Technical Report on the Longnose Ilmenite Project, Minnesota, USA

Report Prepared for
Cardero Resource Corp.

Report Prepared by
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Cover Photo: A meadow on Longnose Property in the summer
Important Notice

This report was prepared as a National Instrument 43-101 Technical Report for Cardero Resource Corp. (“Cardero” or “the Company”) by SRK Consulting (Canada) Inc. (“SRK”). The quality of information, conclusions, and estimates contained herein is consistent with the level of effort involved in SRK’s services based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions, and qualifications set forth in this report. This report is intended for use by Cardero subject to the terms and conditions of its contract with SRK and relevant securities legislation. The contract permits Cardero to file this report as a Technical Report with securities regulatory authorities pursuant to National Instrument 43-101, Standards of Disclosure for Mineral Projects.
Executive Summary

This Technical Report documents the current technical data and Mineral Resource estimate for the Longnose Project (“the Project”). It was prepared following the guidelines of the Canadian Securities Administrators National Instrument 43-101 (“NI 43-101”) and Form 43-101F1, and in conformity with generally accepted CIM “Estimation of Mineral Resources and Mineral Reserves Best Practice Guidelines”. This report has been written by SRK on behalf of Cardero.

Property Description and Location

The Lands making up the Project (“Project Area”) are located in northeastern Minnesota in St. Louis County, Township 59N, Range 13W, Section 30 and is centered at: (Coordinate system: Universal Trans Mercator, Zone 15 North, North American 1983 Datum) 572200 metres East, 5268300 metres North.

Cardero’s indirect wholly owned subsidiary, Cardero Iron Ore (USA) Inc. (“CIOUS”), holds an option to acquire up to an 85% interest in the Project by incurring USD 1,850,000 in expenditures (to acquire 70%) and delivering a feasibility study (to acquire an additional 15%). Upon CIOUS earning its 70% or 85% interest, the optionor of the Project has the option to maintain its 30% or 15% interest and enter into a joint venture with CIOUS, or to convert its working interest to either a 10% or 5% net profits interest. Advance royalties and production royalties are payable to the underlying property lessors.

CIOUS has all required licenses, permits and registrations in place to carry out exploration and resource definition drilling. Additional permits will be required in the future to advance to the next stage.

Accessibility, Climate, Local Resources, Infrastructure and Physiography

Topographic relief is generally low, and the surface is flat-laying. Elevations range between 465 and 490 metres (“m”) above mean sea level. The ground cover at the Project Area is a mixture of Palustrine, forested wetlands (Cowardin classification system), and higher dry forested ground. Overburden, consisting of glacial till, is present and the depth to bedrock is approximately 3 m to 30 m from surface.

Accessibility is excellent, with the Project located off of a paved county highway via a well maintained gravel road.

The climate in northeastern Minnesota is mid-continental. Winter conditions usually begin in mid-December and last until mid-March, with frozen ground beginning in late December to early January. The spring thaw usually begins in mid-March to late April, with stable, dry spring-summer-fall conditions occurring from late April to mid-December.

The population of Aurora, Minnesota (the nearest major population centre) is approximately 1,850, and the nearby city of Hoyt Lakes (8 km, 5 miles, east of Aurora), Minnesota has a population of approximately 2,000 people.

The infrastructure in northeastern Minnesota related to mining activities is excellent, with low cost electricity, railroads, paved state and county highways, international shipping ports, mining professionals, mining vendors, and trained labor all readily available. International shipping ports are
located along the north shore of Lake Superior, including Duluth/Superior, Silver Bay, Taconite Harbor, and Two Harbors, with linked rail systems to all.

**History**

The lands making up the Project ("Project Area") were the subject of historical exploration processes between 1950 and 2008. The deposit was initially discovered by Bear Creek Mining, while exploring for copper-nickel ("Cu-Ni") deposits.

Twelve (12) drill holes were completed by American Shield Corp., Bear Creek Mining, and Nicor during the 1980s and 1990s.

The Project Area was held by a series of mining companies including American Shield and BHP Minerals International Inc. (BHP). BHP held the Project Area for some time in the 1990s. Most of the work completed by BHP centered on metallurgy, and TiO$_2$ recovery. Initial metallurgical testing focused on the production of an ilmenite concentrate. Further upgrading analysis was completed as well, the first of which involved a smelting and sulfation-leaching process developed by the US Bureau of Mines. Their second investigation involved an oxidation-reduction roast followed by chemical leaching, using a process called the "Murso" process.

Several large (1.5 tonne to 60 tonne) bulk samples were utilized to complete the metallurgical testwork. The larger samples were collected from out crop of the Longnose deposit, while smaller test samples were taken from core. The University of Minnesota, Natural Resources Research Institute, Coleraine Minerals Research Laboratory houses what remains of both bulk samples.

**Geological Setting and Mineralization**

The Project Area is located within the Superior Province of the Canadian Shield, and is underlain by intrusive rocks generated during the formation of the Midcontinent Rift. Mineralization is hosted by Oxide-bearing Ultramafic Intrusions ("OUI" or "OUIs") that intruded into layered series intrusions of the Duluth Complex. OUIs are dominantly composed of coarse-grained to pegmatitic pyroxenite, peridotite, and dunite that contain approximately 10-40% titanium-iron oxide mineralization, dominantly as ilmenite with lesser titaniferous magnetite. Typically, zones of massive and semi-massive oxide are also present throughout the stratigraphy. Locally, some OUIs also contain abundant copper-nickel sulfide mineralization as well; however, this style of mineralization has not been intersected within the Project Area. Most OUIs occur along the western margin of the southern portion of the Duluth Complex, and display numerous shapes (sheet-, funnel-, dike- and pipe-like geometries) and inclinations (flat-lying, moderately-dipping, and sub-vertical).

The Longnose OUI is geologically interpreted to be a late-stage intrusion that cut early Duluth Complex stratigraphy, and is associated with magmatism generated by the 1.1 billion year old Midcontinent Rift system.

The Longnose OUI contains disseminated, semi-massive, and massive ilmenite and titaniferous-magnetite mineralization. The Project Area hosts a single intrusion which is at least 150 m thick, dipping shallowly to the southeast.

Mineralization at the Project Area dominantly consists of disseminated to net-textured, medium to coarse-grained, ilmenite, titaniferous magnetite and magnetite (Paster, 1987). Olivine-rich ultramafic rocks (peridotite, feldspathic peridotite & dunite) host the majority of the titanium-iron oxide mineralization found in the Longnose OUI, and will often be net-textured with oxide minerals.
interstitial to silicates. Visual modal mineral calculations generally estimate that titanium-iron oxide minerals compose 15-35% of the peridotitic and dunitic rocks at the Project. Numerous massive and semi-massive titanium-iron oxide horizons or zones (45-100% titanium-iron oxide) have been intersected in drill core. These massive and semi-massive oxides seem to be dominantly hosted by peridotite and dunite, though they have been intersected within zones of pyroxenite as well. It is clear that the main mineralized intrusion at the Project is a thick, laterally and vertically continuous intrusion dominantly composed of a mixture of oxide-bearing peridotite, oxide-bearing dunite, massive oxide, and semi-massive oxide with between 15% and 100% titanium-iron oxide mineralization.

Exploration

Exploration at the Project has included surface sampling, geophysics and diamond drilling.

Twenty-seven diamond drill core holes have been drilled on the Project Area, including six holes drilled by CIOUS in 2010, and nine holes drilled by CIOUS in 2011. Historic drilling includes 12 drill holes completed by a variety of operators in the 1980s and 1990s. The historic drill core has been re-sampled by CIOUS during 2009 and 2010, where such material was available. In total, the twenty-seven holes totalled 5,217 m, with 1,979 m from historic holes and 3,238 m from CIOUS drill holes.

Drill hole spacing for the Project is variable (drill holes are not on a regular grid) between 50 m and 100 m. Drill core has been sampled in 1 m to 6 m intervals.

Exploration data has focussed on the geology and titanium ("Ti") and iron ("Fe") analytical sample data; however, other elements should be reviewed and potentially estimated in future analysis. Titanium was measured as TiO$_2$ and iron was measured as Fe$_2$O$_3$.

Sample Preparation, Analyses and Security

CIOUS has utilized a thorough and robust procedure for sampling, sample preparation, analysis and security.

Procedures for core handling, logging, sampling and sample shipping were well thought out and well implemented. Analysis was completed by ALS, one of the largest commercial laboratories in the world. A robust program of quality assurance and quality control samples was implemented and met or exceeded industry standard procedures. Sample security and chain of custody documentation was maintained throughout the process and was thoroughly reviewed by SRK.

Data Verifications

Exploration data verification for the Project has included a site visit by SRK, enforced database structures, analytical quality assurance and quality control ("QA/QC") samples, independent sampling and assay checking.

SRK’s Wayne Barnett, Pr.Sci.Nat visited the site in July 2009 and Mike Johnson, P. Geo, visited the site in March 2010. During these site visits, SRK verified drill hole locations, drilling, logging and sampling procedures, security and documentation. SRK also collected independent sampling during these site visits and confirmed the TiO$_2$ and Fe$_2$O$_3$ values for five Longnose samples.
CIOUS utilized an onsite database which validated the data entry process as it was being completed and reduced clerical errors. As well, Cardero’s head office checked the data upon import into their main exploration database in order to minimize data errors.

SRK verified 92% of the assay database by downloading these records directly from the commercial laboratory and checking them against the Mineral Resource database.

CIOUS completed QA/QC sampling (blanks, standards, duplicates) totalling 393 samples, equal to 23% of the total samples. SRK has reviewed the QA/QC sample insertion rate and results, and concluded that the analytical data should be reliable.

**Mineral Processing and Metallurgical Testing**

Most processing and metallurgical testwork at the Project was completed prior to CIOUS’ involvement in the property.

Historical metallurgical testwork indicated that there is a reasonable chance that a saleable ilmenite and magnetite concentrate could be created from the Longnose deposit. Metallurgical testing regarding the Longnose deposit has focussed primarily on optimizing ilmenite recovery and creation of the ilmenite concentrate.

The historic metallurgical testwork indicates a relatively simple processing flow sheet. It would include crushing the material to a selected size and processing the ore by density and then by magnetic properties. The density separation would remove the silicates from the much more dense oxides. The oxides would then be split into a non-magnetic / paramagnetic fraction as well as a magnetic fraction. Magnetite would partition into the magnetic fraction, while the ilmenite would partition into the non-magnetic / paramagnetic fraction. The magnetic fraction could be further upgraded to recover some ilmenite that would partition into that fraction. The ilmenite concentrate could then be sold to an external processing site, or could be processed at a newly created process facility as part of a further beneficiation/added value processing project; however, a potential upgrading facility would have very significant capital costs.

