compare ascending versus descending solutions, single or various episodes of mineralization, chemical composition of mineralizing fluids, timing of mineralization, precipitation conditions, the effect of hematite on deposition of copper, etc.

The KEWA Report (2008) succinctly summarizes the factors controlling localization of the native copper ores.

"*All contemporary workers in the district agree that the ore deposits are epigenetic and that the ore-bearing solutions were hydrothermal. Whether the solutions were derived from a crystallizing magma (Butler and Burbank, 1929) or whether they were sweated out in depth during metamorphism (Stoiber and Davidson, 1959; White, 1968) is debatable, but, in either case, they were hot water solutions.*"

"It can therefore be assumed that the orebodies in both amygdaloids and conglomerate beds were formed by hot – ascending solutions that were somehow concentrated in certain select areas. Since the lithologic characteristics of the amygdaloids and conglomerates away from the orebodies are similar

to those with the orebodies, structural, rather than chemical, controls appear to be the main cause for locations of the ore."

"The most reasonable explanation for the form of many deposits lies in the barrier hypothesis, originally advanced by Graton, Broderick, and Butler in special reports to the Calumet and Hecla Mining Company. This theory visualizes the ore solutions as traveling up dip along certain amygdaloids and conglomerates, with through going permeability (Butler and Burbank, 1929). Inasmuch as the thickness and permeability of a given amygdaloid or conglomerate bed may vary enormously from place to place, flow tended to be concentrated along those pathways that afforded the least resistance to flow from depth to the surface, and tended to avoid relatively impermeable areas, which would thus act as barriers. Solutions were funneled by barriers of various types into the areas that are now mineralized."

8.2 Geologic Model for Chalcocite Mineralization

The chalcocite deposits are located near the base of the PLLS within one to two kilometers of the Keweenaw Fault. Chalcocite occurs as open space fillings and replacements in amygdaloidal flow tops and flow top breccias. Native copper and native silver fill thin fractures and blebs but are rare.

The chalcocite deposits are very similar to the native copper deposits hosted by amygdaloidal and fragmental flow tops and they appear to have formed in the same way and possibly at the same time. The major difference between the two deposits is that one is dominated by native copper and the other by chalcocite. Another difference of unknown significance is that there appears to be a stronger association between chalcocite mineralization and the presence of faults and dykes. The relationship between structures and mineralization could be due to proximity to the Keweenaw Fault.

9. EXPLORATION

9.1 Current Exploration Program

9.1.1 Procedures and Parameters

The primary objective of the Highland Copper Company ("HCC") exploration program was to confirm exploration work in the 1970's and 1990's and establish a NI 43-101 compliant mineral resource. The focus of the 2012-2013 diamond drill program was at the 543S and G-2 anomalies. Previous work was the basis for this drill program. Field exploration work was done to generate additional targets. This work included geological mapping, soil sampling and a small IP program.

9.1.2 Topographic Surveys, Coordinates and Datum

The surveyor responsible for reestablishing the Mount Houghton grid is the same person that originally surveyed the grid in the 1970's. A retracement survey was initiated with data from original field books, notes, documentation, and maps from the 1970's that were acquired by Keweenaw Copper Co ("KCC") in 2011. The survey ties grid baselines to physical corner monuments that are still recoverable and, therefore, a high level of confidence is placed on the reestablished grid

The 543S grid was recreated using survey ties from the original 086° (E-W) baseline at points approximately 1.6 km east and 1.6 km mile west of this baseline and referenced in original field books to Land Corner Monuments. An iron pin was recovered in 1992 and shown on plans for the Great Lakes Minerals to be located at the baseline at 121.9 m E (4+00 feet E). Written correspondence from the Surveying Consultant who reestablished the grid in 2012 indicates that this iron pin was recovered prior to any development by Great Lakes Minerals in 1992. It was not set by Great Lakes Minerals in an attempt to reestablish the grid. Further investigation revealed old survey stakes at 30.5 m N (1+00 feet N) and 61 m (2+00 feet N) on an old cut line. This is strong evidence that the 121.9 m E (4+00 feet E) line of the original grid was still intact when surveying was completed in May of 1992. At that time the iron pin and the two wooden survey stakes were referenced to nearby Land Corner Monuments by the same Surveying Consultant that reestablished the baseline for Keweenaw Copper Co in 2012. Therefore, the reestablished drill grid was produced with documentation and collaboration between the original Surveyor of the drill grid and the Surveying Consultant that preserved the 121.9 m E (4+00 feet E) line points in 1992.

The vertical component of the 543S data recorded in field books indicates that the old data were based on the assumed elevation of 304.8 m (1000 feet). The initial benchmark for this elevation was at the intersection of the N-S and E-W baselines. In 1992, real elevations referenced to U.S. Geodetic Survey Benchmarks were established at the project by the Great Lakes Minerals' venture. The historical elevations were translated to agree with actual elevations referenced to the U.S.G.S. Benchmarks. Six locations on the E-W baseline at 61 m (200 feet) intervals in undisturbed forest were compared. The actual elevations at these points were established by the Consulting Surveying firm retained by KCC. Deviations between actual and historic elevations were then averaged, resulting in a positive correction of 49.68 m (163.0 feet). Therefore, all historic elevations were converted to actual elevations by adding 49.68 m (163.0 feet) to the historic value.

Equipment used to survey the project grid systems, as well as locate drilled holes for Horizontal and Vertical location, is as follows:

1. Trimble 5800 GPS units collecting RTK data and Topcon GTS-605 Electronic Total station. (Hein Surveying Consultants, Calumet, MI.)
2. Leica TCR705 Automatic Total Station with Electronic data Collection. (Keweenaw Copper Co)

9.1.3 Geological Mapping and Outcrop Sampling

Geological mapping and outcrop sampling was concentrated along streams and areas of high relief. There are a limited number of outcrops due to vegetation, soil, and glacial till. The work identified 278 outcrops including 41 flow tops, most of which were not previously shown on any USGS maps. The outcrop coordinates were recorded on the Garmin GPS. Any old sumps, trenches or collars of drill holes encountered were marked with the GPS. The data points were systematically transferred to the database daily upon return from the field.

The mapping identified mafic volcanic flows and flow tops of the Portage Lake Lava Series (PLLS), sandstone from the PLLS, a porphyritic felsic intrusive and the Cambrian Jacobsville Sandstone. Outcrop samples were tested for Cu and Ag using a handheld Olympus model DS-400 XRF analyzer.

9.1.4 Soil Sampling

Soil samples were collected and tested for Cu and Ag for the purpose of confirming historical anomalies and generating new drilling targets. A soil auger was used to collect samples below the organic layer, approximately one half meter below the surface. Samples were tested for Cu and Ag on-site using a handheld Olympus model DS-400 XRF analyzer. The soil was analyzed on the back of a wooden clip board that was determined to contain no Cu. The soil was discarded after the analysis was recorded. Sample coordinates were recorded using a handheld Garmin GPS unit. A site name was recorded along with the coordinates. The Cu and Ag values, along with the site names were recorded in field notebooks. The Garmin GPS data was downloaded into a spreadsheet at the end of every day. The Cu and Ag values were manually entered.

The project area is mostly covered by glacial till. The glacial till layer is often thick and masks the surface expression of bedrock mineralization. Soil sampling in the 1970's did not show anomalous soil sample values over the 543S mineralization. Instead of a grid approach, the samples from the 2012 program were collected along drainage valleys, where the glacial till layer is thinner.

A total of 1781 readings were taken during the program. Some 35 points were determined to be outliers. They were calculated as being greater than two standard deviations from the mean of the raw data. The mean and standard deviation for the Cu values are listed in Table 9.1.

A statistical analysis was compiled in the same manner as the historical geochemistry exploration. Classification of anomalous values is as follows: first order is 129 ppm or greater, second order is 94 to 128 ppm, and third order is 59 to 93 ppm.

Table 9.1: Statistical data from the 2012 soil sampling program.

Readings	Mean	Median	Minimum	Maximum	Standard Deviation
1746	23.191	5	5	236	35.070

Cu (ppm)	Category	Number of readings
<10	not detected	1094
10 - 58	not anomalous	478
59 - 93	3rd Order Anomaly	90
94 - 128	2nd Order Anomaly	32
129 or greater	1st Order Anomaly	52

9.1.5 Geophysical Program

Highland Copper Company (HCC) carried out a dipole-dipole DC/IP survey over the 543S area from November 15th to December 21st, 2012. The work was done under the supervision of geophysicist Kwame Barko of Canada. An orientation survey was completed over three lines at the 543S mineralized zone. The lines were spaced at about 60 meters apart where the mineralization is close to the surface.

Highland crews cut 28,950 meters on 13 section lines from September 25 to October 17, 2012. The IP crews surveyed about 9,100 meters on 6 section lines. The IP survey was slowed by numerous equipment breakdowns.

Outside of the orientation survey, four lines were completed totaling about 8,300 meters. Three anomalies were identified. One anomaly was drilled in the 1970's, showing a thin mineralized horizon known as the "Footwall Zone". Two other anomalies were found, one about 400 m north and another about 300 m northeast of 543S. These anomalies were tested by drilling. No significant mineralization was found.

9.2 Future Exploration Work

Highland Copper Company plans to continue exploration within and around the 543S deposit:

1) Continue geologic mapping, soil sampling and ground magnetic surveys to generate additional targets.
2) Continue to develop additional satellite resources from areas with previous drilling.
3) The IP anomalies were drilled with no successful results. No additional IP work is planned at this time.

10. DRILLING

10.1 Drilling Program

The resources defined at 543S are based on historical and current drilling. Historical drilling at 543S was done by Homestake-INCO from 1974 through 1977 and by Great Lakes Minerals, Inc ("GLM") in 1990. From 1974 to 1977, the Homestake Keweenaw Venture ("HKV") drilled 68 holes totaling 15,339 meters using BQ sized core. In 1990, Great Lakes Minerals drilled 10 NQ sized holes, totaling 1,507 meters. The drilling executed by GLM was to confirm the grade and continuity of the mineralization defined by HKV. All of the confirmation drilling was between sections 0+00N to 5+00N and 0+00E to 6+00E.

The 2012-2013 diamond drilling program at 543S was performed to confirm historical resources and establish a NI 43-101-compliant resource. Some holes were drilled to increase the total resource. Highland Copper Company Inc. launched the drilling program on July 16th, 2012. The program was completed on January 30th, 2013. A total of 184 diamond drill holes were drilled for a total of 28,762 meters. The average length of all drill holes is approximately 150 meters. The program generated 26,228 core samples for analysis.

Figure 10.1 Diamond Drill Rig Hagby 1000/3 Skid/Trailer Operated by IDEA Drilling

IDEA Drilling initiated the program with one Hagby 1000/3 Skid/trailer mounted drill rig fitted to drill NQ size core along with one Atlas Copco CS14C Crawler mounted drill rig fitted to drill HQ size core. Two additional Hagby 1000/3 rigs were brought in to increase productivity with the first starting August 14th, 2012 and the second starting August 26th, 2012. The Atlas CopcoCS14C ceased drilling on October 22nd. Three rigs continued until December 1, leaving two rigs to finish up diamond drilling by January 30th.

10.2 Drilling Methodology

The historical drilling program executed by HKV in the 1970's was completed using a 61 meter (200-feet) hole spacing. The 10 drill holes completed by GLM in 1990 filled in some of the mineralized zone using a 30.5-meter (100-feet) hole spacing. All of the HKV and GLM drill holes were pre-NI 43-101 and are considered non-compliant. The 2012-2013 diamond drill program was designed to confirm results of previous work and add to the resource. The program filled in the drilling pattern on the 30.5-meter (100-feet) hole spacing. Additional drilling was completed at 15-meter (50-feet) spacing to better define the near-surface mineralized horizon.

To use the historical data for a NI 43-101 compliant resource, a twinned drill hole program was conducted. In the 2012 drilling program, fourteen diamond drill hole twin and triplets were completed at ten sites. The triplet holes had a dual purpose. Along with validating the historic data, the two holes at four different sites also tested the variation in grade of mineralized intersections for the HCC 2012-2013 diamond drilling at a spacing of about 2 meters. The comparison of the twin and triplet holes focused on historic hole mineralized intersections above a 0.2% Cu cutoff grade. A complete report on the twin and triplet drill hole validation can be found in Appendix A.

10.2.1 Diamond Drill Core Logging

The drilling was done using 10-feet core barrels. Prior to core logging, the depths were converted from feet to meters on the core blocks and the boxes. The core was then photographed. The photos contain the hole number, box number and the "from" and "to" lengths in meters. Files of the photos were labeled by the beginning depth and transferred to the server on the local network.

Core logging for the 2012-2013 diamond drill program was completed in an Excel template on notebooks at the core logging facility. Drill logs were saved directly to the server. The Excel template contained separate tabs for Rock Type, Structure, Alteration, Mineralization, Sampling and Recovery/RQD. The template was modified as the logging progressed. The changes were mostly in the alteration description and separating files to correspond to the duties of the geologists and duties of the field technicians. Many holes were re-logged to reflect changing ideas on the fine-grained mafic volcanic/sub-volcanic rocks.

Most of the historical diamond drill core is no longer available for inspection; however, paper copies of the drill logs are available. This information, both geological data and assay results, was entered into Excel spreadsheets with the same format as the new drilling. The drill log spreadsheets were entered into the Highland acQuire database for validation and storage. Both the historical and current drill hole data is included in the new database provided to G Mining Services Inc.

10.3 Drill Hole Survey

The down-hole survey data were collected by Idea drilling company using Devico surveying products supplied by Minex surveying company out of Virginia, Minnesota. The DeviTool™PeeWee Multishot system records azimuth and inclination using an array of accelerometers and magnetometers. The PeeWee instrument is run out of the hole and collects data every 20 feet. The DeviFlex™ is a nonmagnetic surveying system that uses accelerometers and strain gauges to calculate inclination and azimuth deviation. The DeviFlex survey is run out of the hole, and collects data every 10 feet.

The down-hole surveys conducted at the 543S property utilized the DeviTool Peewee magnetic survey instrument.

10.4 Drill Core Recovery

Diamond drill hole core recovery measurements were performed in the core logging facility at the Centennial #6 dry. The measurements were made after the core boxes had been laid out on the logging table. The driller was responsible for placing a core block after each drill run marking the corresponding depth in feet. The maximum drill run length of IDEA drilling company was limited by the 10-foot (3.045 meter) core barrel. The blocks and core box labels were converted into meters by a Highland technician or geologist before the core was put on the tables for logging. Recovery was measured from block to block, then divided by the drill run length and multiplied by 100 to obtain the recovery percentage. Each hole had its own spreadsheet with recovery and rock quality designation data saved on the local network and the data was later added to the database.

A recovery average for the 543S project was computed of holes with ore-grade mineralization on sections 61 meters W (1+00 feet) through 518 meters E (17+00 feet). Overburden intervals were removed and any recovery measurement above 110% was also not used. The weighted average calculated from this data is 91.2%. An average recovery of core within the mineralized zone on sections 61 meters W (1+00 feet) through 518 m E (17+00 feet) was also computed. This was done by taking the recovery measurements from the beginning to the end of the mineralized zone in each hole. Where several mineralized zones exist near each other in a drill hole, recovery measurements were taken from the top to the bottom of the mineralization, including non-mineralized core in between. The drill run above and below defined mineralization was also included to ensure a wide enough envelope was used. The weighted recovery average for the mineralized envelope was calculated to be 92.6%.

Rock quality designation ("RQD") measurements were taken at the same time as recovery measurements at the core logging facility. For the RQD calculation, all fragments of core greater than 10 cm in length were measured and summed per drill run. The RQD percentage was calculated by taking the RQD measurement, dividing by the drill run length, and multiplying by 100.

11. SAMPLING, PREPARATION, ANALYSES AND SECURITY

11.1 Diamond Drill Core Sampling, Security and Chain of Custody

11.1.1 Historical Drilling

Data is limited for historical drilling projects. Only the Great Lakes Minerals, Inc. procedures were documented in a report. The Homestake Keweenaw Venture ("HKV") procedures were supplied verbally by Dr. Ross Grunwald.

Homestake/Inco:

Core samples were crushed using jaw crushers and roll crushers. Native copper was screened out, electrolytic alloy plated, and weighed. The fine fraction was assayed using atomic absorption and then the final assay was a weighted average of the electrolytic copper and the atomic absorption assay.

Chalcocite projects were as follows:

- Drill core was sawn in half
- Samples were analyzed by HKV laboratory in Michigan
- Checked by INCO's J.R. Gordon Research Laboratory in Ontario, Canada

Samples were analyzed for copper and occasionally for silver and nickel. Analytical procedures and results, if any, from check assay programs are unavailable. The HKV laboratory was set up and operated in accordance with Calumet & Hecla equipment and methods.

Soil samples were screened, and the minus 80 mesh fraction was assayed using atomic absorption methods

Great Lakes Minerals, Inc.

Wawa Assaying, Incorporated used the following analytical procedures:

- Samples were crushed to 1/8 mesh
- A 30 gram split was pulverized to minus 200 mesh

- A 1.0 gram sample was digested using HCl
- Analysis of the 1.0 gram digestion was done by atomic absorption

Samples containing native copper and/or native silver were screened to separate the plus 100 mesh. The entire plus 100 fraction was analyzed and the minus 100 fraction was analyzed using the steps outlined above. The value for the sample was determined by calculating the weighted average of the two fractions..

11.1.2 Current Drilling

The following procedures were used for core sampling:

- Drill core from the entire hole is analyzed.
- Samples are determined and marked by a geologist during the logging process, then tagged, giving each a distinct sample ID.
- Sample intervals are no less than 0.5 meters and no greater than 2 meters in length.
- Within mineralized zones, sample intervals are 0.5 meters.
- Sample intervals at significant lithological contacts are measured to the nearest 0.1 meter and do not cross over contacts.
- Samples are cut using a rock saw to create a representative sample of the interval.
- ½ of the core is for geochemical analysis and the remainder of the core is kept and stored for future reference or further analysis if needed.
- Sample ID's and corresponding intervals are kept in a spreadsheet on file.
- As the core is being cut, pieces from the sample interval are placed in sample bags (pre-marked with sample ID's) along with the corresponding sample tag and tied off.
- There is no further handling of the core samples once they are bagged. They are tied off and placed in larger bags. The larger bags do not exceed 50 lbs (22.68 kg).
- Each larger bag is labeled with its own ID number as well as the range of samples contained in the bag. The bags are then placed into a large box that has its own ID number assigned to it. All of this information is also recorded on a table and kept on file.
- All of the samples within a given hole are sent to the labs in the same batch, never in separate batches.

- The samples are sent out with a document listing all samples within the batch and analytical instructions.
- The transportation of the sample batches to the laboratories is carried out by Conway Freight.

11.2 Analytical Laboratories

11.2.1 Historical Drill Programs

Of the 299 Great Lakes Minerals, Inc. samples, 62 samples or 20.7% were submitted to Skyline Labs Incorporated in Denver, Colorado for check assay. The results were included in Appendix B of the A.C.A Howe 1991 report, but that section was not available for review. The entire report is stored in a warehouse located in Norway, MI. However, according to the A.C.A. Howe report, Skyline's results compared very favourably with the results from Wawa Assaying, with the percent difference between the averages of the copper values being 3.56% (Howe, 1991).

11.2.2 Current Drill Programs

Initially, sample analysis was performed at Accurassay Laboratories in Thunder Bay, Ontario, Canada. Beginning in October 2012 samples were also sent to Activation Laboratories Ltd. in Thunder Bay. The second laboratory was needed to relieve a back-log of samples at Accurassay and to enable cross checks for quality control.

a) Accurassay Laboratories

Accurassay Laboratories is the primary lab used for geochemical analyses. Accurassay is located in Thunder Bay, Canada and a volunteer participant in quality management tests headed by the Standards Council of Canada (SCC). It is also accredited to international quality standards through the International Organization for Standardization/ International Electro-technical Commission (ISO/IEC) 17025. Assays are signed by an Ontario certified assayer. Highland ceased using Accurassay Laboratories in May, 2013 because of carry over issue with high-grade copper samples. This special QAQC procedure and protocol is described in detail in Section 11.5.3.

b) Activation Laboratories (Act-Labs)

Act-Labs is headquartered in Ancaster, Ontario, Canada. 543S samples were sent to Act-Labs facility in Thunder Bay, Ontario, Canada; the laboratory holds an accreditation of (ISO/IEC) 17025 from the Standards Council of Canada. Assays are signed by an Ontario certified assayer. Highland began using Act-Labs in October 2012 to improve assay turnaround time. Act-Labs was also used for umpire check assays and specific gravity testing.

Table 11.1: Assay QA/QC Details

	Count of Samples	**% Samples**
Samples (Core)	22880	82.05
Duplicates	421	1.51
Standards	1166	4.18
Blanks	329	1.18
Blk Duplicates	26	0.09
Std Duplicates	20	0.07
Lab Check Samples	3045	10.92

11.3 Sample Preparation and Analytical Procedures

All laboratories were asked to provide Technical Report results on certificates of analysis following a specific format in Excel spreadsheets and signed PDF files. This format includes summarized sample preparation and analytical procedures, detection limits, internal reference materials, etc., on a layout that facilitates validation and uploading to the database. ICP examination reports the following elements Ag, Al, As, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, Ga, Hg, K, Mg, Li, Mn, Mo, Na, Ni, P, Pb, Sb, S, Sc, Sr, Te, Ti, U, V, W, Y, Zn and Zr. Both labs also report metallic percentages of silver and copper.

Accurassay:

a) Prepping the samples involved, first by crushing samples using Boyd Crushers so that 80% pass a 2 mm sieve and then pulverizing 1 kg split samples using a Herzog Pulverizer HP 1500, so that 95% passes -150 mesh.

b) Samples analyzed for silver and copper are weighed for either a geochemical or an ore grade analysis. The geochemical test is intended more as a screening test. The initial run of samples were analyzed on Agilent (Varian) ICP-OES 720 which uses 0.25 g of sample bulked to a final volume of 12 ml and ran through ICP. If any samples are >5000 ppm Cu, the lab used an ore grade analysis on Agilent (Varian) AA240FS which utilizes a greater sample mass of 2.5 g plus a larger dilution to 250 ml for higher precision at more significant grades thereby allowing accurate determinations at high grades that exceed the upper detection limit for the geochemical analysis.

c) The samples are digested at elevated temperature using multi-acid addition. Once digested, the samples are bulked to their final volume with acid and distilled, de-ionized water. After bulking, the samples are mixed.

d) Once samples have settled, they are analyzed for silver and copper using ICP (AES) spectroscopy. In the case of ICP, a scan of a suite of elements can be conducted. Ore grade samples are finished with AA.

Activation Laboratories (Act-Labs):

a) After drying the sample, crushing is done with a TM or Boyd jaw crusher. Granulometric testing is performed to confirm fineness of the reject once every shift (10 h). After each sample processed, the crusher is cleaned with compressed air and visually inspected for cleanliness. Barren material is used to clean the crusher it fails the visual inspection and/or when samples are ore grade. The crusher is also cleaned with barren material at the start of each order.

b) Splitting of 250 g is done manually using a Jones riffle splitter.

c) Every 50th sample has another split taken off of the coarse reject material and is processed as a duplicate sample.

d) Pulverizing is done with TM and LM pulverizers. The samples are pulverized to #150 mesh and a granulometric test is performed at the beginning of every order and after every 50 samples. 95% must pass #150 mesh. Cleaning of the bowls is done by pulverized cleaning sand after each sample and inspecting for discoloration. If the cleaning sand is discolored then it's dumped and the bowl is re-cleaned with cleaning sand again until no further change in color is observed.

e) A split is taken from the pulp material every 30th sample and processed as a duplicate sample.

f) An ICP analysis is done to determine the levels of minor elements. Any overages (>5,000 ppm Cu and >100 ppm Ag) have a larger aliquot taken (2.5 g instead of 0.25 g) and are digested in a multi-acid solution and analyzed by ICP-OES using an Agilent 735 ICP-OES.

11.4 Specific Gravity Measurements

Specfic gravity measurements were made at a commercial laboratory and in-house. Act Labs Mineral Analysis Company of Thunder Bay, Ontario used the wax coated immersion method to perform specific gravity measurements on 255 core samples taken from 81 drill holes. Each sample was ½ drill core and approximately 10 cm in length. Samples were from mineralized and non-mineralized rock types within the 543S deposit area. HCC made specific gravity measurements on 1097 samples, using the entire length of an assay interval for each sample. Each sample interval was coded by rock type. The rock types were categorized as flow top, flow interior or dike. The procedure used did not include a wax coated immersion.

The specific gravity was calculated by weighing the dry mass and the wet (submerged) mass. The equation used is given below.

Specific Gravity = Dry Mass / (Dry Mass – Wet Mass)

The first step was to weigh the core of an assay interval in a plastic tray. The weight minus the weight of the tray was used as the Dry Mass. The Wet Mass was calculated by placing the core interval on a metal screen that was submerged in water while attached to the scale using an under-hook. The weight minus the weight of the screen was used as the Wet Mass. The scale used was an Ohaus Scout Pro SP6001.

11.5 QA/QC procedures

Highland utilized Excel 2010 spreadsheets to record all geological data. The spreadsheets included basic data validation mechanisms. The geological logs were reviewed by staff geologists after completion. Reviewed geological logs were then imported to the database. Any errors found in the geological logs were referred back to the staff geologists for correction.

In late 2012, HCC coordinated its database and QA/QC management using acQuire software (Database and QA/QC Management www.acquire.com.au), which is considered state-of-the-art for this purpose. The installation and configuration was made by an acQuire representative and the software has been managed by geographer Kelly Azevedo, who has more than ten years of database management experience with both large and junior companies.

The following configurations are in place:

- The database is hosted by Microsoft SQL Server 2008R software.
- An active directory was put in place to manage access permissions.
- The database is only accessible within the Highland Copper domain and there is currently no possibility of external access via VPN.
- The geological team uses the database by accessing Excel files available at a GeoServer directory, which uses ODCB resources to connect the SQL database, thus assuring data integrity.
- HCC technical management does not have write or delete permissions for the database.

Routine QA/QC checks are run on every sample batch to find failures as quickly as possible, but are also run over longer periods of time to identify potential long term trends. QAQC routines, including graphing, assay validation, etc. are performed using acQcquire modules, following the steps described below.

The assay certificates received in Excel format from the laboratories are imported immediately into the active acQuire module and respective QA/QC objects for validation. A general flow chart of assay importation procedures is shown in Figure 11.1.

a. The validation of duplicate assays generates a duplicate data report and graph.

b. Pulp duplicates are considered to have failed if r value <90%.

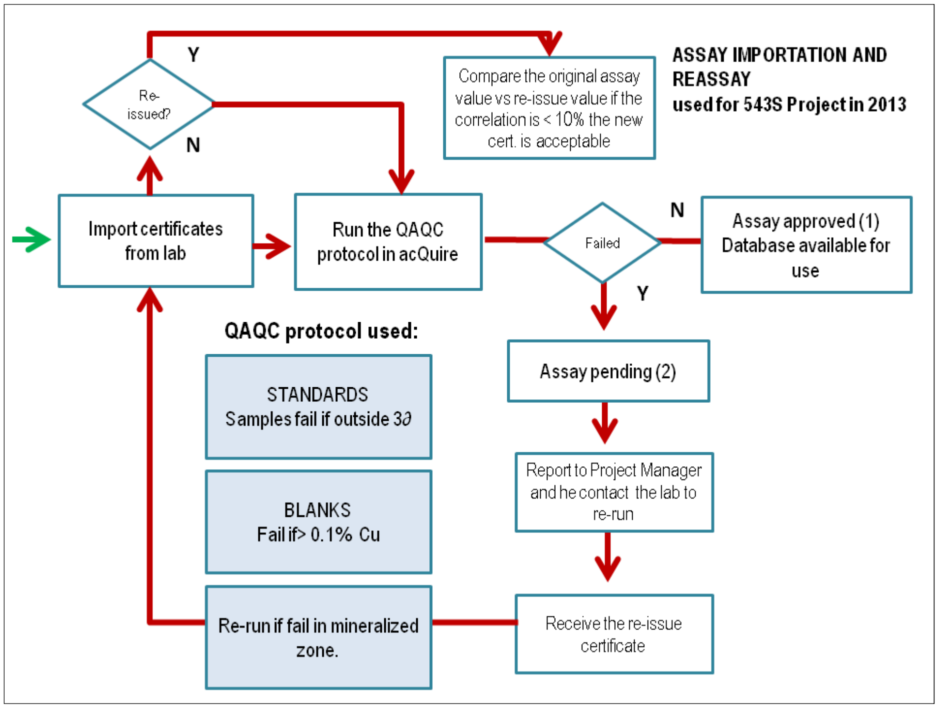
c. The validation of standards generates a data report. SRM assays should fall within two standard deviations when analyzed at the same lab using the same methods. Internal standards assays should fall within three standard deviations. The standard deviation for the precision of the lab data is determined by selecting data over a continuous time period from present, far enough back to achieve at least 20 data points and the value is calculated using an excel spreadsheet.

d. The validation of blanks generates a duplicate data report and graph. Fail criteria is $1/20^{th}$ of anticipated cut off grades (e.g. 4% Cu) = 0.2% Copper.

e. An external Excel spreadsheet is used to register non-conformities.

f. The following priority codes are in used to import data into the database: 1-Accepted, 2-Pending, 3-Rejected, 5-Re-issued and failed again. During import, assays can be loaded into a “pending compound definition” table. Assays imported to “CorpAssay” are then assigned an initial priority value of 2, indicating that they have not passed through QA/QC, and therefore are not marked as accepted (priority 1). After having been analyzed for QA/QC, the priority will be changed to 1 if the results are accepted, and 3 or greater if the results are rejected. The priority for a given sample is stored in the “priority” field. Since only data with Priority=1 is visible using standard views, data loaded into the “Pending compound definitions” table cannot be accessed with standard views or imported using other applications until subjected to a QA/QC procedure. The “pending compound definitions”, however, exposes data with Priority=2, making the priority field editable. The “CorpAssay ADM” allows multiple instances of a single sample to exist in the database with different priority values. This may be necessary where a single sample is subjected to multiple tests, e.g. for laboratory comparisons or batches failed.

Figure 11.1: QA/QC Assay Importation Flow Chart



11.5.1 Inter Laboratory QAQC Umpire Assays

QA/QC umpire analysis calculations have been done to assure the validity and consistency of each laboratory that HCC used in this project. This inter-lab check on assays was conducted on 10% of samples.