Historical testwork has shown that the concentrates created from the Longnose rock can be processed into a potentially saleable concentrate (Westmont, 1990); however, the quality of the concentrate may be adversely affected by the high magnesium content of the ilmenite. (Wright et al, 1984)

CIOUS has completed very limited metallurgical testing at this stage. Recent work includes only Davis Tube tests, which are used to determine the proportion of material which is magnetic and which is commonly associated with magnetite.

CIOUS will have to complete further metallurgical work for the Project if further economic analysis is contemplated.

**Mineral Resource Estimates**

In 2011, SRK was retained by Cardero to complete a Mineral Resource for the Longnose OUI deposit, as well as update the technical report for the Project.

SRK utilized Gemcom’s Surpac® version 6.2 and several other software packages to complete the estimation. A comprehensive and validated drill hole database was utilized to complete the analysis. The database includes twenty-seven drill holes; however, only twenty-four were utilized in
the estimation process due to issues with resampling of some historic drill holes. All 2010-11 drill hole data included multi-shot downhole surveys; however, historic holes did not have downhole surveys. The estimation process utilized 1681 samples out of the database’s 1956 samples. A total of 855 specific gravity measurements were utilized to estimate bulk densities. Estimation of metal grades utilized regularized 2 m composites.

Two geological domains were defined for the estimation process. The domains were defined by the presence of peridotite or pyroxenite oxide bearing rocks. The peridotite domain has higher olivine content and encompasses higher TiO$_2$ grades near the core of the deposit. The pyroxenite domain includes higher pyroxene content, has lower TiO$_2$ grades and is generally found at the periphery of the deposit. The geological domains are generalized, with some instances of other rock types within each domain.

The estimations were made into a three–dimensional block model with 20 m by 20 m by 10 m block size, with sub-blocking to 5 m by 5 m by 2.5m. Estimated parameters included specific gravity, TiO$_2$ and Fe$_2$O$_3$ grades. Metal grade interpolation was completed through three passes using increasingly larger search ellipses and lower restrictions on sample inclusion in each pass. Search ellipses were generally flat “pancakes” with the shortest direction of continuity sub-vertically and the longest in the northwest-southeast direction. The search ellipse orientations, which dip 20 degrees to the east, were based upon variography completed on the 2 m composite data. Ordinary kriging (“OK”) was used to estimate TiO$_2$ and Fe$_2$O$_3$, while inverse distance squared (“ID$^2$”) was used to estimate the specific gravity data. Mineral resources were classified in accordance with definitions provided by the Canadian Institute of Mining (“CIM”) as stipulated in NI 43-101.

In order to quantify the Mineral Resources requirement of “reasonable prospects of economic extraction”, the block model was subjected to conceptual mining limits using an open pit optimization program. The process uses reasonable mining and processing parameters to define a conceptual pit within which the material with reasonable economic prospects should be contained. For the Project optimization runs, it was assumed that all TiO$_2$ is contained in the mineral Ilmenite. Fe$_2$O$_3$ values were modified to reflect the amount of iron taken up by ilmenite as well as the component estimated to be within silicates. However, more detailed testing is required in order to properly quantify the magnetite content of the resource, so iron was not given any value in the resource pit optimization limits. Historic metallurgical data indicates that a very high percentage of the TiO$_2$ is contained within ilmenite (Small, 1994), with a relatively small component in titaniferous magnetite and silicates.

The Mineral Resource Statement for the Project is presented in Table i below.
Table i: Mineral Resource Statement*, Longnose Project, Minnesota, USA, SRK Consulting (Canada) Inc, effective date, January 19, 2012.

<table>
<thead>
<tr>
<th>Category (Open Pit**)</th>
<th>Estimated Quantity</th>
<th>Estimated Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mt</td>
<td>TiO₂ %</td>
</tr>
<tr>
<td>Indicated</td>
<td>58.1</td>
<td>16.6</td>
</tr>
<tr>
<td>Inferred</td>
<td>65.3</td>
<td>16.4</td>
</tr>
</tbody>
</table>

* Mineral resources are reported in relation to a conceptual pit shell. Mineral resources are not mineral reserves and do not have demonstrated economic viability. All figures are rounded to reflect the relative accuracy of the estimate. All composites have been capped where appropriate.

** Open pit (near surface) Mineral Resources are reported at a cut-off grade of 8% TiO₂. Cut-off grades are based on a price of US$170 per tonne of Ilmenite back calculated to TiO₂ and recoveries of 70 percent, without considering revenues from other metals including Fe.

*** Reported Fe₂O₃ has been lowered to reflect the amount of Fe estimated contained within ilmenite and silicates, based upon Davis Tube testing. At this time, accurately quantifying the amount of magnetite contained within this estimate is not possible.

As stated above, the Mineral Resource has been quantified in terms of TiO₂ and Fe₂O₃, the analytical components captured for assays of titanium and iron. The Fe₂O₃ values have been reduced to reflect Fe found within silicates and within the ilmenite associated with the TiO₂, however accurately quantifying magnetite is not possible at this time as further mineralogical work will be needed. In any potential mining scenario, the Project would produce ilmenite (FeTiO₃) and may produce titaniferous magnetite (TiFe₂O₄) and magnetite (Fe₃O₄) as a by-product. Using CIOUS’s Davis Tube test results, historic mineralogy and metallurgy reports, reasonable assumptions regarding mineralogy of the deposit, estimates of the quantity of ilmenite was made. The contained ilmenite in the Mineral Resource is summarized in Table ii.

Table ii: Summary of Longnose Project ilmenite content within the Mineral Resource

<table>
<thead>
<tr>
<th>Category</th>
<th>Quantity</th>
<th>Ilmenite Grade (FeTiO₃)</th>
<th>Contained Ilmenite Mt.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mt</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Indicated</td>
<td>58.1</td>
<td>31.5</td>
<td>18.30</td>
</tr>
<tr>
<td>Inferred</td>
<td>65.3</td>
<td>31.2</td>
<td>20.40</td>
</tr>
</tbody>
</table>

Interpretation and Conclusions

The Longnose deposit is an ultramafic intrusion significantly enriched in ilmenite and magnetite oxides. The deposit is flat lying and provides a geometry that should be amicable to open pit mining. The Longnose deposit is approximately 700 m long in the north-south direction, 600 m wide in the east-west direction and 150 m thick.

The Longnose OUI is geologically interpreted to be late-stage intrusion that cuts early Duluth Complex intrusives, and is associated with magmatism generated by the 1.1 billion year old Midcontinent Rift system. The drilling program conducted in 2010 and 2011 by CIOUS confirmed strong titanium-iron-oxide mineralization at the Project Area, hosted within troctolitic rocks of the Partridge River intrusion.

The Longnose intrusion is stratigraphically simple, consisting of a core of olivine-rich dunitic and peridotitic rocks containing disseminated titanium-iron oxide mineralization with horizons of massive and semi-massive oxide throughout, that is enveloped by pyroxenitic rocks, which contain much less mineralization. Disseminated titanium-iron oxide mineralization is continuous, and the horizons of
massive and semi-massive oxide may link up to form layers that dip moderately coincident with dip of the overall intrusion.

The exploration data for the Project is robust; viable to support the Mineral Resource defined within this document. The data has been well validated and the analyses have been found to be repeatable. Overall, correlation of the mineralization between drill holes is reasonable and it is expected that the Mineral Resource accurately represents the TiO$_2$ and Fe$_2$O$_3$ mineralization. Based on the TiO$_2$ estimates, the mineralogy of the deposit and the Davis Tube test results, the amount of ilmenite and magnetite has been quantified.

Ilmenite and, to a lesser extent, titaniferous magnetite is used as a source material for titanium which is used to make paint pigment and as a metal alloy. Rutile is the ideal source material for titanium as it contains nearly twice as much Ti as ilmenite; however, ilmenite is by far the more common source. Most ilmenite is processed from ilmenite sands (secondary ilmenite) however several primary ilmenite mines have been successfully exploited. Processing plants capable of handling ilmenite concentrates are found in Canada, the US and throughout the world.

Ilmenite is an industrial mineral and there are risks and uncertainties associated with this ilmenite resource, many of which are common to industrial mineral deposits. Industrial minerals have special risks that are not typically associated with precious or base metal mines. Special concerns include mineralogy of material, deleterious elements (such as silica, calcium, magnesium and manganese), and special market factors such as market size or proprietary technology. Because of these and other issues, industrial mineral deposits carry additional risk compared to more common metal products. Historic testwork has indicated that the Longnose deposit produces concentrate with less favourable magnesium levels, which may adversely affect the potential value of the concentrate.

Historic tests have indicated that a viable ilmenite concentrate could be created from processing of Longnose material, although higher than ideal magnesium levels may reduce the product price somewhat. The ilmenite could potentially be sold as a concentrate to an existing ilmenite processing plant, as the deposit is amicable to shipping due to its proximity to rail and a short haul to bulk ports on the western shore of Lake Superior. As well, local added-value beneficiation is under consideration by Cardero. This goal of further beneficiation would be to produce a high TiO$_2$ synthetic rutile slag amicable for processing into the paint pigments; however, such processing facilities are capital intensive and further work is required to determine if such a process is viable.

Based upon the significant amount of historical research completed on the Project, a relatively simple processing flow sheet for ilmenite concentrate, a recent increase in demand for ilmenite and the projects close proximity to other bulk mines and inexpensive shipping routes, SRK believes that the Project meets the criteria for having reasonable prospects of economic extraction.

**Recommendations**

In order to begin to better understand the potential economics of the Project, further work is required. At this stage of the exploration, SRK recommends the following work and expenditures:

- a comprehensive mineralogical study of the oxide and sulfide mineralization should be conducted to confirm the specific oxide minerals present throughout the defined mineralization;
- metallurgical testwork in conjunction with the mineralogical studies, to assist with better understanding of ilmenite and magnetite recovery, project economic analysis and provide an update to the work completed in the 1990s;
• completion of a preliminary economic assessment to assist with further exploration and provide project specific economic criteria;
• further study of the other elements, such as vanadium, magnesium and silica contents and how they are distributed through the deposit;
• a relatively small infill drilling program consisting of 3-5 drill holes; and,
• a small step-out drilling program targeting the southern part of the intrusion consisting of 3-5 drill holes.

A budget to complete the recommended work program is presented in Table iii.

Table iii: Estimated Cost for the Exploration Program Proposed for the Longnose Project.

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Estimated Cost (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mineralogical studies and analytical data</td>
<td>50,000</td>
</tr>
<tr>
<td>Metallurgical analysis and testwork</td>
<td>150,000</td>
</tr>
<tr>
<td>Preliminary economic assessment analysis</td>
<td>150,000</td>
</tr>
<tr>
<td>Geophysical Survey</td>
<td>30,000</td>
</tr>
<tr>
<td>Longnose step-out drilling (3-5 holes/900-1500m @ $165/m*)</td>
<td>200,000</td>
</tr>
<tr>
<td>Longnose infill drilling (3-5 holes/600-1000m @ $165/m*)</td>
<td>130,000</td>
</tr>
<tr>
<td>Acquisition of additional mineral leases/property boundary survey</td>
<td>40,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>750,000</strong></td>
</tr>
</tbody>
</table>

* Drilling cost per meter includes: Site and Trail preparation, drilling, sampling, facility/vehicle lease, and staffing
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1 Introduction and Terms of Reference

This technical report for the Longnose property, located in Minnesota, USA, has been prepared for Cardero. Cardero is a mineral exploration company with corporate headquarters in Vancouver, B.C., Canada, and is listed on the Toronto Stock Exchange and the NYSE-Amex Stock Exchange. The Project interest is held by CIous, and work on the Project is carried on through Cardero Iron Ore Management (USA) Inc., an indirectly wholly owned subsidiary of Cardero.

This report relies on: historical assay data collected from drilling on the Property from the 1950s to the 1970s; re-logging of the drill core in the 2000s; re-assaying of the coarse rejects and quarter core of historical drill cores in 2009. Other geological information has come from a variety of sources, including the Minnesota Department of Natural Resources and other governmental sources, publicly available information, the underlying land owners of the Longnose property and personal communications with geologists and other professionals active in the area. In addition, this report incorporates data from drill testing of the Project commissioned by CIous in 2010 and 2011.

The Project Area is located in northeastern Minnesota near Aurora (Figure 3.1). It represents one of the numerous OUIs hosted by the Duluth Complex, which feature strong titaniferous-iron oxide mineralization. At the ProjectLongnose property, a total of 26 diamond drill holes have been completed: 11 by Northern Illinois Corp. (Nicor) and American Shield Corp., dating back to the mid-1970s, and 15 by CIous in 2010 and 2011.

In 2009, Cardero commissioned SRK Consulting (Canada) Inc. (“SRK”) to visit the Project and prepare a geological and Mineral Resource model for the Project. The services were rendered between July 2009 and January 2012, leading to the preparation of the Mineral Resource statement reported herein.

This technical report documents a Mineral Resource statement for the Project prepared by SRK. It was prepared following the guidelines of the Canadian Securities Administrators’ National Instrument 43-101 and Form 43-101F1. The Mineral Resource statement reported herein was prepared in conformity with generally accepted CIM “Estimation of Mineral Resources and Mineral Reserves Best Practice Guidelines.”

1.1 Work Program

The Mineral Resource statement reported herein is a collaborative effort between Cardero and SRK personnel. The exploration database was compiled and maintained by Cardero, and was audited by SRK. The geological model and outlines for the OUI mineralization were constructed by SRK from drill hole logs provided by Cardero. In the opinion of SRK, the geological model is a reasonable representation of the distribution of the targeted mineralization at the current level of sampling. The geostatistical analysis, variography and grade models were completed by SRK during the months between September 2011 and January, 2012.

The Mineral Resource statement reported herein was prepared in conformity with generally accepted CIM “Exploration Best Practices” and “Estimation of Mineral Resource and Mineral Reserves Best Practices” guidelines. This technical report was prepared following the guidelines of NI 43-101 and Form 43-101F1.

The technical report was assembled in SRK Vancouver’s office during January 2012.
1.2 Basis of Technical Report

This report is based on information collected by SRK during a site visit performed March 12 and March 13, 2010 and on additional information provided by Cardero throughout the course of SRK’s investigations. Other information was obtained from the public domain. SRK has no reason to doubt the reliability of the information provided by Cardero.

This technical report is based on the following sources of information:

- Discussions with Cardero personnel;
- Inspection of the Project area, including outcrop and drill core;
- Review of exploration data collected by CIOUS; and
- Additional information from public domain sources.

1.3 Qualifications of SRK and SRK Team

The SRK Group comprises over 1,000 professionals, offering expertise in a wide range of resource engineering disciplines. The SRK Group’s independence is ensured by the fact that it holds no equity in any project and that its ownership rests solely with its staff. This fact permits SRK to provide its clients with conflict-free and objective recommendations on crucial judgment issues. SRK has a demonstrated track record in undertaking independent assessments of Mineral Resources and Mineral Reserves, project evaluations and audits, technical reports and independent feasibility evaluations to bankable standards on behalf of exploration and mining companies and financial institutions worldwide. The SRK Group has also worked with a large number of major international mining companies and their projects, providing mining industry consultancy service inputs.

The resource evaluation work and the compilation of this technical report was completed by Michael D. Johnson, P.Geo. By virtue of their education, membership to a recognized professional association and relevant work experience, Michael D. Johnson is an independent Qualified Person as this term is defined by NI 43-101.

The data validation and QA/QC analysis was completed by Darrell Farrow, Pr.Sci.Nat. By virtue of education, membership to a recognized professional association and relevant work experience, Darrell Farrow is an independent Qualified Person as this term is defined by NI 43-101.

Dr. Wayne Barnett, Pr.Sci.Nat, a Principal with SRK, reviewed drafts of this technical report prior to their delivery to Cardero as per SRK internal quality management procedures. Dr. Wayne Barnett visited the project in July 2009.

1.4 Site Visit

In accordance with NI 43-101 guidelines, Mike Johnson of SRK visited the Longnose project on March 12 and 13, 2010, accompanied by Chris White, Senior Site geologist for CIOUS.Cardero. Wayne Barnett of SRK has also previously visited the site in July 2009 accompanied by Cardero’s Tansy O’Connor-Parsons.

The purpose of the most recent site visit was to review the digitalization of the exploration database and validation procedures, review exploration procedures, define geological modelling procedures, examine drill core, interview project personnel, and collect all relevant information for the preparation of a Mineral Resource model and the compilation of a technical report. During the visit, particular
attention was given to the treatment and validation of historical drilling data as well as the procedures being implemented during drilling, logging and sampling.

The site visit was completed while drilling was taking place on the Project. SRK staff was able to observe drilling, surveying, logging, sampling and sample handling and shipping.

SRK was given full access to relevant data and conducted interviews with Cardero/CIOUS personnel to obtain information on the past exploration work, to understand procedures used to collect, record, store and analyze historical and current exploration data.

1.5 Acknowledgement

SRK would like to acknowledge the support and collaboration provided by Cardero/CIOUS personnel for this assignment, particularly Chris White and Tansy O'Connor-Parsons. Their collaboration was greatly appreciated and instrumental to the success of this project.

As well, the authors would like to thank SRK’s Dr. Gilles Arseneau, P.Geo., Marek Nowak, P.Eng, and Dr. Adrian Dance for their contributions, reviews and advice during analysis and reporting of this Mineral Resource.

1.6 Declaration

SRK’s opinion contained herein and effective January 19, 2012, is based on information collected by SRK throughout the course of SRK’s investigations, which in turn reflect various technical and economic conditions at the time of writing. Given the nature of the mining business, these conditions can change significantly over relatively short periods of time. Consequently, actual results may be significantly more or less favourable.

This report may include technical information that 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, SRK does not consider them to be material.

SRK is not an insider, associate or an affiliate of Cardero, and neither SRK nor any affiliate has acted as advisor to Cardero, its subsidiaries or its affiliates in connection with the Project. The results of the technical review by SRK are not dependent on any prior agreements concerning the conclusions to be reached, nor are there any undisclosed understandings concerning any future business dealings.
2 Reliance on Other Experts

In preparing this report, SRK has relied on information provided by Cardero for matters pertaining to environmental, socioeconomic, and permitting issues. SRK has not performed an independent verification of land title and tenure as summarized in Section 3 of this report. SRK did not verify the legality of any underlying agreement(s) that may exist concerning the permits or other agreement(s) between third parties, but have relied on a preliminary title work carried out by Minnesota counsel to Cardero.

SRK was informed by Cardero that there are no known litigations potentially affecting the Project.
3 Property Description and Location

The Project Area is located in northeastern Minnesota near Aurora ((image sourced from the Minnesota Department of Transportation)

Figure 3.1). The Project Area is located in St. Louis County, Township 59N, Range 13W, Section 30.

![Location of the Longnose property](image sourced from the Minnesota Department of Transportation)

**Figure 3.1: Location of the Longnose property**

The Project Area is centered at: (Coordinate system: Universal Trans Mercator, Zone 15 North, North American 1983 Datum) 572200 m East, 5268300 m North. CIOUS holds an option to acquire an interest in mineral leases on 280 acres (113 hectares) at the Project.

Properties in Minnesota are defined using the Township and Range, Section, quarter-section, quarter-section method. Sections are marked by corner posts; however corner posts are not always present. CIOUS has conducted a geographical location survey on the Project. This survey mainly focused on locating historical drill collars and the original sampling grid cut baseline. An in-depth property boundary survey has not been completed; however the Project Area boundaries have been located on aerial photographs (Figure 3.2).
Figure 3.2: Longnose Property boundary with 2010 drill collar locations.

Mineralization at the Project Area is approximately centered at: (Coordinate system: Universal Trans Mercator, Zone 15 North, North American 1983 Datum) 572100 m East, 5268300 m North. There have been no commercial mining operations at the Project Area.

3.1 Mineral Tenure

Minerals in Minnesota are typically held as fee simple interests, either as part of the overall land estate or as a separate property interest. In many cases, ownership of the mineral estate has been severed from the surface estate, and may be held by a different owner. Although title to the mineral estate is often held by the State of Minnesota or the US Federal government, there are significant areas of private mineral ownership in Minnesota. Thus, there is often split-estate ownership, where the person or entity owning the surface may be, and often is, different than the person or entity that owns the mineral rights. Additionally, mineral rights themselves may also be split (e.g. the hydrocarbon rights owner may be different than the non-hydrocarbon mineral rights owner). United States law indicates that in split-estate situations mineral rights are the dominant estate and have precedence over all other property rights (including surface). However, the mineral rights owner
must have due regard for the surface estate and only occupy/use those portions of the surface that are necessary for mineral development.

Land holdings at the Project are primarily a split-estate wherein ALLETE, Inc. (ALLETE; a Minnesota corporation) (“Allele”) holds the surface rights, and a collection of individuals and other corporations holds the mineral rights (although Allele also holds an interest in some of the minerals). CIOUS has entered a ground license agreement with Allele dated January 12, 2010, pursuant to which CIOUS pays Allele a fixed fee per bore hole drilled, and agreed to carry out all required reclamation and indemnify Allele. In addition, under the ground license CIOUS has a right of first refusal to match any offer that may be made by a third party to purchase the surface estate held by Allele over the Project Area.