11.5.2 QA/QC Methodology of Sample Stream

HCC adopted a drill sampling procedure that includes control samples that are inserted randomly among the original samples. HCC used seven certified referenced standards, one certified referenced blank and one internal blank core sample selected from intervals that previously assayed <0.01% Cu.

Sample Plan: Standard and blank insertion is done at the core logging and cutting facility by a group of trained geo-technicians under the supervision of a geologist. This is also the case when sample tags are put into sample bags in a continuous sequential order according to the sample plan prepared by the overseeing geologist. The sample plan includes instructions regarding where standards and blanks are inserted into the sample sequence.

Sample Tags: Sample tags are kept in a secure location in the logging and sampling facility and only geologists have access to them.

11.5.3 Laboratory Sample Flow Management

HCC uses more than one laboratory, but the management of sample flow is essentially the same and follows these steps:

- Once the batch is finished, a submittal form is completed that lists the number of samples, sample numbers, and assay instructions for the laboratory. A receipt form is included for the lab representative to confirm delivery with a signature.
- Batch numbers are used by the HCC core shed staff to monitor the submission, completion, and return of the samples.
- Sample numbers are marked on the outside of bagged samples and then they are individually tied. Five bagged samples are put into larger rice bags and consecutive from-to sample numbers are written on the outside. The rice bags are securely tied.
- Sample Tags:
  - Sample Tags at HCC are printed in triplicate. The first stub noting all the details related to the sample, including date, project, hole, from-to interval in meters, and geologist's initials.
  - The first stub is filled out for every sample.
  - The second stub is inserted in the sample bag.
  - The third stub is stapled into the core box at the beginning of the sample interval it represents.
  - The laboratory will return both the pulp reject and the coarse reject with the sample tags included.

11.5.4 Rejects Management

To ensure sample integrity, HCC stores both pulp and coarse rejects in a shed that is secure and weatherproof. The samples are organized and cataloged for easy retrieval.

12. DATA VERIFICATION

12.1 Database

From November 2012 until March 2013, Highland Copper Company, Inc. (HCC) provided G Mining Services Inc. (“GMSI”) data files for the 543S project. The information consisted of diamond drilling and soil sampling files in a comma-separated-values format. The files were exported from Highland’s acQuire database. The files received consisted of the following tables and fields:

- Collar information: Hole ID, X,Y,Z coordinates of collar, maximum depth target information, start date and completed date.
- Down-hole survey: Hole ID, downhole depth, dip, azimuth, type of survey equipment.
- Geotechnical: Hole ID, depth from and to, recovery, rock quality designation.
- Density: Hole ID, depth from and to, specific gravity, rock description.
- Assay: Hole ID, depth from and to, Cu %, Ag ppm.
- Assay, All-Element: Hole ID, depth from and to, Cu %, Ag ppm, ICP data for 36 elements.
- Geology: Hole ID, depth from and to, rock type, description.
- Structure: Hole ID, depth from and to, type of structure, angle from core axis, description.
- Alteration: Hole ID, depth from and to, alteration type, alteration minerals, description.
- Mineralization: Hole ID, depth from and to, mineralization style, ore minerals, description.

GMSI imported the files into an MS Access database using the Geovia® GEMS software. The database was reviewed and corrected if necessary prior to final formatting for resource evaluation. The following activities were performed during database validation:

- Validate total drillhole lengths and final sample depth data.
- Verify for overlapping and missing intervals. Correct if necessary.
- Check drill-hole survey data for out of range or suspect down-hole deviations.
- Visual check of spatial distribution of drill holes.
- Validate lithology, structure, alteration and mineralization codes.

12.2 Database Content

The database includes historic diamond drill hole data collected in the 1970's and 1990's as well as the HCC 2012-2013 diamond drill program. The historic data includes drilling by the Homestake Mining Company and the International Nickel Company joint venture (HKV) in the 1970's and additional work by Great Lakes Minerals (GLM) in 1990. The content of the database is summarized in Table 12.1.

Table 12.1: Content of Diamond Drill Holes Available for the Resource Estimate for 543S

Hole Type	Hole Size	Number of Holes	Average Length (m)	Total Length (m)	Number of Assays
HKV (1970's)	BQ	81	199	16,722	1,654
GLM (1990)	NX	10	151	1,507	425
HCC (2012-2013)	NQ	129	162	20,963	16,794
HCC (2012-2013)	HQ	42	129	5,438	4,405

12.3 Core Recovery Data

The core recovery data is described in Section 10.4. The drill hole recovery inside the mineralized envelope was over 92% and thus, considered appropriate for use in the resource estimation.

12.3.1 Survey Control

The surveying of grids and drill hole collars was done by an in-house survey crew and validated by an independent contractor. The methods are described in detail in Section 9.1.2 and are considered to be industry standard.

12.4 Check Sampling Program

Metallic mineralization is easily noted in the basaltic country rock in the deposit. Umpire assays were run on 10% of the samples over 0.2%. Random samples were taken from low 0.20-0.99%, medium 1.0-2.99% and high > 3.0% grade samples from each lab and re-assayed by the subsequent lab. Correlation coefficients were calculated on each umpire assay resulting in greater than a 95% correlation relationship.

12.5 HCC Standards

Table 12.2: CRM Standards used in recent diamond drill programs

Name	Mean Cu %	Number of Samples	Standards Deviation
CM-24	0.365	94	0.01
CM-17	0.791	287	0.02
ME-11	2.44	354	0.055
ME-13	2.69	33	0.10
ME-19	0.474	305	0.009
ME-1205	0.218	240	0.006
OREAS-98	14.8	93	0.10

12.5.1 Standards

As described in Table 12.2, HCC used seven certified standards that ranged from very high grade to around cut-off values of 0.2% Cu. These standards are inserted as described in Section 11.5.2.

Table 12.3 presents the statistical information for each lab and certified standards. Of the two labs used Act-labs consistently had slightly higher values. The high grade standard OREAS-98 had a higher than average failure rate. This may be due to the low standard deviation tolerance set for such a high value. To understand this phenomenon better, ten samples of CRM Oreas-98 and CRM BL-10 (for similar reasons, see Section 12.5.2 for blank description) were sent to each lab for assay. Results suggested that the standard deviations for both the very high grade standard and the very low grade blank should be expanded on either side of the 95% confidence value.

A systematic validation of failing standards was completed by GMSI in February 2014 and each standard outside of three “reference” standard deviations was investigated. Figure 12.1 to Figure 12.7 display results for the seven certified standards using ±2 and ±3 “reference” standards, for the two labs used. Re-assayed standards, as well as the batch they refer to, drill holes ignored for the resource evaluation (B-series) and standards lacking Hole-ID information were discarded from the graphic compilation for visual purposes. No major irregularity or red-flags were noted in the data review. The great majority of failing standards fell into one of the following categories: a low- to very low-grade intervals, some high-grade or above cut-off grade samples before and/or after standards that were re-assayed, or a standard copper value inside three “practical” standard deviations. A Grubbs test was completed on the standards dataset, excluding re-assayed batches, and only one standard outside three “practical” standard deviations was not assessed (Sample #21378 – Batch 201340045). However, it is noted that lab replicates adjacent to this sample passed QA/QC.

Table 12.3: Statistics for Internal Standard Control Samples (including standards of re-assayed batches).

Laboratory and Statistics	Internal Standards						
ACCURASSAY	**CM-17**	**CM-24**	**ME-11**	**ME-1205**	**ME-13**	**ME-19**	**OREAS-98**
Total	195	90	255	201	27	278	74
Total (Without Outlier)	181	87	249	196	26	275	65
Number Outlier	14	3	6	5	1	3	9
Lab Average Cu%	0.791	0.341	2.48	0.209	2.568	0.457	14.75
Lab Standard Deviation	0.057	0.016	0.157	0.012	0.226	0.022	0.56
Reference Average Cu%	0.791	0.365	2.44	0.218	2.69	0.474	14.8
Outlier - %	7%	3%	2%	2%	4%	1%	12%
Lab Average % to Reference Value	100%	93%	102%	96%	95%	96%	100%
Pass 2 STD - %	79%	37%	68%	61%	69%	60%	28%
Pass 3 STD - %	83%	62%	80%	70%	77%	68%	35%

ACTLABS	**CM-17**	**CM-24**	**ME-11**	**ME-1205**	**ME-13**	**ME-19**	**OREAS-98**
Total	92	4	99	39	6	27	19
Total (Without Outlier)	87	4	97	39	6	25	17
Number Outlier	5	0	2	0	0	2	2
Lab Average Cu%	0.821	0.386	2.527	0.226	2.76	0.486	15.07
Lab Standard Deviation	0.017	0.006	0.067	0.008	0.133	0.010	0.318
Reference Average Cu%	0.791	0.365	2.44	0.218	2.69	0.474	14.8
Outlier - %	5%	0%	2%	0%	0%	7%	11%
Lab Average % to Reference Value	104%	106%	104%	104%	103%	103%	102%
Pass 2 STD - %	72%	50%	69%	75%	100%	80%	41%
Pass 3 STD - %	96%	100%	89%	90%	100%	96%	41%