3.2 Longnose Interest

Pursuant to an agreement dated November 26, 2008 and accepted on December 8, 2008 between Cardero Iron Ore Company Ltd. and Raymond L. Morley (on behalf of The Morley Group Inc.) (“Morley”), CIOUS has been granted the option to acquire up to an 85% interest in the interest of Morley in certain existing mineral leases, and in a lease to be entered into, covering 100% of the fee mineral rights to approximately 200 acres and 50% of the fee mineral rights to approximately 80 acres, located in St. Louis County, Minnesota, just north of the town of Hoyt Lakes and referred to as the “Longnose” property.

CIous can earn an initial 70% interest in the Morley interest by incurring cumulative expenditures of USD 1,850,000 over 4 years to December 8, 2012 and paying USD 50,000 to Morley on or before August 15, 2009 (and each and every August 15th thereafter) to be used by Morley to make the annual USD 50,000 advance royalty payment due to the underlying landowners under the existing leases. CIOUS can earn an additional 15% interest in the Morley interest (for 85% overall) by delivering a feasibility study (no time limit for delivery). Upon CIOUS having earned a 70% or 85% interest, Morley can elect to convert its interest to a 10% net profits interest (if CIOUS elects not to earn the additional 15% interest) or a 5% net profits interest (if CIOUS elects to earn the full 85% interest). If Morley does not so elect, upon CIOUS having earned its 70% or 85% interest, as applicable, CIOUS and Morley will enter into a joint venture, with each party being responsible for its pro-rata share of all joint venture expenditures. If a party to the joint venture is diluted to a 10% or lesser interest, such interest will be converted to a 2.5% net profits interest. To October 31, 2011, CIOUS has incurred an aggregate of USD 1,802,389 in expenditures and made all of the required USD 50,000 payments to August 15, 2011.
### 3.3 Permits and Authorization

All licenses, permits, and registrations required to conduct exploratory drilling in Minnesota have been obtained by CIOUS, and are up to date. The required licenses, permits, and registrations that CIOUS has obtained are listed below.

- Licensed Exploratory Borer with the Minnesota Department of Natural Resources ("MDNR"); License number: A10-0102 (annual renewal).
- Licensed Explorer Company with the Minnesota Department of Health ("MDH"); License number 2850 (annual renewal).
- Licensed Explorer Responsible Individual with the Minnesota Department of Health; License number: 2841 (Chris White; lifetime license).
- Permit for drilling in wetlands with the United States Army Corp of Engineers for the Project and the Titac Project (also held by CIOUS) (Permit expired on August 22, 2011).
- Road Use Permit with the U.S. Forest Service for use of F.S.R. 117 to access the Project Area (annual renewal).
- Special Uses Permit with the U.S. Forest Service for use of spur off of F.S.R. 117 to access the Project Area (3-year permit with annual renewal).
- Storm Water Pollution Prevention Plan Permit ("SWPPP") with the Minnesota Pollution Control Agency ("MPCA") for each property (permit open until project completion, must notify MPCA upon completion of project for closure of permit).

### 3.4 Environmental Considerations

MDH regulations require that CIOUS must file a drill plan with the MDNR and the MDH at least 14 days prior to drilling operations, and the Explorer Responsible Individual must file well abandonment forms with the MDNR and the MDH within 30 days of completing each drill hole, and that exploratory bore holes must be sealed upon completion of drilling in compliance with MDH rules and regulations.
Upon filing an initial drill plan, CIOUS may begin drilling operations after 14 days, and may revise, or expand the drill plan by notifying the MDNR and MDH within one day of executing the new drill plan.

MPCA regulations state that any ground disturbance greater than one acre requires the development, approval, and institution of a SWPPP. The plan must be drafted by a person, or persons, certified by the MPCA, and a certified SWPPP site manager must oversee implementation of the plan, and application of the plan throughout the duration of the project. This plan must be modified as the project progresses to reflect any change in operations that warrant additional or different pollution prevention measures. CIOUS’s consulting geologist, Chris White, has obtained the proper certification with the MPCA to draft the SWPPP and to act as the SWPPP site manager; and Warren Johnson, a CIOUS contractor, is a certified SWPPP contractor with the MPCA. Chris White has been retained by CIOUS to oversee the overall and day-to-day project operations, and Warren Johnson’s company has been retained to install all drill trails and drill pads at the Longnose property.
4 Accessibility, Climate, Local Resources, Infrastructure and Physiography

4.1 Accessibility

Accessibility is excellent, with the Project Area located off of a paved county highway via a well maintained gravel road.

The Project Area is located approximately 15.7 km (10 miles) east of Aurora, Minnesota. CIOUS is leasing a large portion of an old school building (Cina Building, 200 S. 2nd St. E., Aurora, MN 55705) in Aurora, Minnesota that serves as a field office, a drill core logging, preparation, and sampling facility, and a drill core, coarse sample, and sample pulp storage facility.

To access the Project Area from Aurora, MN: Beginning at the intersection between St. Louis County highway 99 and St. Louis County highway 110, travel east on St. Louis County highway 110 for 8.2 km (5.1 miles) to St. Louis County highway 666. Turn left, traveling north on St. Louis County highway 666 for 4.5 km (2.8 miles) to Forest Service Road 117. Turn right, traveling east on Forest Service Road 117 for 5.6 km (3.5 miles) to an unnamed spur which travels north. Turn right, traveling north on the unnamed spur for 0.3 miles (0.5 km) to an open equipment staging area.

4.2 Local Resources and Infrastructure

The population of Aurora, Minnesota is approximately 1,850, and the nearby city of Hoyt Lakes, Minnesota (5 miles east of Aurora) has a population of approximately 2,000 people. Duluth, Minnesota (pop. 84,419) is located approximately 120.7 km (75 miles) south of the Project. Virginia, Minnesota (pop. 8,481) is located approximately 56.3 km (35 miles) west of the Project.

Northeastern Minnesota has been supporting mining activities since the Soudan Mine opened in 1882. Currently, northeastern Minnesota facilitates six taconite (iron ore) mines located approximately within 96.5 km (60 miles) west of the Project in the Iron Range of Minnesota in the Virginia, and Hibbing, Minnesota area. When at full production, the taconite (iron ore) mining industry directly employs nearly 4,000 people in northeastern Minnesota.

The infrastructure in northeastern Minnesota related to mining activities is excellent with low cost electricity, railroads, paved state and county highways, international shipping ports, mining professionals, mining vendors, and trained labor all readily available. International shipping ports are located along the north shore of Lake Superior including Duluth/Superior, Silver Bay, Taconite Harbor, and Two Harbors with linked rail systems to all.

Northeastern Minnesota is easily accessible through air travel with three airports located within 96.5 km (60 miles) of Hoyt Lakes, Minnesota including the Eveleth Virginia Municipal Airport located in Virginia, Minnesota; the Range Regional Airport ("RRA"), located in Hibbing, Minnesota; and the Duluth International Airport ("DIA"), located in Duluth, Minnesota. Commercial flights are offered by Delta Airlines at RRA and DIA, and also by Allegiant Air at DIA. The Minneapolis/St. Paul airport is located approximately 321.7 km (200 miles) south of Hoyt Lakes, Minnesota. Connecting flights are available from Minneapolis/St. Paul to both DIA, and RRA.

The Laskin Energy Center is located near Hoyt Lakes, Minnesota (less than 16 km (10 miles) from the Project), providing 110 megawatts of electric service, and a 138KVA electricity transmission line
runs within 5 km (3.1 miles) of the Project. The DM&IR (Canadian National) Railway services the Laskin Energy Park, located next to the Laskin Energy Center and a rail spur runs within 2 km (1.3 miles) of the Project. The Laskin Energy Park also provides natural gas, water and waste water, and industrial steam power services.

The Erie plant (formerly owned by LTV Steel Mining Company and currently owned by Polymet Mining Corporation), a large crushing, grinding, and milling facility, is located approximately 4 miles (6.4 km) west-northwest of the Project. The Erie plant was built in the 1950s, and processed approximately 100,000 tons of taconite (low-grade iron) ore per day until 2001 when LTV Steel Mining Company filed for bankruptcy. Polymet intends to use the Erie plant to process the copper-nickel-platinum group element ore from its NorthMet deposit, and estimates that the plant will provide 400 full-time jobs.

The Steel Dynamics, Inc. Mesabi Nugget plant is located just north of Hoyt Lakes, Minnesota. Mesabi Nugget uses an innovative direct-reduction process to produce pig-iron nuggets. Production began at Mesabi Nugget in December of 2009, and the plant has a capacity to produce 500,000 tonnes of pig-iron nuggets a year. The Mesabi Nugget plant currently provides approximately 90 full-time jobs.

4.3 Climate

The climate in northeastern Minnesota is mid-continental. Winter conditions usually begin in mid-December and last until mid-March, with frozen ground beginning in late-December to early-January. The spring thaw usually begins in mid-March to late-April, with stable, dry spring-summer-fall conditions occurring from late-April to mid-December. Table 4.1 below displays the monthly average temperatures and precipitation for the Hoyt Lakes area.
Table 4.1: Average monthly temperatures and precipitation, Hoyt Lakes, Minnesota

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<td>0.61</td>
</tr>
</tbody>
</table>

Source: www.weather.com

4.4 Physiography

Topographic relief on the Project Area is generally low, and the surface is flat-laying. Elevations on the Project Area range between 465 m and 480 m. The ground cover is a mixture of Palustrine, forested wetlands (Cowardin classification system), and higher dry forested ground. Longnose creek runs through the Project Area. Overburden, consisting of glacial till composed of pebbles, cobbles, and boulders within a sand and clay matrix, covers much of both properties. At the Project Area, bedrock is locally exposed to the north-northwest with up to approximately 3 m of overburden. The bedrock surface gently dips to the south-southeast where overburden thickens to approximately 20 m.
Figure 4.1: Typical Landscape in the Project Area (provided by CIous)
5 History

Northeastern Minnesota has a strong history of iron and taconite mining, as well as copper, nickel, and platinum group element exploration. Titaniferous iron deposits were first discovered in northeastern Minnesota in the mid to late 1800s in the northern portion of the Duluth Complex. Additional titaniferous iron deposits were discovered in the southern part of the Duluth Complex in the mid to late 1900s during reconnaissance exploration for copper and nickel.

5.1 Titaniferous Iron Oxide Mineralization in the Duluth Complex

In 1967, several companies began exploring magnetic anomalies delineated from state geophysical surveys in the southern part of the Duluth Complex. Exploration drilling targeted these magnetic anomalies searching for copper-nickel sulfide mineralization. While copper-nickel sulfide mineralization was intersected in many drill holes, the magnetic anomalies were largely composed of titaniferous-iron oxide mineralization. At the time, these intrusions were generally thought to be of little importance, because copper-nickel grades were too low to have economic significance during that time period. However, several titaniferous iron oxide intrusions have been explored in detail including the Longnose intrusion.

The following summarizes the known history of the Project Area.

5.2 Longnose Property

Twenty seven diamond drill cores have been drilled at the Project Area. Bear Creek Mining Co. drilled the first hole in 1958 to investigate a magnetic high and electromagnetic anomaly. This first hole (A1-1) intersected titanium-iron-oxide mineralization to a depth of 102.1 m (335 feet), that was hosted by peridotite and pyroxenite. A decade later (1969), Exxon Corp. drilled a second hole (BA-6) on the property that intersected titanium-iron-oxide mineralization to a depth of 81 feet (24.7 m). American Shield Corp began exploration at Longnose in 1975, drilling a single hole (LN-1), and resumed drilling in 1984 via a joint venture agreement with Northern Illinois Corp. ("Nicor"); completing nine more drill holes on the property. Figure 5.1 displays the locations of historic drill holes on the Property Area including: A1-1, BA-6, and LN-1 through LN-10 (taken from Patelke and Severson, 2005). Exploration drilling on the Project Area halted until 2010, when CIOUS drilled six holes followed by nine holes in 2011.

Two bulk samples for metallurgical testing and TiO₂ recovery have been collected from the Project Area. The test pit locations are displayed in Figure 6.1 (Patelke and Severson, 2001). The first bulk sample measured 32+ tons of material and was collected in 1984 by the American Shield Corp/Nicor joint venture. The second bulk sample measured 60 tons and was collected in the 1990s by American Shield Corp. The University of Minnesota, Natural Resources Research Institute, Coleraine Minerals Research Laboratory houses what remains of both bulk samples.

BHP Minerals International Inc. ("BHP") held the Project Area for some time in the 1990s. Most of the work completed by BHP centered on metallurgy, and TiO₂ recovery as well as value-added beneficiation of the ilmenite to a higher titanium product.
5.2.1 Historic Metallurgical Studies

Metallurgical Testing was completed on the Longnose deposit at a variety of scales at different times. This included several bulk samples on which larger scale processing and metallurgy tests were completed.

The Coleraine Minerals Research Laboratory ("CMRL") was provided with a sample of approximately 680 kg on March 6, 1991 by the American Shield Corp/Nicor joint venture. The sample was collected from a large outcrop within the western part of the Longnose deposit. A processing flow sheet was developed and the sample was beneficiated by grinding, spiral separation, magnetic concentration, and dry high tension concentration. The first full-scale pilot plant run was made on October 3, 1994. (Coleraine Minerals, 1994)

A larger bulk sample was collected in the 1990s by American Shield Corp. This 39 tonnes (43-ton) bulk sample of Longnose material was also collected from outcrop within the western portion of the deposit. The material was crushed to rod mill feed size, minus 3/8 inch, and processed in the CMRL wet pilot
plant by rod-mill grinding, spiral separation, wet magnetic separation ("WLIMS"). The WLIMS operation yielded two streams (magnetic & non-magnetic fractions) that were subsequently processed. The downstream processing of the magnetic fraction incorporated ball mill grinding, and a second WLIMS step. The magnetic fraction essentially concentrated the iron, and the non-magnetic fraction was further processed using desliming and flotation so as to enrich the titania. The post-flotation stream comprised ~17% of the final titania concentrate. The previously mentioned non-magnetic fraction was dried and upgraded using high tension separation. The ‘conductors’ from the high tension separation step became ~83% of the final titania concentrate. A flow sheet showing the average material balance for the wet & dry processing steps is given in the following table. Overall, the indicated recovery of TiO₂ from this process was 66%.

![PROPOSED LONGNOSE ILMENITE PILOT-PLANT FLOWSHEET](source CMRL, 1996)

**Figure 5.2: 1996 bulk sample treatment flow sheet**

Value-added pyrometallurgical processing has also been contemplated for the Longnose deposit. Up to 1996, the metallurgical analysis of the Longnose material was mainly focused on producing an Ilmenite concentrate above 45% TiO₂. Further beneficiation by upgrading of this concentrate to a titanium slag & pig iron has been contemplated because it is expected that such processing would have significant economic benefit and provide a site where an optimized process, designed for the local ilmenite bearing bodies, can be developed. It had been noted that the magnesium content of the ilmenite was higher than average and that local beneficiation may be advantageous compared to ilmenite concentrate sale.

BHP completed preliminary down-stream beneficiation testwork in the 1990s. Their first investigation involved a smelting and sulfation-leaching process developed by the US Bureau of
Mines, a somewhat modified version of a process which is completed at several processing facilities located around the world, including in the US and Canada. Their second investigation involved an oxidation-reduction roast followed by chemical leaching. The second process was based on modifying the "Murso process". The Murso process involved an acid leach of the material which results in a high grade (+94% TiO$_2$) synthetic rutile. BHP apparently abandoned the Longnose project over a dispute regarding the ownership of the "Murso" technology (Ulland, 2000).
6 Geological Setting and Mineralization

6.1 Regional Geology

The Project Area is within the Superior Province of the Canadian Shield. The regional basement rocks are composed of Archean granitoid intrusions, metasedimentary rocks, and metavolcanic rocks; and Paleoproterozoic sedimentary rocks. Mafic flows, mafic and felsic intrusives, and related interflow sedimentary rocks cut these basement rocks during the development of the Mesoproterozoic Midcontinent Rift System (“MCR”).

The Midcontinent Rift System stretches from Lake Superior to Iowa (Figure 6.1), and is largely buried by sediments; however, MCR bedrock is relatively well exposed in the Lake Superior region. In northeastern Minnesota, the MCR is dominantly composed of several groups of rocks including: the North Shore Volcanic Group (“NSVG”), the Beaver Bay Complex, and the Duluth Complex. The roof zone of the MCR is largely composed of NSVG lava flows, and the Duluth Complex is generally the intrusive equivalent of the NSVG lava flows.

![Bouguer Gravity Anomaly](Source: geo.umn.edu/mgs/nicegeo/pdfs/boug_grav.pdf)

Figure 6.1: Mid-continent Bouguer gravity anomaly (Source: geo.umn.edu/mgs/nicegeo/pdfs/boug_grav.pdf)

Figure 6.1 shows the Mid-continent rift extending from Lake Superior through Iowa, USA.

The multiple intrusions of the Duluth Complex occur within an arcing band from Duluth to near the Canadian border that is 270 km long and up to 40 km wide. In terms of aerial exposure, it is the second largest mafic intrusive complex on Earth after the Bushveld Complex of South Africa. The
Duluth Complex is typically subdivided into four intrusive series based on dominant lithology, general age, and internal structure. In order of relative decreasing age, these series are the felsic series, the early gabbroic series, the anorthositic series, and the layered series (Miller et al., 2002). Field evidence suggests that the layered series intruded into the anorthositic series; however, U-Pd dates obtained by Paces and Miller (1993) show that the anorthositic series and the layered series are virtually identical in age. This indicates that the layered series likely intruded into the anorthositic series when it was still quite warm, and possibly semi-molten. The anorthositic series has not been subdivided into individual intrusions; however, the layered series has been shown to consist of at least 12 distinct mafic layered intrusions (Miller et al., 2002; Error! Reference source not found.).

A geological map of northeastern Minnesota displaying the Duluth Complex and associated formations with the layered series intrusions is shown in Figure 6.1.

![Geological Map of northeastern Minnesota](image)

**Figure 6.2 Geological Map of northeastern Minnesota**

In Figure 6.1, the geological units defined include: TI – Tuscarora intrusion, L1T – Lake One Troctolite, WLI – Wilder Lake intrusion, SKI – South Kawishiwi intrusion, BEI – Bald Eagle intrusion, OLI – Osier Lake intrusion, GLI – Greenwood Lake intrusion, PRI – Partridge River intrusion, WMI – Western Margin intrusion, BLI – Boulder Lake intrusion, DLS – Layered Series at Duluth (Miller et al. 2002).
6.2 Property Geology

Several layered series intrusions host numerous OUIs in the Duluth Complex, including (from north to south) the Partridge River intrusion, the Western Margin intrusion, and the Boulder Lake intrusion. All known OUIs occur proximal to the western contact of the Duluth Complex in a straight line beginning just south of Babbitt, Minnesota, and ending just north of Duluth, Minnesota. Known OUI intrusions in the Duluth Complex include Section 17, Longear, Longnose, Section 22, Skibo, Water Hen, Section 34 (Titac), Boulder Creek, Boulder Lake North, and Boulder Lake South. OUI deposits cut the layered series intrusions, and are generally regarded as late occurring events in the development of the MCR. Geometrically, OUIs have various shapes and sizes including pipe-like, sheet-like, and funnel-like, and their emplacement may be structurally controlled (Severson, 1995).

6.3 Geology of the Longnose Property

Outcropping bedrock is sparse on the Project Area with regards for the Longnose intrusion itself, though several outcrops do exist toward the northern extents of the Project Area, and country rock is exposed to the south of the intrusion. Most of the known geology of the Longnose intrusion comes from the 27 drill cores that have been drilled into and around the intrusion; 12 drill holes are historic, while six holes were drilled by CIOUS in 2010, and nine in 2011. The Longnose OUI is dominantly hosted by troctolite and augite troctolite of the Partridge River intrusion. Drilling has indicated that the Longnose intrusion is approximately 7000 m long, by 600 m wide, by 150 m thick, and it appears to have a sill-like geometry with a moderate southeastern dip (Error! Reference source not found.). The eastern, southeastern, and southern margins of the intrusion are not completely defined, and the intrusion may extend in these areas at depth. Lithologically, the OUI is composed of medium- to coarse-grained to pegmatitic pyroxenite, feldspathic pyroxenite, peridotite, feldspathic peridotite, dunite, semi-massive oxide, and massive oxide, as defined by the Severson and Hauck (1990) rock classification scheme for Duluth Complex rocks (Figure 6.3). The core of the intrusion is composed of olivine-rich rocks (feldspathic peridotite, peridotite, and dunite), while the outer zones consist of predominantly pyroxenite. Massive and semi-massive oxides (Error! Reference source not found.) may be crudely layered or zoned throughout the intrusion. Contacts between country rock and the OUI are typically sharp (cm scale), and internal lithologic contacts of the OUI intrusion are also sharp. Titanium-iron oxide mineralization is known to extend to a true depth of at least 150 m, and may extend deeper to the east, southeast, and south of the intrusion (Error! Reference source not found.).
Figure 6.3: Schematic cross-section through the Longnose Oxide-bearing Ultramafic Intrusion
6.4 Mineralization at Longnose

Mineralization at Longnose dominantly consists of disseminated to net-textured, medium- to coarse-grained, ilmenite, titaniferous magnetite and magnetite. It is quite difficult to tell the difference between titanium-rich mineralization and iron-rich mineralization in hand sample; however, it is Cardero’s experience that drill core exhibiting a dark-silvery color is ilmenite-rich; drill core exhibiting a dull-black color is rich in titaniferous magnetite; and drill core exhibiting a shiny-black color is magnetite-rich. Olivine-rich ultramafic rocks (peridotite, feldspathic peridotite, & dunite) host the majority of the titanium-iron oxide mineralization found in the Longnose OUI, and will often be net-textured with oxide minerals interstitial to silicates. Cardero’s visual modal mineral calculations generally estimate that titanium-iron oxide minerals compose 15-35% of the peridotitic and dunitic rocks at Longnose.