Figure 12.1: Graphs of Analytical Results of CRM CM-17 by Laboratory over Time

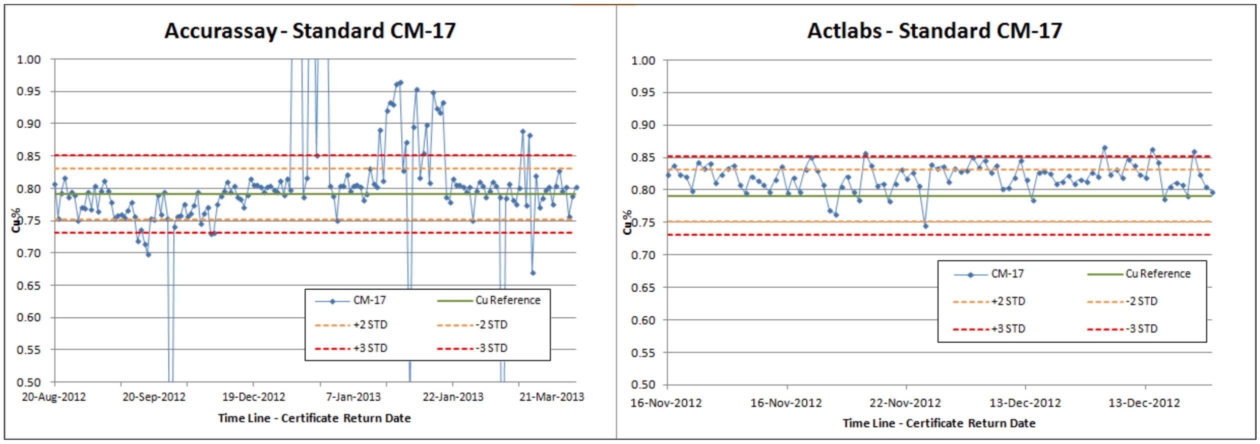


Figure 12.2: Graphs of Analytical Results of CRM CM-24 by Laboratory over Time

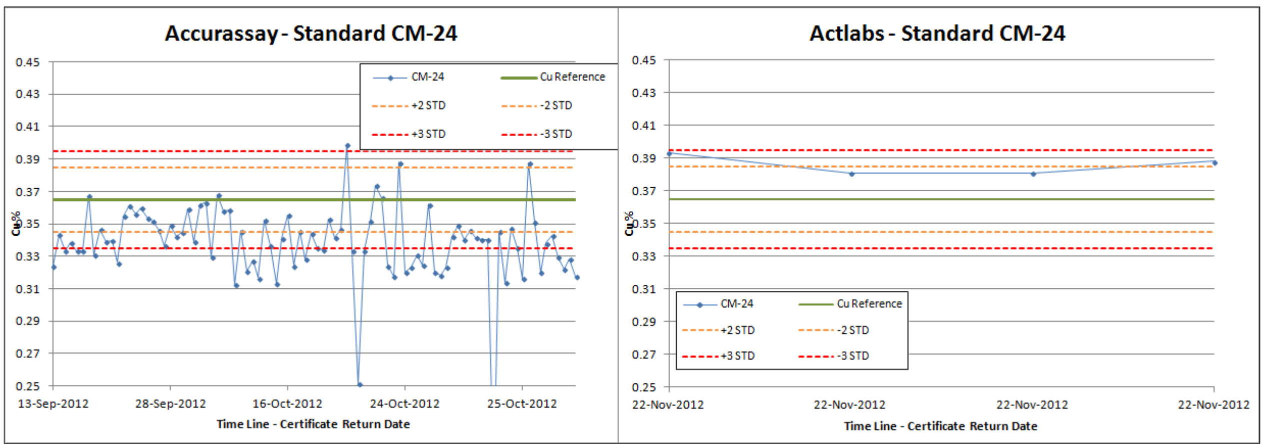


Figure 12.3: Graphs of Analytical Results of CRM ME-11 by Laboratory over Time

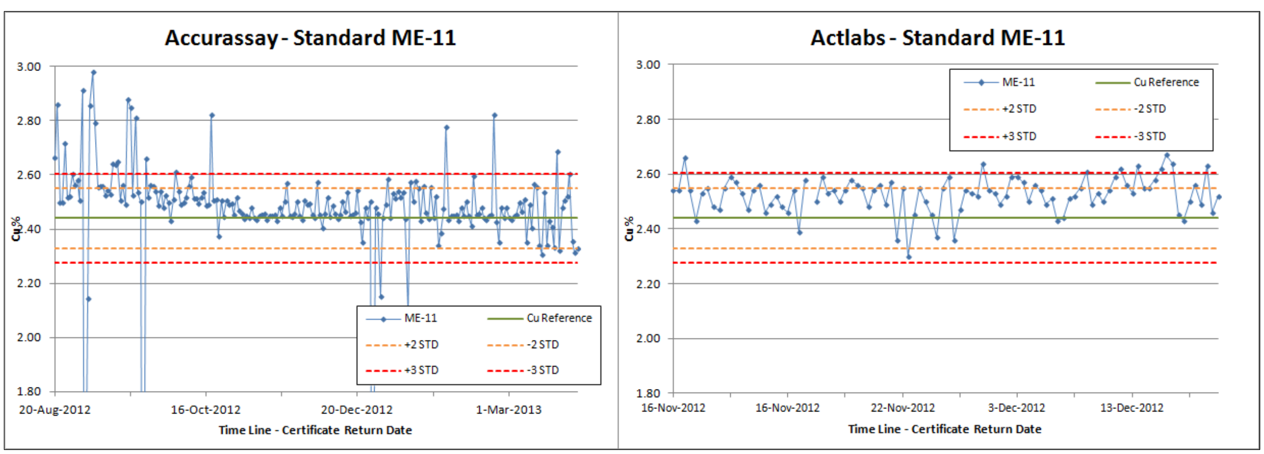


Figure 12.4: Graphs of Analytical Results of CRM ME-1205 by Laboratory over Time

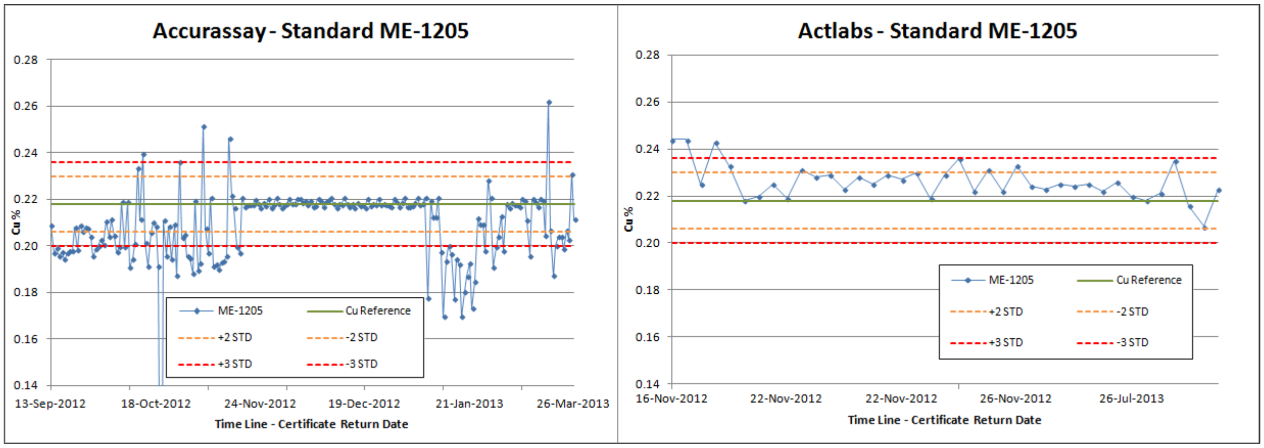


Figure 12.5: Graphs of Analytical Results of CRM ME-13 by Laboratory over Time

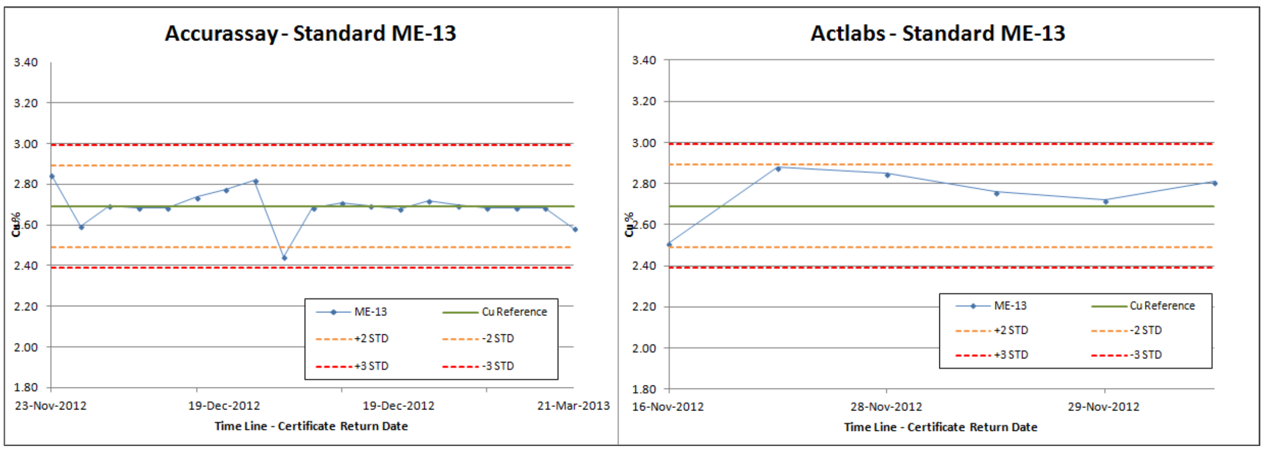


Figure 12.6: Graphs of Analytical Results of CRM ME-19 by Laboratory over Time

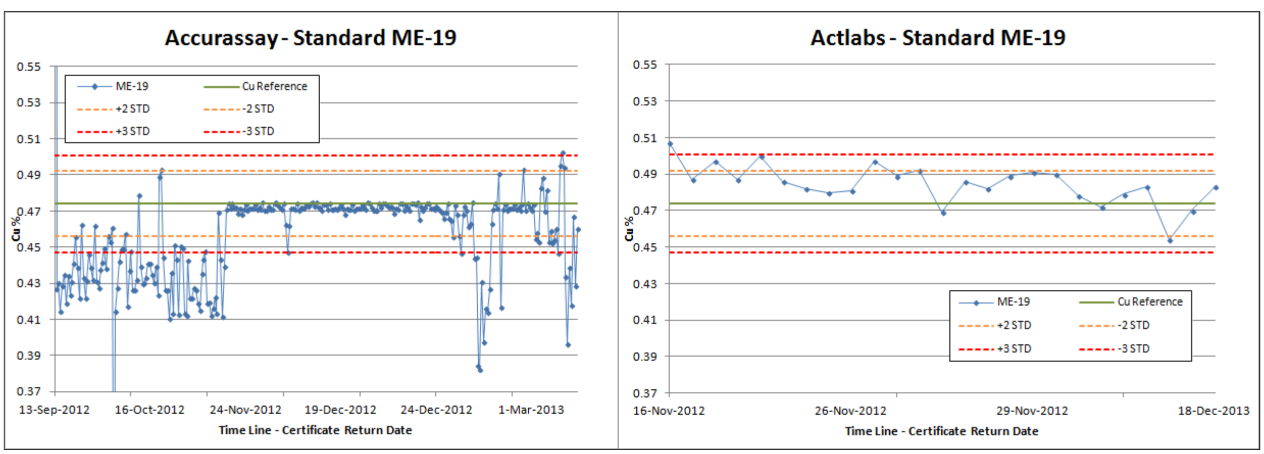
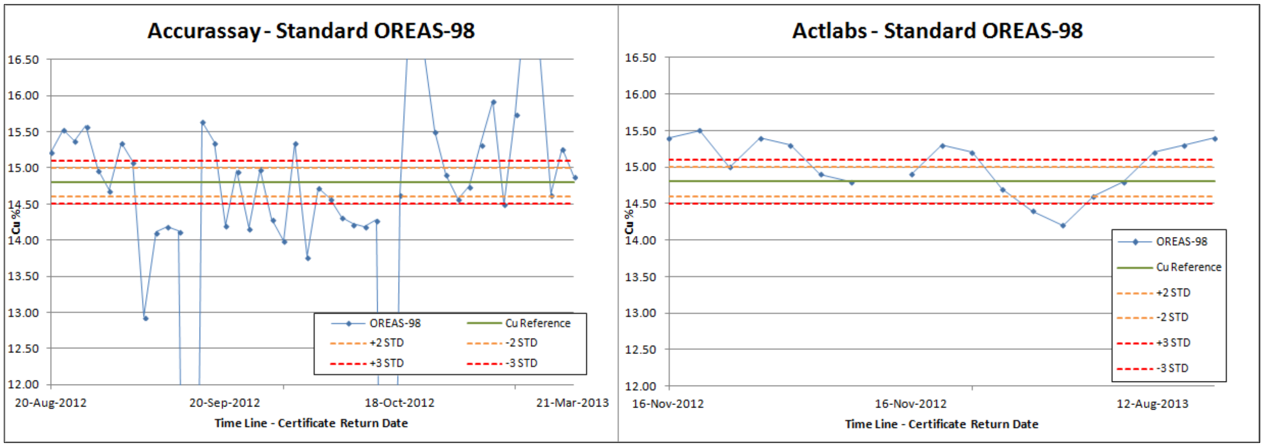


Figure 12.7: Graphs of Analytical Results of CRM OREAS-98 by Laboratory over Time



12.5.2 Blanks

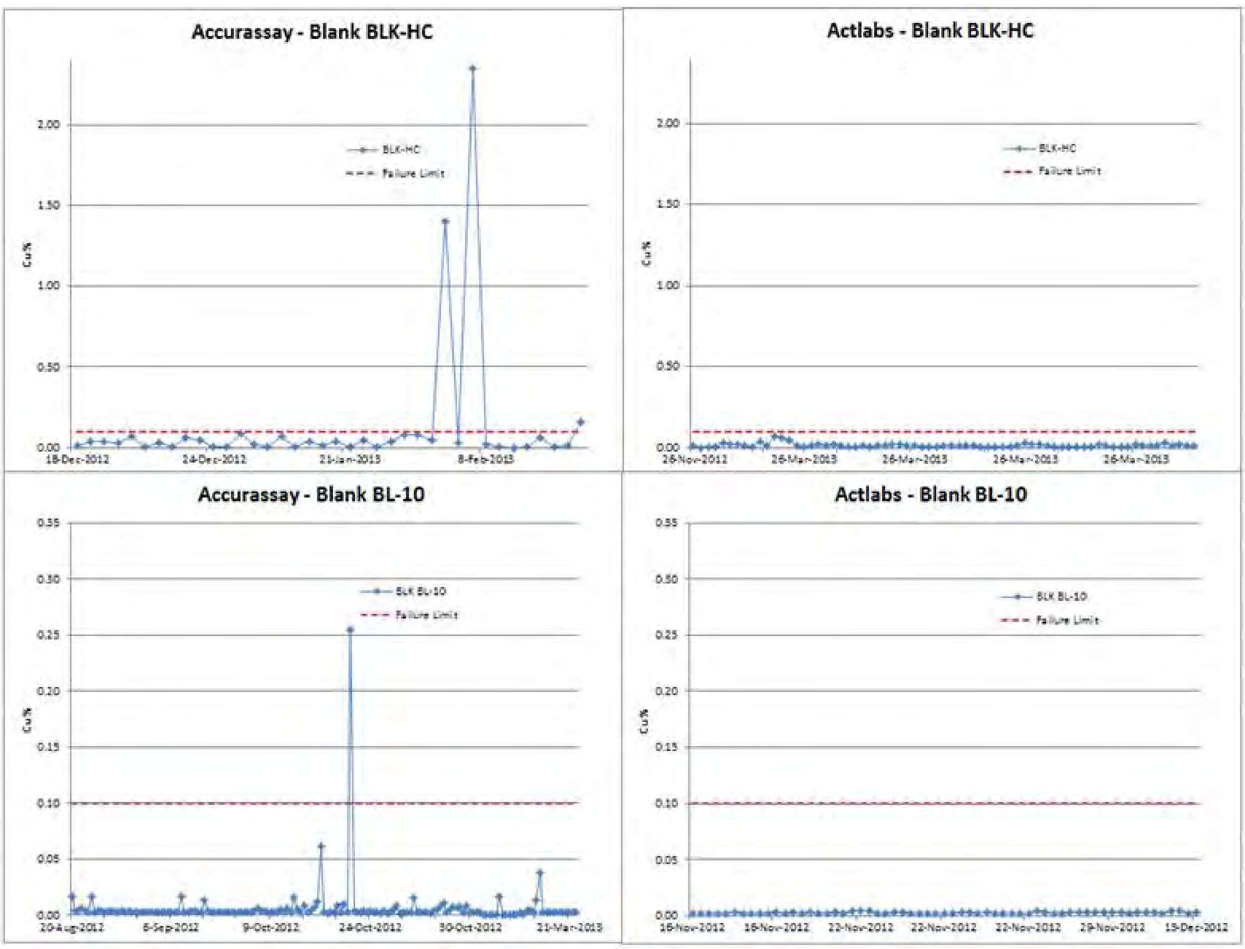
Two blanks were used in the program. A certified blank named BL-10 was used throughout the program. Coarse blanks were introduced in December 2012. They were assayed by both labs. CRM Blank (BL-10) passed 99% of the time after recalculating tolerance limits for such a low value (

Table 12.4). This was a result of a side project that was discussed earlier in Section 12.5.1. There is only a singular outlier that was noted in the data for BL-10. Since no evidence was found for sample contamination of the CRM Blank in the preparation facility, these issues are interpreted as a switched standard and blank occurrence. Coarse blanks were chosen from core that had been assayed with results showing < 0.01% Cu (BLK-HC). Due to failure issues with this blank material a lab inspection was undertaken (Figure 12.4). The results of the inspection showed that an inadequate flushing time of the sensor probe contaminated the coarse blank sample resulting in higher values. After re-assaying these samples using a refined procedure the lab was able to produce and report values < 0.01% Cu. Figure 12.8 illustrates the results of the blank assays, excluding failing blanks of re-assayed batches and those from DDH not used in the resource estimation.

Table 12.4: Blanks used in Recent Diamond Drill Programs (including failing blanks, excluding unused DDH)

Standards	Accurassay		Actlabs	
	BLK-HC	BL-10	BLK-HC	BL-10
Total	79	160	72	65
Total Passing	56	159	71	65
Number of Failure	23	1	1	0
Failure Limit	0.10	0.10	0.10	0.10
Passing %	71%	99%	99%	100%
Average Grade % Cu	0.099	0.016	0.006	0.003
Expected Average Grade % Cu	< 0.01	< 0.01	< 0.01	< 0.01

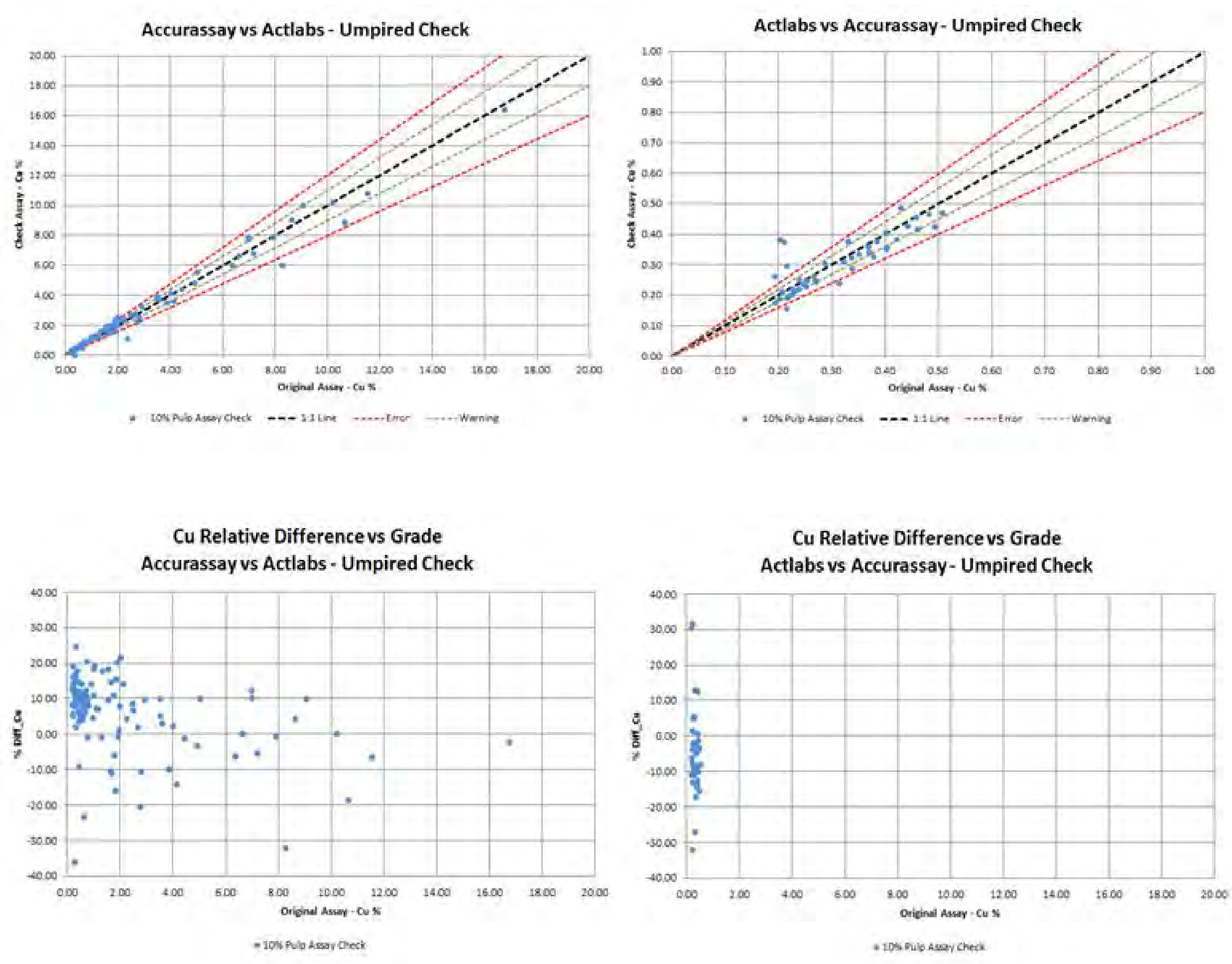
Figure 12.8: Graphs of Analytical Results of CRM BL-10 and Coarse Blank BLK-HC by Laboratory over Time (excluding failing blanks of re-assayed batches and unused DDH)



12.5.3 Pulp duplicates and Umpire Analysis

Since two labs were used in assaying the drill core, it was important to ensure that results from the different labs were comparable. Accurassay was sent all the samples at the start of the drilling program. After a backlog of samples developed due to using a large sample for acid digestion, Act-labs was used as a second lab. There were 226 duplicates and umpire analyses completed between the two laboratories. After compiling and graphing the assay results, correlation between the labs was deemed satisfactory (Figure 12.9).