Historic petrography work was completed by T.P. Paster on behalf of Westmont Mining Inc. in 1987. This work looked at 22 polished sections and three (3) concentrates from the Longnose deposit. Based on this work, cumulus ilmenite was found to be the dominant oxide, followed by cumulus...
titaniferous magnetite and intercumulus titaniferous magnetite. Magnetite was found to be minor and generally a product of olivine alteration. Cumulus oxides tended to be 0.2 mm to 10 mm in size. Minor rutile and hematite occurred as rims to ilmenite crystals. Silicate mineralogy included olivine, hyperthene and augite. (Pastor, 1987)

Numerous massive and semi-massive titanium-iron oxide horizons or zones (45-100% titanium-iron oxide) have been intersected by CIOUS in drill core. These massive and semi-massive oxides seem to be dominantly hosted by peridotite and dunite, though they have been intersected within zones of pyroxenite as well. It is somewhat unclear if the massive and semi-massive zones are continuous throughout the intrusion, or if they exist as discrete “pockets”.

It is clear, though, that the main mineralized intrusion at Longnose is a thick, laterally and vertically continuous intrusion, dominantly composed of a mixture of oxide-bearing peridotite, oxide-bearing dunite, massive oxide, and semi-massive oxide with between 15% and 100% titanium-iron oxide mineralization.
7 Deposit Types

Titaniferous iron oxide intrusions within the Duluth Complex were first discovered in 1867, approximately coincident with the discovery of the Mesabi Range iron ores (Winchell, 1897). Broderick (1917) was the first to classify the intrusions while working in the northern part of the Duluth Complex, subdividing them into 4 groups: A) inclusions of Gunflint Iron-Formation, B) gabbroic banded segregations, C) irregular late intrusions of titaniferous magnetite, and D) dike-like intrusions of titaniferous magnetite. Severson (1988), and Severson and Hauck (1990) recognized types 3 and 4 while working in the western and southern portions of the Duluth Complex and reclassified them together as OUIs, based on their ultramafic composition, high oxide content, and cross-cutting relationships to the layered series troctolitic intrusions that host them. Hauck et al. (1997) reclassified Broderick’s (1917) subdivisions into three general types: Type 1, banded or layered, oxide-rich metasedimentary inclusions in mafic and ultramafic rocks; Type 2, banded or layered oxide segregations (cumulates) in mafic rocks; and Type 3, discordant OUIs with semi-massive to massive oxide zones. The Longnose intrusion is classified as Type 3 titaniferous iron oxide intrusions (Hauck et al. 1997) as described below.

Type 3 titaniferous iron oxide intrusions in the Duluth Complex are somewhat similar to the ultramafic intrusions of the Bushveld Complex, the Stillwater Complex, and the Rio Jacare Intrusion of Brazil (Hauck et al. 1997). They are typically composed of coarse-grained to pegmatitic, oxide-bearing (>5% to 30% oxide minerals) pyroxenite, peridotite, and dunite, which contain lenses of semi-massive (>30% to 90% oxide minerals) and massive oxide (>90% oxide minerals). OUIs in the Duluth Complex vary in size and shape, but generally seem to occur as sheet-like intrusions (sills), funnel-like intrusions, dike-like intrusions, or pipe-like intrusions. They can be zoned with numerous apophyses around a centralized ultramafic core. When they are zoned, they tend to feature pegmatitic pyroxenite, generally surrounding a core of coarse-grained to pegmatic peridotite and dunite. They appear to be deep-seated and several Duluth Complex OUIs seem to be root-less.

Genesis of the Duluth Complex OUIs is speculative and several theories have been proposed as described below:

1) Severson (1988, 1991, & 1994), and Severson and Hauck (1990) suggest that a spatial/empirical relationship between the Duluth Complex OUIs and the Biwabik Iron-Formation exists, and that incorporation of the Biwabik Iron-Formation by the Duluth Complex at the basal contact may have inspired the genesis of the Duluth Complex OUIs. This does not directly explain the high titanium content of the Duluth Complex OUIs; however, Muhich (1993) finds that the Biwabik Iron-Formation is locally enriched in titanium proximal to the Duluth Complex basal contact. Muhich’s (1993) observations suggest that the Duluth Complex OUIs may be genetically related to the Biwabik Iron-Formation, and may be assimilated inclusions of Biwabik Iron-Formation that have been enriched in titanium and iron from Duluth Complex magmas and fluids.

2) Severson (1988, 1994) and Severson and Hauck (1990) also suggested, as did Ross (1985), that Duluth Complex OUIs formed by infiltration metasomatism. Infiltration metasomatism calls on the upward streaming of intercumulus fluids that are derived from within a crystallizing cumulus pile, or more simply put, the magma itself. This genesis mechanism has been suggested for the formation of similar ultramafic plugs in the Bushveld Complex (Schiffries, 1982; Viljoen and Scoon, 1985).
3) Bonnichsen (1972) and Mainwaring and Naldrett (1977) suggested a magmatic origin for the Duluth Complex OUIs. In this empirical magmatic genesis model, the Duluth Complex OUIs would form from ferrogabbroic magmas, containing an abundance of suspended plagioclase crystals which separate from the magma and rise to the top of the magma chamber due to density contrasts, subsequently leaving the much more dense iron-rich titaniferous ultramafic magma toward the bottom.

Evidence for all three genesis models exists, thus all three models, or a combination of the three may be accurate in specific instances. Mineralization at both properties appears to be largely intrusive in nature, but also exhibits textures near contacts with country rock that could be metasomatic in nature. It also seems apparent that in some instances Biwabik Iron formation could have influenced mineralization, based on the proximity of some OUIs to Biwabik Iron-Formation country rock. However, not all OUIs in the Duluth Complex show obvious proximity to occurrences of Biwabik Iron-Formation.
8 Exploration

Exploration of the Project Area by CIous began in the summer of 2009 with field searches for historic drill collars and resampling of historic drill holes.

Benchmark Engineering (Mountain Iron, Minnesota) was contracted to conduct the search with key CIous personnel on hand to oversee the work. At that time, re-assaying of historic drill core from the Project Area, which is stored at the University of Minnesota, Natural Resources Research Institute, Coleraine Minerals Research Laboratory, Coleraine, Minnesota, was also conducted.

Very little bedrock is exposed at the Project Area. Because of this, no bedrock mapping has been completed by CIous, although at least one bedrock map of the Project Area has been published (Linscheid, 1991). Bedrock outcrops from Linscheid (1991) were evaluated and included in the Bedrock Geological Map of Allen Quadrangle (Severson and Miller, 1999; pers. com., Severson, July 2010).

An airborne geophysical survey was conducted by the Minnesota Geological Survey which provided the initial template for early exploration. A ground magnetic survey was conducted by American Shield Corp. and this survey has not been obtained by Cardero; however, the original grid for the survey is still largely visible in the field.
9 Drilling

Drilling on the Project Area can be broken into historic and contemporary eras. Prior to 2010, 12 drill holes had been completed on the Project Area by a variety of operators. These holes should be considered historic drilling as Cardero had no involvement in the completion of these holes; however, some collar locations have been found and inferred and most of these holes were re-sampled by CIOUS.

IOUS completed drilling of 15 NQ2 diamond drill holes totaling 3480.4 m (11,418.5 feet) on the Project Area between February 2010 and April 2011, which are the current or contemporary holes. Drilling depths were recorded in feet, as is the standard in the US. Drilling was completed by licensed drilling contractor Idea International Drilling Ltd. (“Idea”). In 2010, Idea conducted drilling operations using four different drill rigs (Atlas Copco CS1000, Atlas Copco Diamec U6, Atlas Copco CT14, and a Sandvik DE130), with two rigs operating at any given point in time. Drill rigs were skid-mounted (with the exception of the Atlas Copco CT14) and maneuvered in the field using Caterpillar DSM and D7G tractors. In 2011, one Morooka mounted drill rig (Boart Longyear LF70) was utilized. Licensed contractor Warren Johnson Excavating was contracted to install all drill trails, drill pads, and entrance/exit points. Trails, pads, and entrance/exit points were installed using a combination of Caterpillar tractors, Caterpillar excavators, and various logging skidders.

All drill holes were permanently abandoned per MDH standards, by setting a plug at least 300 feet below the surface of bedrock and filling the portion of the boring above the plug with neat cement. One drill hole (LNG-002-2010) was temporarily abandoned per MDH standards by installing a five foot casing extension on the drill collar and screwing a cap onto the casing extension. This hole was temporarily abandoned due to unseasonably warm temperatures, causing swamp-ground to become unworkable and forcing drilling operations in the swamp to cease and heavy equipment in the immediate area to be evacuated.

Down-hole surveys have been completed on all contemporary drill holes. The Idea survey crew conducted down-hole surveys of each respective drill hole following completion of each hole. Down-hole surveys were completed using a Gyro-based tool, with survey readings collected every 20 feet. Data consists of a dip reading in degrees, and easting and northing readings in feet relative to the starting position of the survey.

Drill hole locations were recorded at the time of drilling using a hand held Garmin GPS unit with accuracy to +/- 6 metres. Because casing was pulled upon completion of each drill hole, a steel fence post was used to mark the location of each hole. A location survey was completed by the Idea survey crew upon completion of drilling operations. Licensed surveyors Northern Lights Surveying and Mapping Inc. (Virginia, Minnesota) were contracted by Idea to place four to five location pins on site. Upon installation of these pins, Idea surveyed drill hole locations with sub-metre accuracy, recording the easting, northing, and elevation of each drill hole.

Some of the historic drill hole collars have been located by IIOUS and observed by SRK. Only the drill holes completed prior to approximately 1970 have drill collars that still exist on site. These drill collars have been located and surveyed with a differential GPS. Since approximately 1970, drill casings have been mandated to be removed upon remediation of the drill site, so these drill collars do not exist. Circumstantial evidence for other historic drill holes, such as drill pad clearings in the forest, has been found to support the location of many of these historic holes and their drill collar locations are believed to be within 10 m accuracy.
Table 9.1 documents the technical specifications of all contemporary and historic drilling at the Project Area.