Figure 12.9: Scatterplot Graphs of Umpire Analysis between Laboratories and Relative Difference vs. Grade



12.6 Conclusions

The drill hole information was provided by HCC as electronic files in CSV formats. These data files were imported into Geovia® software and interrogated via GEMS validation functions. Key fields within critical drill hole database data files were validated for potential numeric and alpha-numeric errors. Data validation, cross referencing collar, survey, assay and geology files, was performed in GEMS to confirm drill hole depths, inconsistent or missing sample/logging intervals and survey data. All the errors found were promptly corrected by HCC and the corrected drill hole files were sent back to GMSI.

A review of QA/QC procedures was also undertaken by Analytical Solutions, Ltd. (2014) to insure that proper actions were implemented throughout the assaying process. All failing standards in regard to their "reference" standard deviations were investigated, as well as all blanks above a failure limit of 0.10% Cu. Of all the data examined, the great majority of possible inconsistencies were assessed and answered. No red-flags were noted in the course of this QA/QC review and the protocols in case of failing standards or failing blanks were found to be implemented following industry best practices.

GMSI is of the opinion that the drill hole and assay database for the 543S Project is of satisfactory quality to permit the completion of a "NI 43-101 Mineral Resource Estimate" and provide the basis for the conclusions and recommendations reached in this Technical Report.

13. MINERAL PROCESSING AND METALLURGICAL TESTING

Historical preliminary metallurgical studies have been done in 1991 by the institute of Materials Processing on three samples of copper sulfide ore from the Keweenaw Peninsula of Michigan, property of A.C.A. Howe International. In summary, the sampled ore was found amenable to concentration by conventional flotation. Concentrate grades over 40% Cu and recoveries over 90% are achievable at grinds between 200 and 270 meshes when combined with cleaning and re-cleaning of the rougher concentrates. A ball mill grindability work index of a composite of 19.36 KWh/t was also reported.

In January 2014, three composite samples representing the cut-off, average and high grade ores made from Drill Core Samples are subject of ongoing met testing at SGS Lakefield. The three composites assays results are presented in Table 13.1.

Preliminary results on average grade sample (Table 13.2) returned a conventional FL2 flotation circuit as shown in Figure 13.1.

The reported copper recoveries neglect the copper distribution contained in the cleaner tailings. In a continuous circuit this material would be re-circulated back to the rougher and cleaner flotation stages, respectively and a substantial part of it would be recovered in the final concentrate. The effect of this recirculation cannot be determined without running locked cycle tests or continuous pilot plant trials.

It is concluded that reasonable expectation from equivalent optimized & closed version of the circuit shown in Figure 13.1 would be:

- Recoveries: 90% Cu, 80% Ag
- Concentrate grades: 44% Cu, 59 g Ag/t
- Mass Pull: 5.5%

Therefore, those numbers are used for the base case reported in this NI 43-101 Technical Report.

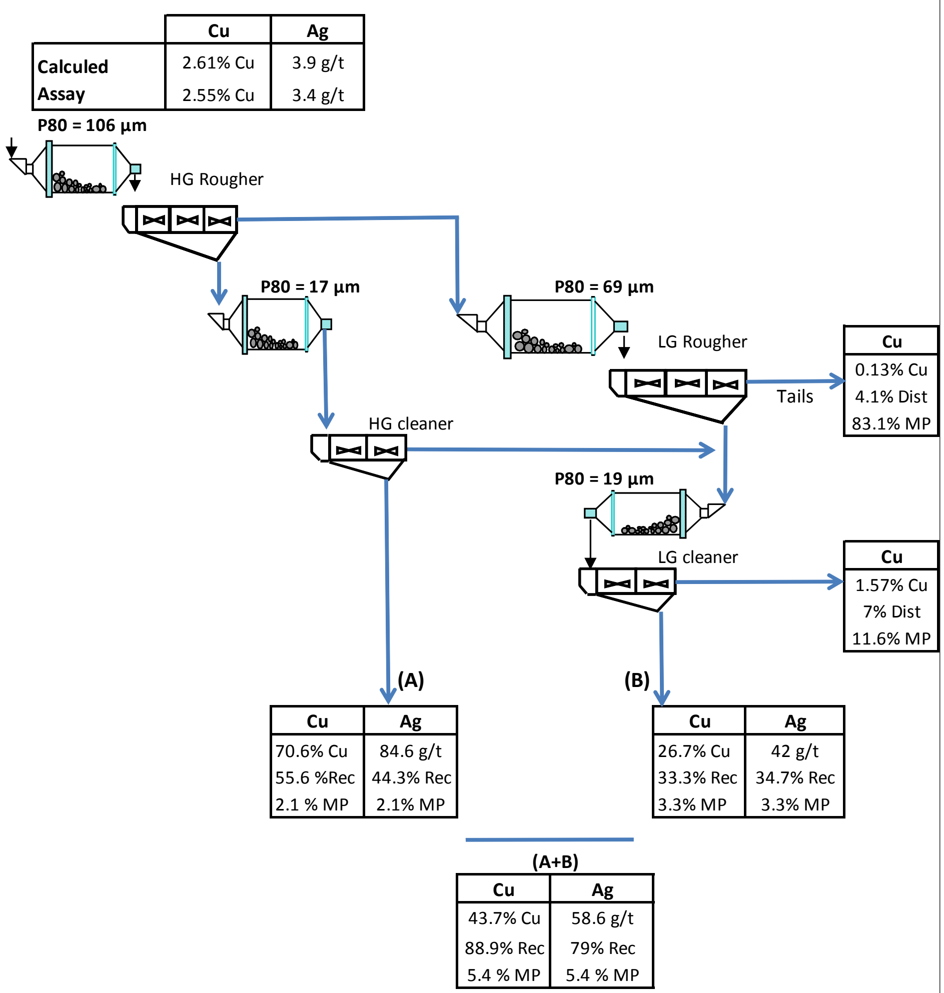
Table 13.1: Head Assay on Cut-Off Comp, AVG Comp and HG Comp.

Assay	Sample ID Cut-off Comp	AVG Comp	HG Comp
Cu %	1.45	2.55	4.53
Cu Sulfide as Cu %	1.37	2.45	4.42
Cu Oxide as Cu %	0.077	0.099	0.11
ICP Scan			
Ag g/t	2.2	3.4	13.8
S %	0.35	0.62	1.03
Al g/t	76000	76800	77500
As g/t	< 30	< 30	< 30
Ba g/t	270	208	96.9
Be g/t	0.7	0.72	0.66
Bi g/t	< 20	< 20	< 20
Ca g/t	28800	25000	24800
Cd g/t	< 2	< 2	< 2
Co g/t	47	53	60
Cr g/t	90	112	125
Fe g/t	70300	77100	82100
K g/t	15500	14600	14200
Li g/t	52	57	73
Mg g/t	43800	47000	51300
Mn g/t	887	900	910
Mo g/t	< 5	< 5	< 5
Na g/t	21300	23300	19700
Ni g/t	129	147	167
P g/t	853	830	720
Pb g/t	< 20	< 20	< 20
Sb g/t	< 30	< 30	< 30
Se g/t	< 30	< 30	< 30
Sn g/t	< 20	< 20	< 20
Sr g/t	163	155	133
Ti g/t	7720	8470	9130
Tl g/t	< 30	< 30	< 30
U g/t	< 20	< 20	< 20
V g/t	191	211	246
Y g/t	31.1	25.5	17.7
Zn g/t	112	83	136
Cu Sequential			
Cu seq H_2SO_4 %	0.11	0.14	0.16
Cu seq. NaCN %	1.4	2.4	4.2
Cu seq. A/R %	0.029	0.050	0.051

Table 13.2: Average Grade Composite Sample Components

FROM	TO	Length	Hole ID	Sample ID	Rock Type	Description2	Grade Range	
105.76	116.52	10.76	CEN411	36006-1	Amygdaloidal	Thin veins	0.484	3.85
144.50	146.00	1.50	CEN340	36025	Dike	Trace	1.23	5.96
120.20	123.70	3.50	CEN353	36036	Fragmental	Intermediate veins	0.054	10.131
123.90	127.90	4.00	CEN368	36042	Fragmental	Thin veins	0.618	7.84
170.60	179.00	8.40	CEN433	36027	Ophitic	Disseminated	0.46	4.3128
81.50	85.36	3.86	CEN339	36004	Ophitic	Intermediate veins	0.2157	6.9571
104.10	110.40	6.30	CEN353	36034	Ophitic	Thin veins	0.0232	9.6937
75.29	81.50	6.21	CEN339	36003	Scoriaceous	Intermediate veins	0.5173	9.9276

Figure 13.1: Preliminary Flotation Based Scheme for 543S Sample Testing



Reagents addition (g/t)				
CMC	Aero 3894	Aero 3477	NaHS	MIBC
15	70	70	300	55

14. MINERAL RESOURCES ESTIMATES

G Mining Services Inc. ("GMSI") has prepared an initial mineral resource estimate for the 543S copper deposit, which has been tested by drilling. Resource estimation methodologies, results and validations are presented in this section of the Technical Report.

The resource estimate was prepared in accordance with CIM Standards on Mineral Resources and Reserves (adopted November 27, 2010 and is reported in accordance with the Canadian Securities Administrators' National Instrument NI 43-101 ("NI 43-101"). Classification, or assigning a level of confidence to Mineral Resources, has been undertaken with strict adherence to the CIM Standards on Mineral Resources and Reserves. In the opinion of GMSI, the resource evaluation reported herein is a reasonable representation of the global mineral resources found in the 543S deposit at the current level of sampling.

The mineral estimate was prepared by Mr. Réjean Sirois, Eng. GMSI, Vice President, Geology and Resources, an independent "qualified person" as defined in NI 43-101. GEMS software was used to facilitate the resource estimation process.

The mineral resource estimates include inferred mineral resources that are normally considered too speculative geologically to have economic considerations applied to them that would enable them to be categorized as mineral reserves. There is also no certainty that these inferred mineral resources will be converted to the indicated and measured categories through further drilling, or into mineral reserves, once economic considerations are applied.

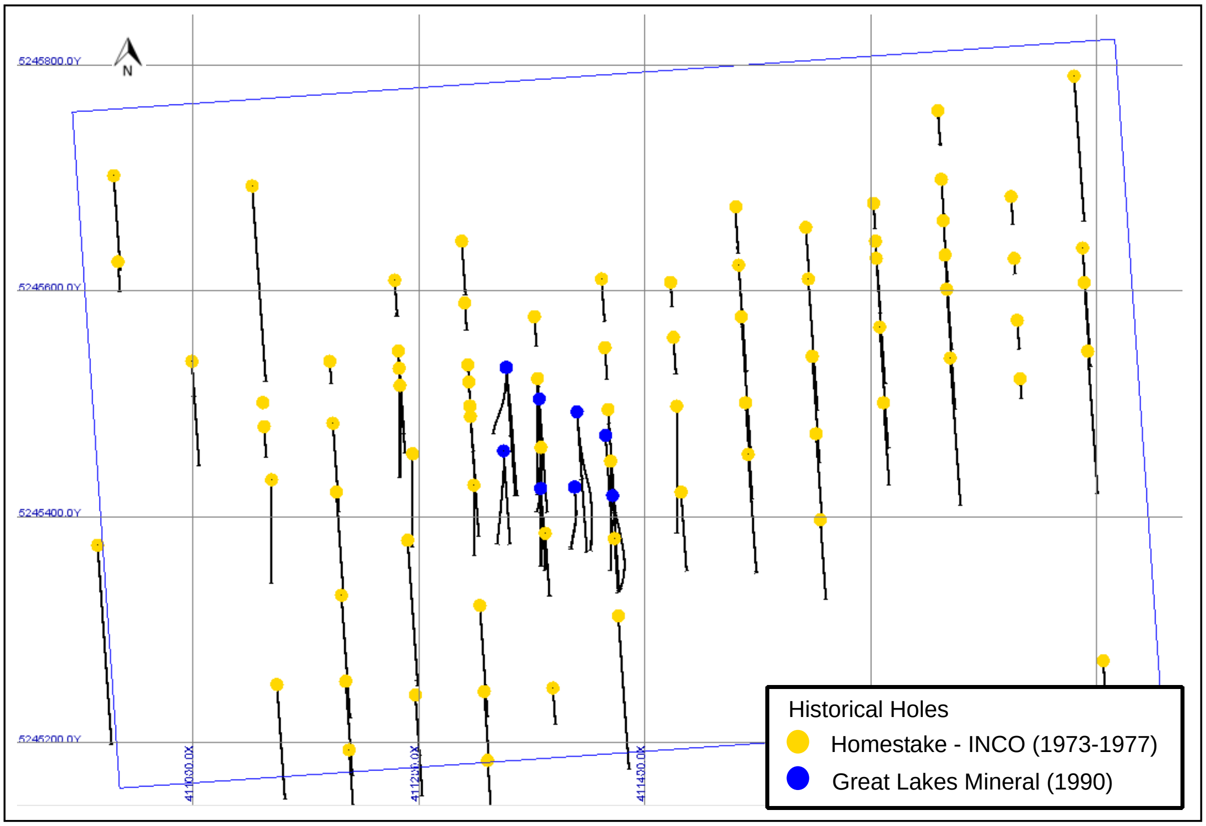
14.1 Data

Raw data incorporated into this Technical Report consists of all diamond drilling data obtained from the 543S Project between 1973 and 2013. On March 8th 2013, HCC released the final version of the database to use for the resource estimate and which integrated holes up to CEN487 inclusively. GMSI has reviewed and discussed sample collection methodologies adopted by Highland Copper Company Inc. ("HCC") and is satisfied that they are of a satisfactory standard. A review of findings pertaining to input data is presented in the Technical Report sections below and issues regarding the suitability of this data for inclusion in current and future resource estimates discussed in Section 14.8 - Resource Classification. The current resource estimate is derived exclusively from the database described in Section 12.1. The database was found to be in good condition and the errors detected during the data validation were promptly assessed and corrected if necessary.