Table 9.1: Contemporary and historic drilling at the Longnose property

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9.1 Drilling Results

The Longnose OUI is defined by drilling with between 75 m and 125 m between pertinent drill holes. Most drill holes on the Project Area have intersected thick intervals of titanium-iron oxide mineralization, and the intrusive stratigraphy of the OUI can be fairly well correlated. The drilling completed by American Shield Corp. and Nicor follows a grid pattern in which section lines have a 315 degree bearing, and most of these holes were drilled with an azimuth of 315 degrees and a dip
of -45 degrees, except two holes that were drilled vertically (See Table 9.1). The drilling completed by CIOUS does not follow this grid, but instead fills in local gaps, and explores the outer limits of the defined Longnose intrusion. The intrusive stratigraphy of the Longnose OUI seems to dip to the southeast at 30-45 degrees; therefore drill holes with a -45 degree dip should give a reasonably accurate indication of the true thickness of mineralization.

Figure 9.1 and Figure 9.2 show the drill holes in typical plan and section views.

Figure 9.1: Map Showing the Distribution of Longnose Drilling.
Figure 9.2: Example of drill holes with the Pyroxenite domain boundary in oblique section, looking northeast

9.2 Historic Drill Hole Sampling

The twelve historic drill holes were sampled by previous operators; however, none of the historical assay results were utilized by SRK or Cardero. Sampling and resampling has been completed by CIOUS on both contemporary and historic drill holes.

Remnants of historic drill core were retained by the government of Minnesota. CIOUS undertook to re-sample as much of the historic core as possible during 2009 and 2010. In rare instances, little or no material was available, but for the most part, core or assay rejects were available and were resampled. The procedures used to re-sample the historic core were largely the same as those used for the modern core (see section 10 & 11).

The sampled historic drill core material was either half or quarter core (preferentially), or assay rejects from historic sampling campaigns. In term of material samples, 14% of the historic resampled material was half core, while 36% was quarter core and 50% was from rejects. Core material was typically resampled at a 2.5 m interval, while reject material was sampled at an average interval of 3.1 m.

Only historic drill hole BA-6 could not be resampled at all. Historic drill hole A1-1 had only two samples that could be resampled, which encompasses only 7% of the hole length. For the remaining ten historic holes, approximately 70% of the drill hole intervals were resampled.
10 Sample Preparation, Analyses, and Security

10.1 Sampling Method and Approach

Modern samples collected by CIOUS for analysis are from drill core, while historic drill holes were re-sampled from drill core or sample rejects. Drill core sampling is typically continuous through the length of each drill hole, except where drill core is obviously not mineralized. In the cases of re-sampling historic core where no rejects or core material was available, the intervals have obviously not been re-assayed. Every effort was made to ensure there were no sample biases, and samples are representative of the mineralization found. The rocks are intrusive and competent, typically with limited, localized fracturing. Drill core recovery averages 92.3% and rock quality is typically good.

10.2 Drill Core and Sample Interval Preparation

Drill core is logged lithologically as it is drilled, and then stored in original cardboard boxes (10 feet per box) on pallets until additional analysis of core can be performed. As time permits, data is collected on core regarding rock quality, core recovery, magnetic susceptibility, and specific gravity. Sample intervals are then set-up, and the drill core is photographed. All drill core from the 2010 and 2011 drilling programs has been logged and sampled, and all sample results from the 2010 and 2011 drill core sampling campaign are complete. Lithologic logging and collection of other data from drill core is done per standard industry practices as follows:

**Lithologic log**

Lithologic intervals are recorded in feet based on run blocks inserted at the time of drilling. Specific data is collected on rock type, texture, grain-size, lithologic contacts, modal mineralogy, structures, oxide mineralization, sulfide mineralization, and alteration.

**Rock quality/Core recovery**

Intervals are recorded in feet based on run blocks inserted at the time of drilling. Actual lengths of intervals are measured and recorded in inches. The sum of all pieces of core greater than 4 inches is recorded, and total fractures per interval are recorded. RQD for each interval is determined by dividing the sum greater than 4 inches by the actual total inches of core recorded, and multiplying by 100.

**Magnetic Susceptibility**

Magnetic susceptibility data is collected on all drill core using a SAIC Exploramum KT-9 magnetic susceptibility meter. Five readings are collected for each core interval so that a reading is collected at least every 2 feet.

**Specific Gravity**

Specific gravity measurements are collected approximately every 20 feet. Core pieces measuring approximately 4 - 5 inches are weighed first in air (grams), and then in water (grams), using a manual balance and custom built work station.

**Core photography**

All drill core is photographed using a Sony Cyber-shot digital camera, typically with two core boxes per photo. All pictures are labeled as follows: “DDH Box # (#-#).”
Sample intervals

All sample intervals are determined by visual inspection of drill core, generally based on a visual estimation of oxide and sulfide mineralization. Attempts are made to not cross lithologic boundaries within sample intervals; however, given the intrusive, locally lithologically heterogeneous nature of drill core this is not always possible. Drill core is pieced together and a line is drawn parallel to the long axis of all drill core to be sampled. Sample intervals range in length from 0.2 m to approximately 2.5 metres, with most sample intervals from 1.5 - 2.0 metres in length. Sample tags are stapled into boxes, and sample identification numbers are written on core for future reference. Sample intervals are recorded, noting the type of sample (i.e. core, quarter core original, quarter core duplicate, prep duplicate, standard, or blank), and the general lithology of the sample.

10.3 Sample Collection and Preparation

Samples are collected by sawing core in half along the line drawn parallel to the long axis of core with a diamond tipped blade. The core cutting saw is cleaned at the end of each day, or after 120 m (400 ft) of core has been cut (whichever is earlier), and the saw is filled with clean water at the time of cleaning. The left half of drill core is kept and remains in the original cardboard boxes, which are securely stored at CIous's field office in Aurora, Minnesota. The right half of core is collected and packaged in clear poly bags, along with a sample tag designating the sample identification number. Bags are labeled in black permanent marker with the corresponding sample identification number and a zip tie is used to close each poly bag. The weight of each sample is then recorded (in grams). Poly bags are packaged in white sand bags (typically five samples per sand bag). Each sand bag is labeled with the sample identification numbers that it contains, and the batch number that the samples belong to. Sand bags are first secured with a standard zip tie, and then a second individually numbered zip tie is placed over the standard zip tie for security. The security number is recorded along with the sample numbers that it represents. The sand bags are then transferred to a standard shipping pallet (generally 10-15 sand bags per pallet). The pallets are shrink wrapped, and labeled with the sample batch numbers. Generally, each drill hole is given a unique sample batch number.

10.4 Sample Preparation, Analyses and Security

Sample preparation of drill core is conducted at the CIous facility in Aurora, Minnesota by persons under contract with CIous to carry out the exploration, drilling, and sampling programs. Sample preparation of historic core from the Project Area was carried out by CIous personnel prior to the involvement of contractors hired to carry out the exploration, drilling, and sampling programs.

10.5 Sample Analysis

Samples are prepared for assay analysis by ALS Laboratory Group (“ALS”) at their Thunder Bay, Ontario facility. The laboratory prepares samples for assay using code prep-31, in which samples are crushed, and 250 g of material from each sample is split off and pulverized so that better than 85% pass through 75 micron mesh. Samples are dried if necessary using code DRY-21. The sample pulp is then shipped to the ALS facility in Vancouver, British Columbia, Canada for assay, while the coarse sample is put in temporary storage at ALS in Thunder Bay (and eventually shipped back to CIous’s field office in Aurora, Minnesota).
ALS Laboratory Group laboratories are ISO 17025 certified. The ALS laboratory used for sample preparation is located at 1160 Commerce Street, Thunder Bay, Ontario, Canada P7E 6EP. The ALS laboratory used for sample analysis is located at 2103 Dollarton Hwy, North Vancouver, British Columbia, Canada V7H 0A7.

A whole rock analysis (code: ME-ICP06) is conducted on samples, and base metals are analyzed using code ME-4ACD81. Sample analysis method ME-ICP06 returns results for all major oxides from 0.01-100% as displayed in Table 10.1, and sample analysis method ME-4ACD81 returns results for base metals as listed in Table 10.2. Numerous samples have also been analyzed for rare earth and trace elements by ALS using sample method MA-MS81. The elements and respective ranges for sample method MA-MS81 are displayed in Table 10.3.

Table 10.1: Analytes and Ranges of ALS Laboratory Group sample analysis method ME-ICP06

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Range (%)</th>
<th>Analyte</th>
<th>Range (%)</th>
<th>Analyte</th>
<th>Range (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SiO2</td>
<td>0.01-100</td>
<td>Na₂O</td>
<td>0.01-100</td>
<td>P₂O₅</td>
<td>0.01-100</td>
</tr>
<tr>
<td>Al₂O₃</td>
<td>0.01-100</td>
<td>K₂O</td>
<td>0.01-100</td>
<td>SrO</td>
<td>0.01-100</td>
</tr>
<tr>
<td>Fe₂O₃</td>
<td>0.01-100</td>
<td>Cr₂O₃</td>
<td>0.01-100</td>
<td>BaO</td>
<td>0.01-100</td>
</tr>
<tr>
<td>CaO</td>
<td>0.01-100</td>
<td>TiO₂</td>
<td>0.01-100</td>
<td>LOI</td>
<td>0.01-100</td>
</tr>
<tr>
<td>MgO</td>
<td>0.01-100</td>
<td>MnO</td>
<td>0.01-100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 10.2: Analytes and Ranges of ALS Laboratory Group sample analysis method ME-4ACD81

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Range (ppm)</th>
<th>Analyte</th>
<th>Range (ppm)</th>
<th>Analyte</th>
<th>Range (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ag</td>
<td>0.5-100</td>
<td>Cu</td>
<td>1-10,000</td>
<td>Ni</td>
<td>1-10,000</td>
</tr>
<tr>
<td>As</td>
<td>5-10,000</td>
<td>Hg</td>
<td>1-10,000</td>
<td>Pb</td>
<td>2-10,000</td>
</tr>
<tr>
<td>Cd</td>
<td>0.5-1,000</td>
<td>Mo</td>
<td>1-10,000</td>
<td>Zn</td>
<td>2-10,000</td>
</tr>
<tr>
<td>Co</td>
<td>1-10,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 10.3: Analytes and Ranges of ALS Laboratory Group sample analysis method ME-MS81