14.1.1 Drill Hole Density

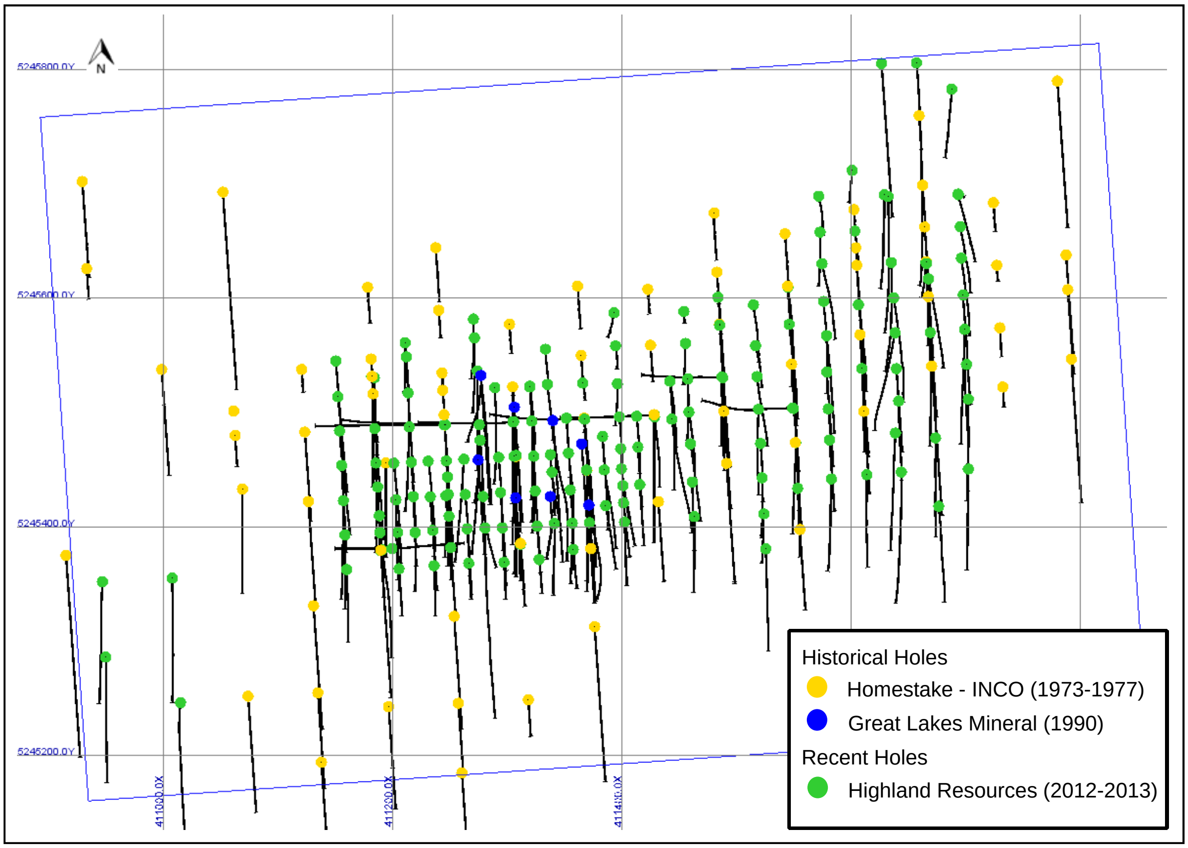
The historical drill holes from Homestake – Inco drilled between 1973 and 1977 followed a pattern of 60 x 60 m along the deposit. A few more holes drilled by Great Lakes Mineral in 1990 added locally more precision to the grid spacing with holes positioned at 30 x 30 m. The Figure 14.1 illustrates the grid spacing displayed by the historical holes.

Figure 14.1: Plan View of the Historical Drill Hole Spacing Grid within the Footprint's Deposit Outline (in blue).



HCC added more holes to the deposit in 2012 and 2013 with more than 26,000 m of drilling. The drill spacing was reduced to a 30 x 30 m drill pattern with the new drill holes being inserted in between the historical ones. Moreover, the western part of the deposit was drilled on a 15 x 30 m grid for more precision in that area. Figure 14.2 shows the combination of drill holes, historical and recent covering the entire 543S deposit.

Figure 14.2: Plan View Showing the Drill Hole Distribution by Company Inside the Deposit`s Footprint Outline (in blue)



The final drill spacing, combining the recent and historical holes, is judged adequate to develop a reasonable model of the mineralization distribution, and to quantify its volume and quality with an acceptable level of confidence.

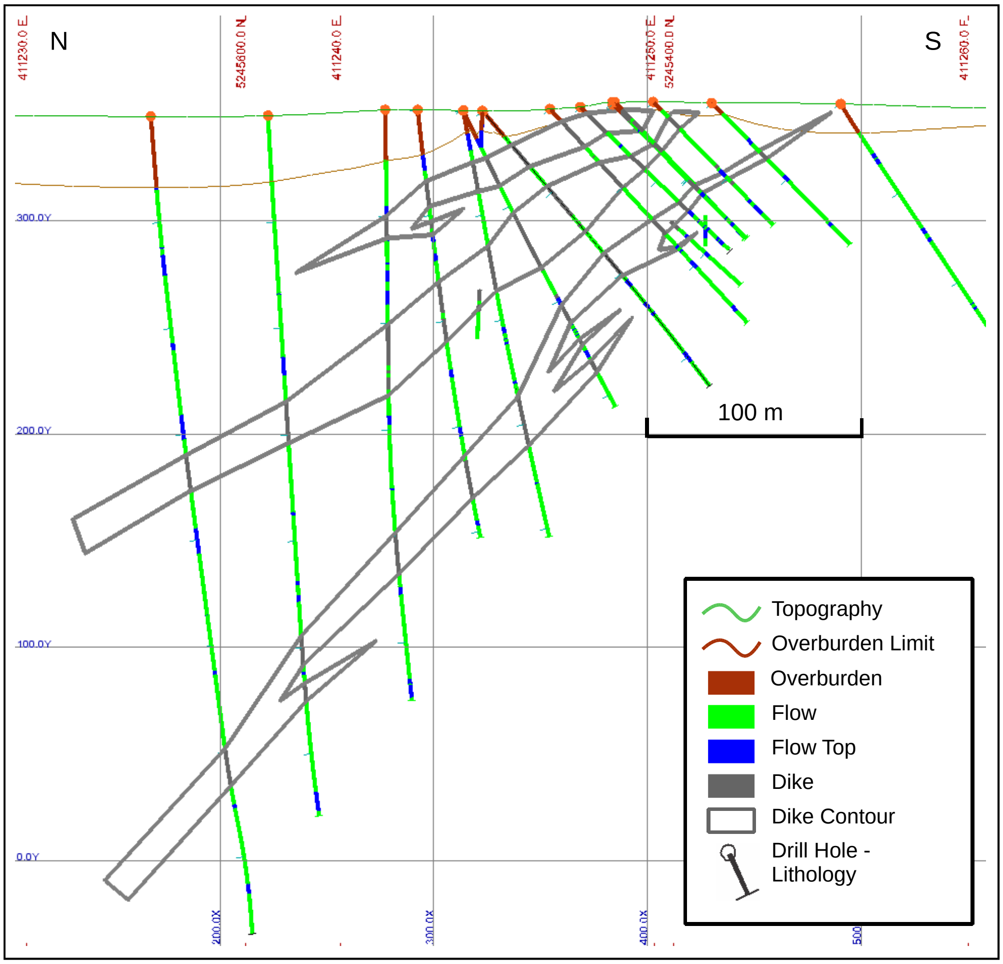
14.2 Modelling

The 2D and 3D modelling elements used for this resource estimate were produced by GMSI and were based on the geology and mineralization interpretation supplied by HCC. The modelling of the mineralized domains and other surfaces were carried out using the 3D geological modelling softwares Geovia® GEMS (version 6.4.1) and Leapfrog Mining® (version 2.5.2.27).

14.2.1 Geological Modelling

Geological outlines were drawn on cross-sections by HCC and those were digitised and transferred to GMSI to be imported into GEMS®. The interpretation of the main geology elements of the deposit contributed in the design of the mineralization domains. The main geology elements modelled consisted of a series of sub-parallel dikes and lava flow tops. The 2D interpretation of the dikes is illustrated in Figure 14.3.

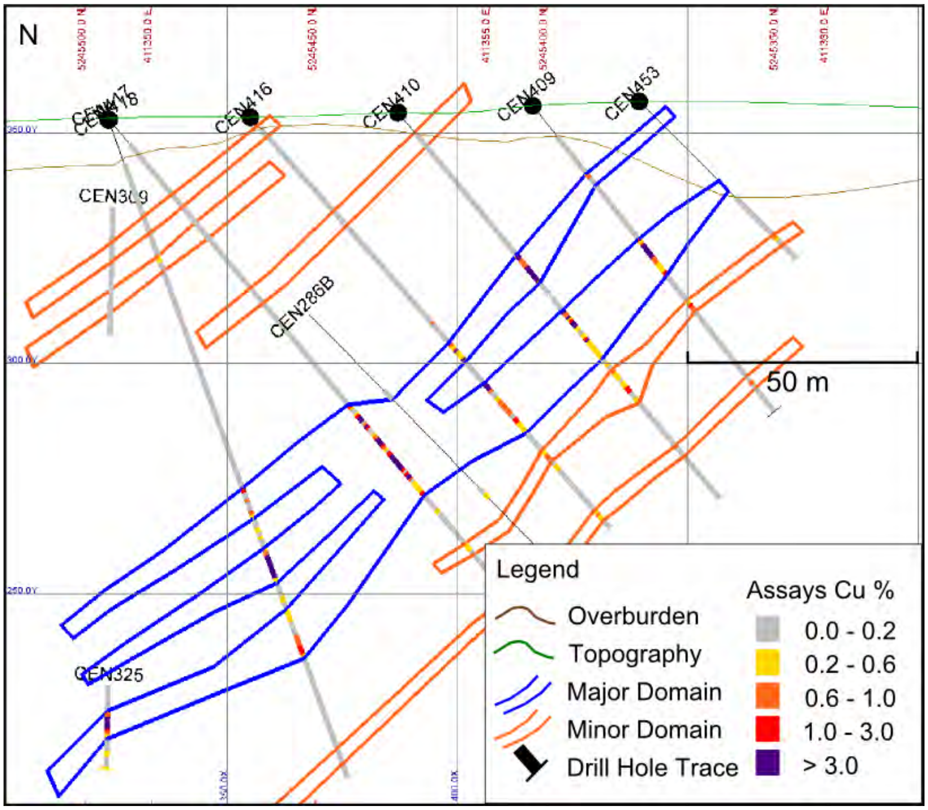
Figure 14.3: Section View of the Dike Contour Interpretation – Section 50200E Looking East



14.2.2 Mineralized Domains

The interpretation of the mineralization was firstly performed by HCC on sections. The digitized contour lines were exported to GMSI which imported them into the GEMS project. The 3D domains were constructed based on the initial HCC interpretation and included as much as possible assays greater than 0.20% Cu. The development of the zones also followed the general orientation and shape of the lithologies, mainly the lava flow tops. The Figure 14.4 illustrates an example of the contours drawn on sections from the lithology and assay information from the drill holes.

Figure 14.4: Cross Section View of the Mineralization Interpretation - Section 50500E Looking East



A total of eighteen (18) zones were modelled; one major zone crossing the whole deposit (#20) and other local minor zones. The thicknesses of the zones vary from a minimum of 3 m to a maximum of 34 m. The 3D mineralization wireframes were used as hard boundaries to constrain the interpolation of Cu and Ag grades. Table 14.1 presents a short description of the series of mineralized domains modelled by GMSI.

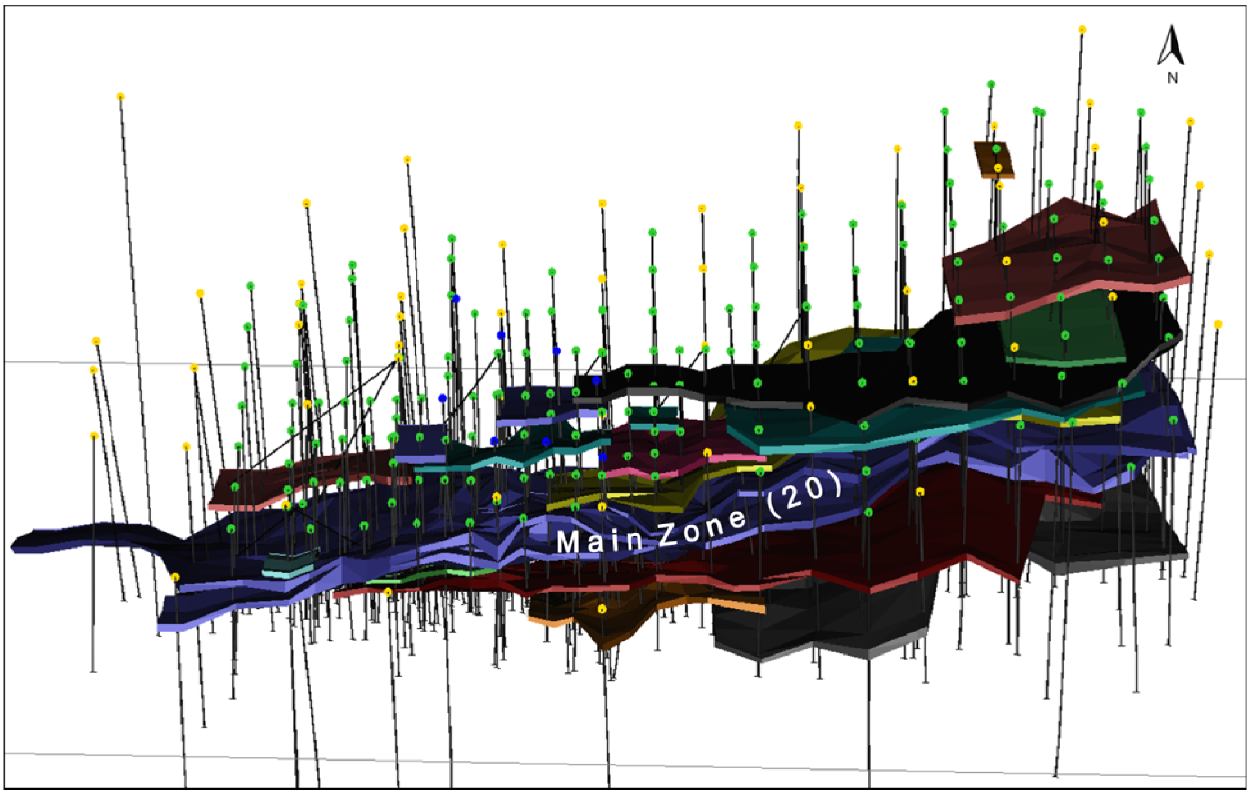
Figure 14.5 shows all the 3D mineralized wireframes.

Table 14.1: Mineralized Domains Modelled for the Resource Estimate

Count	Solid Description	Localisation (in relation to the Main Zone)	Depth Localisation	Solid Name	Rock Code
1	Main ore zone	Main Zone	-	20	20
2	Minor ore zone	South	-	21	21
3	Minor ore zone	North	-	22	22
4	Minor ore zone	South	-	23	23
5	Minor ore zone	North West	Mid level	25	25
6	Minor ore zone	South East	-	26	26
7	Minor ore zone	North East	-	27	27
8	Minor ore zone	North East	Near surface	28	28
9	Minor ore zone	North East	Near surface	30	30

Count	Solid Description	Localisation (in relation to the Main Zone)	Depth Localisation	Solid Name	Rock Code
10	Minor ore zone	North East	Near surface	31	31
11	Minor ore zone	North	Near surface	32	32
12	Minor ore zone	South West	At depth	33	33
13	Minor ore zone	North West	Near surface	34	34
14	Minor ore zone	North East	Near surface	35	35
15	Minor ore zone	South West	Near surface	36	36
16	Minor ore zone	North West	Near surface	37	37
17	Minor ore zone	South East	At depth	38	38
18	Minor ore zone	South West	Near surface	39	39

Figure 14.5: 3D View of the Drill Holes and the Domains (in various colors)



14.2.3 Surface Topography and Overburden

GMSI created a 3-D wireframe model of the surface topography using the surveyed drill hole collars of the project. The surface was generated through Leapfrog® software and then exported into the GEMS project for further use in the block model. The resulting topography provides a good representation of the predominantly flat terrain in the area of the 543S deposit.

A 3-D wireframe defining the interpreted lower limit of overburden in the area was constructed in the Leapfrog software. The surface relied on the intervals of overburden thoroughly identified in all the drill logs.

Table 14.2 indicates the location and name of the surfaces found in the GEMS project.

Table 14.2: Topography and Overburden 3-D Wireframes Description

Surface Description	Workspace Name	Solid Name	Origin
Topography	Topo	Topo / Clip / V12	Surveyed DDH Collar Points
Overburden Lower Limit	Topo	Overburden / Clip / V12	Drill Logs - Lithology Description

14.3 Statistical Analysis

14.3.1 Statistics of the Raw-Assays

Statistical analyses were conducted using the assays available in the drilling database of the 543S deposit. Only the assays located within the mineralized domains were compiled for this study as the interpolation processes will be using only those. A summary of the statistics results of the project is presented by mineralized domains in Table 14.3 for copper values and in Table 14.4 for silver values.

Table 14.3: Statistics of the Assays Located Inside the Wireframes – Cu (%) Grade Values

Zones	Number of Assays	Mean	Standard Deviation	CoV	Max.	Min.
20	3,882	1.84	2.76	1.50	22.75	0.00
21	184	0.71	1.55	2.19	10.77	0.00
22	312	0.23	0.47	2.08	4.48	0.00
23	510	1.27	2.53	2.00	15.60	0.00
25	54	0.87	1.42	1.63	4.71	0.00
26	499	1.33	2.16	1.63	16.22	0.00
27	467	0.67	1.21	1.81	8.30	0.00
28	242	0.47	1.29	2.73	10.30	0.00
30	135	0.35	1.50	4.25	12.80	0.00
31	42	0.18	0.54	3.02	2.36	0.00
32	99	0.18	0.30	1.68	1.81	0.00
33	7	0.31	0.30	0.99	0.90	0.01
34	68	0.12	0.22	1.77	1.14	0.00
35	9	0.95	1.05	1.11	3.27	0.01
36	47	0.63	1.62	2.56	7.69	0.00
37	18	0.63	0.27	2.03	4.20	0.00
38	22	0.12	0.14	1.25	0.45	0.01
39	25	0.76	0.98	1.30	4.36	0.00

Table 14.4: Statistics of the Assays Located Inside the Wireframes – Ag (gpt) Grade Values

Zones	Number of Assays	Mean	Standard Deviation	CoV	Max.	Min.
20	3,190	5.01	25.66	5.13	730.00	0.15
21	158	1.09	1.76	1.61	14.27	0.15
22	302	1.07	4.58	4.30	79.00	0.15
23	460	2.10	5.76	2.74	81.10	0.15
25	35	1.23	1.07	0.86	5.00	0.50
26	418	5.16	11.15	2.16	124.36	0.15
27	421	5.58	4.01	1.56	31.99	0.15
28	213	1.15	1.78	1.55	20.40	0.15
30	135	0.94	1.67	1.78	13.20	0.15
31	42	0.64	0.76	1.18	3.70	0.15
32	97	0.90	0.88	0.98	4.99	0.15
33	3	1.90	0.74	0.39	2.94	1.26
34	68	0.77	0.67	0.88	4.00	0.15
35	9	2.94	1.85	0.63	5.64	1.00
36	44	0.90	1.38	1.53	8.20	0.15

Zones	Number of Assays	Mean	Standard Deviation	CoV	Max.	Min.
37	17	4.11	9.71	2.36	41.00	0.15
38	20	0.62	0.33	0.54	1.20	0.15
39	3	0.50	-	-	0.50	0.50

Based on the study of the effect of the high grade values on the mean and standard deviation, and from probability and histogram plots, GMSI applied various capping limits depending on the mineralized domain. The capping was applied on the raw-assays before compositing. Table 14.5 and Table 14.6 tabulate the capping levels used on the raw-assays per domain for Cu and Ag grades.

Table 14.5: Capping Values Used on Assays per Domain – Cu (%)

Zones	Capping Value (% Cu)	Number of Assays Capped
20	17	7
21	7	2
22	3	1
23	13	3
25	4	5
26	11	5
27	6	2
28	4	5
30	3	2
31	-	-
32	1	2
33	-	-
34	1	2
35	-	-
36	7	1
37	4	1
38	-	-
39	3	1

Table 14.6: Capping Values Used on Assays per Domain – Ag (gpt)

Zones	Capping Value (Ag gpt)	Number of Assays Capped
20	80	12
21	7	2
22	7	2

Zones	Capping Value (Ag gpt)	Number of Assays Capped
23	40	2
25	4	1
26	50	4
27	20	5
28	7	2
30	6	2
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	2	3
38	-	-
39	-	-

14.3.2 Compositing

The capped raw-assays were composited into regular 2.5 m run length (down-hole) within each domain coded in the drill hole database. Each composite was coded using the domain's code from the corresponding domain. Composites measuring less than 1.25 m in length were removed from the database (*e.g.* composites created at the end of a domain).

14.3.3 Statistics of the Composites

A statistical analysis was undertaken to describe the characteristics of the composites of Cu and Ag grades within each of the mineralization domains, and to assess the need for limiting the influence of very high grading assays during interpolation. The statistics of the 2.5 m composites within the mineralized domains are summarized in Table 14.7 and Table 14.8 for copper and silver respectively.

Table 14.7 : Summary Statistics of the 2.5 m Composites inside the Domains – Cu (%)

Zones	Number of Assays	Mean	Standard Deviation	CoV	Max.	Min.
20	1,327	1.61	1.95	1.21	12.41	0.00
21	53	0.58	0.70	1.21	2.71	0.00
22	117	0.20	0.31	1.58	1.52	0.00
23	164	1.04	1.59	1.53	8.53	0.00
25	21	0.68	0.81	1.20	3.02	0.01

Zones	Number of Assays	Mean	Standard Deviation	CoV	Max.	Min.
26	171	1.13	1.55	1.38	9.63	0.00
27	141	0.55	0.82	1.50	4.13	0.00
28	95	0.30	0.58	1.95	4.00	0.00
30	45	0.15	0.35	2.32	1.89	0.00
31	18	0.09	0.35	3.71	1.52	0.00
32	42	0.17	0.22	1.32	0.71	0.00
33	4	0.27	0.21	0.77	0.57	0.02
34	27	0.10	0.16	1.60	0.67	0.00
35	2	0.84	0.83	0.99	1.68	0.01
36	16	0.42	0.93	2.21	3.33	0.00
37	5	0.32	0.60	1.89	1.51	0.00
38	9	0.11	0.14	1.28	0.31	0.01
39	10	0.94	0.81	0.86	2.60	0.00

Table 14.8: Summary Statistics of the 2.5 m Composites inside the Domains – Ag (gpt)

Zones	Number of Assays	Mean	Standard Deviation	CoV	Max.	Min.
20	959	3.61	5.50	1.52	50.83	0.15
21	46	1.16	1.29	1.11	5.90	0.31
22	111	1.13	3.96	3.51	42.13	0.15
23	143	2.11	3.38	1.60	23.82	0.15
25	15	1.37	0.95	0.70	3.71	0.50
26	125	3.88	6.70	1.73	38.48	0.18
27	125	2.15	2.57	1.20	14.49	0.15
28	82	1.05	0.94	0.89	4.80	0.15
30	45	0.75	0.67	0.90	3.27	0.15
31	18	0.54	0.49	0.91	2.50	0.16
32	40	0.88	0.79	0.90	3.50	0.15
33	2	1.87	0.51	0.27	2.38	1.36
34	27	0.74	0.50	0.67	2.40	0.15
35	2	2.75	1.75	0.64	4.50	1.00
36	15	0.79	0.78	0.99	3.01	0.15
37	5	0.69	0.39	0.57	1.44	0.39
38	8	0.66	0.31	0.47	1.04	0.22
39	1	0.50	-	-	0.50	0.50

14.4 Bulk Density Data

In the second half of 2013, 1,100 specific gravity measurements were taken from core samples, as described in Section 11.4. A review of the relationship between these density results and the copper content per lithology was undertaken by Dr. Julian Barnes (Barnes, 2013). Barnes suggested regression formulas for the three main lithologies are presented in Table 14.9. It is noteworthy that the grouped flow-tops category ("All flow-tops") was chosen to be on par with the 3D geological model.

Table 14.9: Regression Formulas as Suggested by Barnes (2013)

Lithology	Rock Type	Regression Equation
All Flow-Tops	40	2.77 + ((0.0123 x Cu%) - 0.0143)
Dike	15	2.66 + ((0.019 x Cu%) - 0.0075)
Ophitic Basalt	41	2.71 + ((0.0212 x Cu%) - 0.0299)

With this in hand, GMSI opted to implement density in the block model in a two-step manner. First, the block model was coded with the relevant lithological solids (flow-top, dike, and background basalt) and then each of these blocks were given a density value based on regressions presented in Table 14.9. This step was done after all steps relating to copper interpolation, including grade estimation validation. Secondly, an interpolation profile was set up to estimate densities in the vicinity of the 1,100 density measurements. Considering that these values are closer to real densities than those estimated by regression, they will overwrite those estimated from copper grade. Table 14.10 summarizes the parameters used to interpolate density around the specific gravity measurements. Each density sample could only interpolate inside blocks with matching rock types.

Table 14.10: Density Interpolation Parameters

Calculation Method	Inverse Distance Cube
Point-Area Workspace	Density / Dens_10Jan2014
Search Ellipse	50 m x 50 m x 50 m
Target Rock Codes	15, 40, 41
Minimum Number of Samples	1
Maximum Number of Samples	12
Limit of samples per hole	3

A summary of basic statistics of density values for all domains is displayed in Table 14.11. All overburden material was set to a unique density value of 2.35 g/cm^3. Table 14.12 presents densities of other materials outside of mineralized domains and search ellipse range (50 m) connected to specific gravity measurements.

Table 14.11: Basic Statistics of Block Model Density

Block Model Code	Number of Blocks	Density		
		Minimum (g/cm^3)	Maximum (g/cm^3)	Average (g/cm^3)
20	138,782	2.52	3.04	2.76
21	6,359	2.60	2.94	2.75
22	12,649	2.60	2.79	2.73
23	17,860	2.62	2.93	2.73
25	2,675	2.65	2.80	2.75
26	29,633	2.65	2.99	2.76
27	19,102	2.56	2.91	2.76
28	10,560	2.65	2.81	2.75
30	6,595	2.74	2.78	2.75
31	2,599	2.74	2.77	2.74
32	2,783	2.61	2.76	2.71
33	1,513	2.66	2.76	2.75
34	1,590	2.57	2.78	2.71
35	94	2.74	2.78	2.75
36	667	2.72	2.85	2.77
37	250	2.59	2.77	2.73
38	1,772	2.65	2.75	2.72
39	5,076	2.74	2.80	2.76
All Domains (20 to 39)	260,559	2.52	3.04	2.75

Table 14.12: Density of Blocks outside Mineralized Domains

Rock Type	Lithology	Density (g/cm^3)
2	Overburden	2.35
15	Dike	2.65
40	Flow-Tops	2.76
41	Ophitic Basalt (Host Rock)	2.74

14.5 Variography

Grade variography was generated in preparation for the estimation of copper and silver grades with the Ordinary Kriging method. The variography was based on the 2.5 m down-hole composite data included in the major zone (#20). The other minor domains were composed of too few composites to generate acceptable individual variogram models. The geostatistical software Sage 2001® was used to perform the analysis.

A series of correlograms was generated from the capped copper grades every 30 degrees azimuth and at 15 degrees dip increments. The optimal anisotropy directions were determined through regression by Sage 2001®. The minimum number of composite pairs required for variography was 100. The variography model included a nugget effect and two spherical structures.

The resulting variogram model is presented in Table 14.13. The same variogram model is used for Cu and Ag grades, and for all the domains. The rotation angles around axes ZYZ follows the GEMS® convention and are based on the orientation of the block model. The orientation results were brought into GEMS® for visualization to confirm the appropriateness of the rotation axes with the orientation of the mineralization domains.

Table 14.13: Variogram Models for Cu and Ag Capped Composites

Element	Nugget	Ranges of Influence (m)								Rotation		
		1st Structure				2nd Structure				Z	X	Z
		X	Y	Z	Sill	X	Y	Z	Sill			
Cu	0.381	28.5	20.8	6.2	0.489	211.7	118.2	45.9	0.13	0	-45	90
Ag	0.377	24.3	6.2	7.4	0.562	135.3	144.6	103.0	0.061	0	45	0

As discussed in a memo sent to HCC in October 2013 (GMSI, 2013), several tests were made with different nugget effects to assess the variability of resources. It was found that the nugget effect does not have a significant influence for global resources. A difference of less 1% was calculated between the estimations made. However, shifting from a low to a high nugget effect will definitely locally change copper and silver grades. Given the final interpolation method chosen (Section 14.7 – Interpolation Methodology) nugget effects will not be used in the final grade interpolation, but they are still useful in defining and/or refining search ellipses.

14.6 Block Modelling

A block model was constructed for the 543S deposit. The block model covers an area large enough to manage pit optimizations, associated pit slopes and possible underground developments. The block model was set in the GEMS® 6.4.1 database.

The drilling pattern (30 m x 30 m, and locally 15 m x 30 m) additionally with the mine planning considerations guided the choice of block dimension. The block model parameters for 543S are summarized in Table 14.14.

Table 14.14: Block Model Parameters for 543S Deposit

Block Model Name	Orientation	Origin	Number of Columns, Rows, Levels	Block Size (m)	Rotation[1]
543S_BM4	East	410,935	370	2.5	4
	North	5,245,160	240	2.5	
	Elevation	425	182	2.5	

[1] For a positive value, the direction of rotation is counterclockwise around the elevation axis

The rock type model, or domain coding, relied on the multiple wireframe constraints presented in Section 14.2. Table 14.15 describes the coding and the associated domains developed from the different wireframes and used in the block model. Densities associated with these domains are presented in Table 14.11.

Table 14.15: Rock Codes Used in the Rock Type Model

Rock Description	Block Model Codes
Air	999
Overburden	2
Main Ore Zone #20	20
Ore Zone #21	21
Ore Zone #22	22
Ore Zone #23	23
Ore Zone #25	25
Ore Zone #26	26
Ore Zone #27	27
Ore Zone #28	28
Ore Zone #30	30
Ore Zone #31	31
Ore Zone #32	32
Ore Zone #33	33
Ore Zone #34	34
Ore Zone #35	35
Ore Zone #36	36
Ore Zone #37	37
Ore Zone #38	38
Ore Zone #39	39

Additionally, a series of attributes needed during the block modelling development were incorporated into the block model project. Table 14.16 presents the list of attributes found in the block model project 543S_BM4 in the Standard folder.

Table 14.16: List of Final Attributes Found in the Block Model 543S_BM4

Folder Name	Model Name	Description
Standard	Rock Type	Domain coding
	DENS_LEST	Specific Gravity
	15-CU ID3	Inverse Distance Cube Cu (%)
	15-AG ID3	Inverse Distance Cube Ag (gpt)
	15-CuEq ID3	Copper Equivalent[1]
	15-Pass	Interpolation Pass (Copper)
	15-AG Pass	Interpolation Pass (Silver)

(1) Copper equivalent grade calculations are presented in Section 14.7

14.7 Grade Estimation Methodology

Several interpolation methods were tested within the 543S deposit, with relatively similar results both in grade and tonnage, except for the Indicator Kriging method which yielded notably lower copper content. The following calculation methods were assessed: Ordinary Kriging (OK), Indicator Kriging, Inverse Distance Power 12 (ID^{12}), Inverse Distance Square (ID^2) and Inverse Distance Cube (ID^3). The ID^{12} method was discarded given that it is very close to a nearest neighbor interpolation, which gives too much influence on samples near the interpolated block and very little to samples farther. This technique may give grades similar to a polygonal method. As stated above, the Indicator Kriging method was also discarded due to a difference of approximately 11% and 16% in tonnage with the ID^3 and OK method respectively. The other tested techniques were all judged adequate for the deposit and no significant discrepancies between the methods were noted.

Subsequent to discussions with HCC, the Inverse Distance Cube interpolation method was used for the grade interpolation of Cu and Ag composites. This method is judged adequate given that the coefficients of variation of copper composites of the Main Zone are moderate (1.21 for Zone 20). Geovia® GEMS 6.4.1 software was used for the estimation.

Note that the mineralized domains were considered as hard boundaries through each interpolation step. A block being interpolated used only composites from within its corresponding domain.

The sample search approach used to estimate the blocks is summarized below:

- **First Pass**: A minimum of 5 and maximum of 12 composites within the search ellipse ranges. A maximum of two composites per hole could be used for any block estimate.
- **Second Pass**: A minimum of 3 and maximum of 12 composites within the search ellipse ranges. A maximum of two composites per hole could be used for any block estimate. Only blocks which were not estimated during the first pass could be estimated during the second pass.
- **Third Pass**: A minimum of one and maximum of 12 composites within the search ellipse ranges. A maximum of two composites per hole could be used for any block estimate. Only blocks which were not estimated during the first and second pass could be estimated during the third pass.

For the first, second and third passes, restrictions on the search ellipse ranges were applied on composites of very high grade to limit their influence. This measure is judged to be prudent since the continuity of the higher grade values within the domains is still to be confirmed. This limit, or high grade threshold, ensures that those composites of higher grade are only selected within the ranges of the half search ellipse before being used for the interpolation estimation. The high grade thresholds were chosen based on the statistical analysis of the 2.5 m composites presented in Section 14.3.3.

It is important to note that since the standard search ellipses are very narrow in thickness (range Z), the range Z for the half search ellipse was kept constant instead of being cut in half.

The various profiles of interpolation and search ellipses for Cu and Ag composites utilized in the estimation of the resources of the 543S deposit are tabulated in Table 14.17 , Table 14.18 and Table 14.19. The high grade thresholds affecting the ranges of the search ellipsoid are presented by domains in Table 14.20 for Cu and Ag composites.

GMSI calculated a Copper Equivalent grade for each blocks using copper and silver grades. The parameters presented in Table 14.21 result in the following formula integrated in the Block Model:

$$Cu\ Eq. = Cu\% + \left(Ag\frac{g}{t} \times 20\frac{\$}{oz} \times 80\% \times 90\%\right) \div \left(22.0462\frac{lbs}{10kg} \times 3\frac{\$}{lbs} \times 31.1035\frac{g}{oz} \times 90\% \times 96.5\%\right)$$

Table 14.17: Interpolation Profile Settings Used for the Final Estimations of Resources – Inverse Distance Cube – Cu & Ag

Profile Name	Element	Pass #	Composites			Point Area Name	Grade Field	Rock Code Target
			Min	Max	Max per Hole			
ID3_P1	Cu	1	5	12	2	6V13_Cmp2_5m2_Ore	Cu_Cap	20 to 39
ID3_P2	Cu	2	3	12	2	6V13_Cmp2_5m2_Ore	Cu_Cap	20 to 39
ID3_P3	Cu	3	1	12	2	6V13_Cmp2_5m2_Ore	Cu_Cap	20 to 39
AG_ID_P1	Ag	1	5	12	2	6V13_Cmp2_5m2_Ore	Ag_Cap	20 to 39
AG_ID_P2	Ag	2	3	12	2	6V13_Cmp2_5m2_Ore	Ag_Cap	20 to 39
AG_ID_P3	Ag	3	1	12	2	6V13_Cmp2_5m2_Ore	Ag_Cap	20 to 39

Table 14.18: Sample Search Ellipsoid Settings Used in the Final Estimations of Resources – Cu

Ellipse Profile Name	Interpolation Pass	Rotation			Anisotropy Range (m)			High Grade Threshold	High Grade Range (m)		
		Z	Y	Z	X	Y	Z		X	Y	Z
##CU_P1	1	0	-45	90	20	20	5	Variable (see Table 14.20)	10	10	5
##CU_P2	2				40	40	5		20	20	5
##CU_P3	3				80	80	20		40	40	20
CU_P1_0	1				20	20	5	None	-	-	-
CU_P2_0	2				40	40	5				
CU_P3_0	3				80	80	20				

Table 14.19: Sample Search Ellipsoid Settings Used in the Final Estimations of Resources – Ag

Ellipse Profile Name	Interpolation Pass	Rotation			Anisotropy Range (m)			High Grade Threshold	High Grade Range (m)		
		Z	Y	Z	X	Y	Z		X	Y	Z
##AG_P1	1	0	-45	90	20	20	5	Variable (see Table 14.20)	10	10	5
##AG_P2	2				40	40	5		20	20	5
##AG_P3	3				80	80	20		40	40	20
AG_P1_0	1				20	20	5	None	-	-	-
AG_P2_0	2				40	40	5				
AG_P3_0	3				80	80	20				

Table 14.20: High Grade Thresholds Used in Each Domain to Limit the Search Ellipsoid Ranges – Cu (%) and Ag (g/t)

Rock Codes	High Grade Threshold	
	Cu (%)	Ag (g/t)
20	11.5	50
21	2.5	5.5
22	1.5	5
23	6	-
25	2.5	-
26	6	35
27	-	-
28	3	-
30	-	-
31	-	1
32	-	-
33	-	-
34	-	-
35	-	-
36	-	1.2
37	-	-
38	-	-
39	-	

Table 14.21: Parameters Used in the Definition of Copper Equivalent Grades

Parameter	Copper	Silver
Metal Price	3 $/lb	20 $/oz
Recovery	90%	80%
Payable Rate	96.50%	90%

14.8 Classification and Resource Reporting

The CIM Definition Standards on Mineral Resources and Mineral Reserves, prepared by the CIM Standing Committee on Resource Definitions and adopted by the CIM council on November 27, 2010, provide standards for the classification of Mineral Resources and Mineral Reserve estimates into various categories. The category to which a resource or reserve estimate is assigned depends on the level of confidence in the geological information available on the mineral deposit, the quality and quantity of data available, the level of detail of the technical and economic information which has been generated about the deposit and the interpretation of that data and information. Under CIM Definition Standards:

An *"Inferred Mineral Resource"* is that part of a Mineral Resource for which quantity and grade or quality can be estimated on the basis of geological evidence and limited sampling and reasonably assumed, but not verified, geological or grade continuity. The estimate is based on limited information and sampling gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes.

An *"Indicated Mineral Resource"* is that part of a Mineral Resource for which quantity, grade or quality, densities, shape and physical characteristics can be estimated with a level of confidence sufficient to allow appropriate application of technical and economic parameters, to support mine planning and evaluation of the economic viability of the deposit. The estimate is based on detailed and reliable exploration and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes that are spaced closely enough for geological and grade continuity to be reasonably assumed.

A '*Measured Mineral Resource'* is that part of a Mineral Resource for which quantity, grade or quality, densities, shape, and physical characteristics are so well established that they can be estimated with confidence sufficient to allow the appropriate application of technical and economic parameters, to support production planning and evaluation of the economic viability of the deposit. The estimate is based on detailed and reliable exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes that are spaced closely enough to confirm both geological and grade continuity.

In addition, the classification of interpolated blocks is undertaken by considering the following criteria:

- Quality and reliability of drilling and sampling data.
- Distance between sample points (drilling density).
- Confidence in the geological interpretation.
- Continuity of the geologic structures and the continuity of the grade within these structures.
- Variogram models and their related ranges (first and second structures).
- Statistics of the data population.
- Quality of assay data.

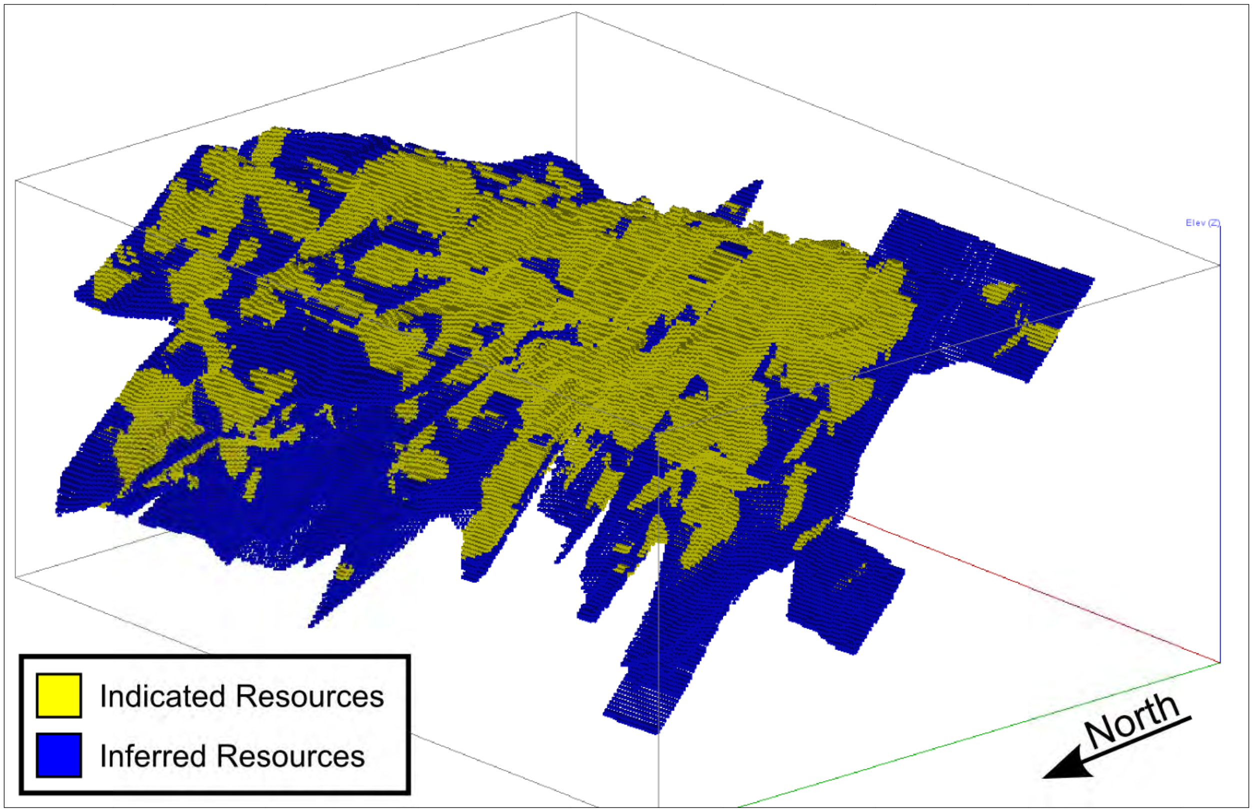
The resources were classified according to the above mentioned criteria which also directed the choice of the search parameters for each interpolation pass during the block estimation.

Indicated resources are limited to the blocks interpolated in the first and second estimation passes.

Inferred resources are the blocks estimated from the third estimation pass.

Figure 14.6 shows how the resources categories are distributed in the deposit for the Inverse Distance Cube interpolation method. Indicated resources are spatially limited to areas of higher drilling density, whereas inferred resources are mostly limited to the extremities of wireframes and/or to areas of low density drilling. Indicated and inferred resources account for 71% and 29% respectively of all estimated blocks in the three interpolation passes.

Figure 14.6: Resource Categories



14.9 Grade Estimation Validation

Validation was completed on the 543S block model. The validation process included visual checks of the model and comparisons with models built from other interpolation estimation methods.

14.9.1 Visual Validation

The visual checks consisted of visualization of slices of the block model, mineralized domains and drill hole database. The slicing was performed vertically on 15 and 30 m intervals (depending on the area) and horizontally on 5 m intervals. The data source was visually compared with the different model attributes (rock type, density, Cu and Ag grades) throughout the strike length of the deposit. The mineralized domains and the overburden layer are well represented in the rock type model, and the Inverse Distance Cube based copper and silver resource estimates were found to be a good representation of the drill hole composites.

14.9.2 Model Validation Using Different Interpolation Methods

The validation of the block model was also done using 1) the indicator kriging and 2) the ordinary kriging interpolations to compare with the inverse distance cube estimate. The same set of composites, search ellipses, and settings were used for the different interpolations and only the estimation method differed. Table 14.22 presents the models that served for the validation process described above.

Table 14.22: List of Models Used for Validation of the Block Model 543S_BM4

Model Name	Element	Interpolation Method	Number of Interpolation Passes	Data Source	Description
7-IND CU	Cu (%)	Indicator Kriging	Three passes	All holes	Cu (%) estimation
7-IND AG	Ag (gpt)	Indicator Kriging	Three passes	All holes	Ag (gpt) estimation
7-Pass	-	-	-	-	Interpolation pass indicator
12-CU OK New NE 0.381	Cu (%)	Ordinary Kriging	Three passes	All holes	Cu (%) estimation
12-AG OK New NE	Ag (gpt)	Ordinary Kriging	Three passes	All holes	Ag (gpt) estimation
12-Pass	-	-	-	All holes	Interpolation pass indicator

The results of the different validation estimations were found to be reasonably comparable. An example comparing the Cu % grade distribution estimated using the different interpolation methodologies is presented in Figure 14.7.