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Range (ppm)</th>
<th>Analyte</th>
<th>Range (ppm)</th>
<th>Analyte</th>
<th>Range (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>g</td>
<td>1-1,000</td>
<td>Ho</td>
<td>0.01-1,000</td>
<td>Ta</td>
<td>0.1-10,000</td>
</tr>
<tr>
<td>Ba</td>
<td>0.5-10,000</td>
<td>La</td>
<td>0.5-10,000</td>
<td>Tb</td>
<td>0.01-1,000</td>
</tr>
<tr>
<td>Ce</td>
<td>0.5-10,000</td>
<td>Lu</td>
<td>0.01-1,000</td>
<td>Th</td>
<td>0.05-1,000</td>
</tr>
<tr>
<td>Co</td>
<td>0.5-10,000</td>
<td>Mo</td>
<td>2-10,000</td>
<td>Ti</td>
<td>0.5-1,000</td>
</tr>
<tr>
<td>Cr</td>
<td>10-10,000</td>
<td>Nb</td>
<td>0.2-10,000</td>
<td>Tm</td>
<td>0.01-1,000</td>
</tr>
<tr>
<td>Cs</td>
<td>0.01-10,000</td>
<td>Nd</td>
<td>0.1-10,000</td>
<td>U</td>
<td>0.05-1,000</td>
</tr>
<tr>
<td>Cu</td>
<td>5-10,000</td>
<td>Ni</td>
<td>5-10,000</td>
<td>V</td>
<td>5-10,000</td>
</tr>
<tr>
<td>Dy</td>
<td>0.05-1,000</td>
<td>Pb</td>
<td>5-10,000</td>
<td>W</td>
<td>1-10,000</td>
</tr>
<tr>
<td>Er</td>
<td>0.03-1,000</td>
<td>Pr</td>
<td>0.03-1,000</td>
<td>Y</td>
<td>0.5-10,000</td>
</tr>
<tr>
<td>Eu</td>
<td>0.03-1,000</td>
<td>Rb</td>
<td>0.2-10,000</td>
<td>Yb</td>
<td>0.03-1,000</td>
</tr>
<tr>
<td>Ga</td>
<td>0.1-1,000</td>
<td>Sm</td>
<td>0.03-1,000</td>
<td>Zn</td>
<td>5-10,000</td>
</tr>
<tr>
<td>Gd</td>
<td>0.05-1,000</td>
<td>Sn</td>
<td>1-10,000</td>
<td>Zr</td>
<td>2-10,000</td>
</tr>
<tr>
<td>Hf</td>
<td>0.2-10,000</td>
<td>Sr</td>
<td>0.1-10,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Copper analyses that return values greater than the detection limits (>10,000 ppm) of sample method ME-4ACD81 are re-analyzed by ALS using sample method Cu-OG62, which has detection limits of 0.01-40%.

The key elements for the Project are titanium (Ti), which is measured as TiO$_2$ and iron (Fe) which is measured as Fe$_2$O$_3$.

10.6 Sample Security

Drill core is retrieved from drill sites on a daily basis by CIOUS staff, and delivered directly to the CIOUS field office in Aurora, Minnesota. Drill core is securely stored on-site at the field office until sampling can be conducted by CIOUS personnel. The CIOUS field office is locked at night and when personnel are not present at the facility and the local Aurora police force regularly patrol the area.

Upon collection of samples they are packaged as described above and shipped via chartered and bonded independent carrier Valley Carthage Transport and Manitoulin Transport for customs brokerage to ALS Laboratory Group Laboratories in Thunder Bay, Ontario, Canada. There have been no reported incidents regarding the individually numbered security zip ties placed on each sand bag, and thus there are no issues regarding the security of sample shipment.

There were no issues regarding drill core or sample security.

10.7 Quality Assurance and Quality Control Programs

CIOUS has instituted extensive QA/QC procedures to ensure the integrity of sample analyses. The QA/QC procedures followed for all drill core sampling conducted by CIOUS at the Project are outlined in Figure 10.1 below.
Field duplicates (FDUP) are inserted 1:20 (sample numbers are pre-determined as 01, 02, 21, 22, 41, 42, etc., these samples are collected by quartering the core over the designated interval and placing each quarter into separate sample bags.

Preparation duplicates (CDUP) are inserted 1:20 (sample numbers are pre-determined as 09, 29, 49, 69, 89). Submit an empty bag with a ticket number, alerting the preparation lab to prepare the duplicate from the previous sample.

Standards are inserted 1:20 (sample numbers are pre-determined as 10, 30, 50, 70, 90). Skip the number in the sample sequence for later insertion of the standard reference material. The type of standard (certified reference material) inserted must be at appropriate levels that the geologist determines will bracket the expected values to be encountered in the sample.

Blanks are inserted randomly as determined by the geologist in place of a routine sample. Blanks are inserted at the rate of 1 sample in every 40, (1:40). It is recommended to insert a blank sample between mineralized samples or at the end of a mineralized intersection.

Figure 10.1 Cardero Longnose Project Quality Control/Quality Assurance procedures

Field duplicates ("FDUP") in this case refer to quarter core duplicates of the same sampling interval. A preparation duplicate ("CDUP") consists of a poly bag containing only a sample tag with instructions for laboratory personnel to prepare the sample from the preceding standard drill core analysis by taking a split after the coarse crushing stage.

Three different reference materials are used in the Longnose sampling program. "TTC-1" and "LNC-1", which are in-house reference materials created by Cardero and, "DH6701" which is a certified reference materials manufactured for Brammer Standard Company, Inc.

Blank material is collected locally in Minnesota from bedrock outcroppings of the Pokegama quartzite near Virginia, Minnesota. Pokegama quartzite is a suitable blank reference because it is dominantly composed of SiO$_2$. 
11 A total of Data Verification

11.1 Quality Control Results

Quality control samples (duplicates, blanks and standards) are used to monitor laboratory sample preparation, potential for contamination and analytical accuracy.

A total of 105 reference materials and 61 Pokegama quartzite blank samples were submitted blindly to the laboratory during the re-analysis of historical drill core samples in 2009 and the core sampling campaign and in 2010 and 2011. A total of 90 quarter core duplicate pairs were collected and submitted to the laboratory and 137 preparation duplicate pairs were prepared by the laboratory. Only the quarter core duplicates were blind to the laboratory. All analytical data including quality control samples were checked and verified by Cardero’s senior geochemist, Tansy O’Connor-Parsons and reviewed by SRK.

In the opinion of SRK, the sampling preparation, security and analytical procedures used by CIOUS are consistent with generally accepted industry best practices and are therefore adequate.

Quarter-core and preparation duplicate data for TiO$_2$ are presented in Figure 11.1 and Figure 11.2. These data exhibit good to excellent correlation for the elements of interest.

![Bias Chart Check Assay Pairs](image)

Figure 11.1: Scatterplot graph of TiO$_2$ data for quarter core field duplicate data
Two internal reference materials (LNC-1 and TTC-1) and one commercial standard reference material (DH6701) were utilized by Cardero. Reference material results are plotted against their known concentration with tolerance levels within 10% (Figure 11.3, Figure 11.4, and Figure 11.5). Overall, performance of the certified reference materials was satisfactory. TTC-1 shows a slightly high bias and relatively larger scatter, while LNC-1 shows no bias but significant scatter.
To monitor the analytical accuracy of the laboratory, umpire/check assays were submitted to a second laboratory (Acme Analytical Laboratories in Vancouver, BC) where the sample pulps were analysed by the 4A04 package (lithium metaborate fusion/ICP-ES finish). All 303 samples from a single drill hole were submitted for the umpire assay, as the drill hole intersected all levels of ferro-titanium mineralization. The drill hole (TTC-019) is located at a nearby CIOUS ilmenite project with identical mineralization style as occurs at the Project referred to as “Titac”. The Titac drilling program was concurrent with the Longnose program and adhered to the same procedures, so the check assay results are considered to be comparable. The results for TiO$_2$ and Fe$_2$O$_3$ are presented.
in Figure 11.6. The data correlate very well for both analytes, however there is a slight low bias at the concentrations of > 27% TiO$_2$ for the data from the ALS Minerals laboratory. This is not considered to be significant, as the data is within 10% analytical precision.

Figure 11.5: Scatterplots presenting analytical umpire (check) assays versus original assay results for Fe$_2$O$_3$ (left) and TiO$_2$ (right) data

Coarse blank samples (Figure 11.7) show a slightly higher than background value for TiO$_2$, indicating that the blank is not devoid of titanium. SRK normally compares the blank data to five times the detection limit, in this case a value of 0.05% TiO$_2$; however, this blank has an average TiO$_2$ value ten times the detection limit. When the individual values are compared to a low baseline value of 0.1% TiO$_2$, the blank sample results indicate very low-level carryover contamination during the preparation through to analytical stage.

Figure 11.6: TiO$_2$ data presented for the Pokegama Quartzite Blank samples
SRK has reviewed the results of all QA/QC samples. Duplicate and umpire analysis performed very well and blank samples performed adequately. The results of analytical, standard results are less ideal. Both internal standard results showed a large amount of scatter and standard TTC-1 showed a slight high bias. Also, CIOUS did not complete full round robin testing on the standards, making them difficult to properly use as a reference. CIOUS should be more careful to appropriately utilize reference standards for future drill programs.

In the opinion of SRK, the results of the analytical QA/QC program used by CIOUS provide sufficient support that the analytical data is viable to support the exploration analysis and the Mineral Resource.

11.2 Verifications by Cardero

Cardero completed several processes to verify the exploration data that has been captured at the Project.

Firstly, all exploration data was entered into a database which provided a level of data checking to ensure that errors are minimized. This includes standardized naming conventions and limits on field entries.

Secondly, all field records were retained by CIOUS and spot checks were made by Cardero head office staff to ensure that the database accurately reflected the data captured.

Data from the site database is backed up weekly to Cardero’s Vancouver office server.

11.3 Verifications by SRK

SRK completed a series of verifications to ensure that the exploration data is reliable enough for the creation of the Mineral Resource. These verifications included the site visits review of field procedures, reviewing analytical quality control data, independent sampling and independent verification of the assay results.

11.3.1 Site Visit

During the site visit completed on March 12 & 13, 2010, SRK was able to verify:

- Exploration planning;
- Selection of drill hole sites;
- Mobilization of drill rigs;
- Drilling processes and drill rig core handling;
- Down-hole surveying;
- Collar site marking & surveying;
- Core logging;
- Core sampling;
- Sample QA/QC insertion;
- Sample shipping and security; and
- Data capture and backup.

In the opinion of SRK the site procedures used by CIOUS are consistent with generally accepted industry best practices and are therefore adequate.
11.3.2 Verifications of Analytical Quality Control Data

Table 11.1 summarizes CIOUS’s insertion rate for analytical QA/QC samples.

Table 11.1: Summary of Analytical Quality Control Data Produced By Cardero on the Longnose Project, 2010/11

<table>
<thead>
<tr>
<th>Sampling Program</th>
<th>Drilling and Sampling Programs</th>
<th>Percent of Samples (%)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Count</td>
<td>1695</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Blanks</td>
<td>61</td>
<td>3.6</td>
<td>Locally derived quartzite material</td>
</tr>
<tr>
<td>Standards</td>
<td>105</td>
<td>6.2</td>
<td></td>
</tr>
<tr>
<td>TTC-1</td>
<td>48</td>
<td>2.8</td>
<td>Internal Cardero reference material</td>
</tr>
<tr>
<td>LNC-1</td>
<td>49</td>
<td>2.9</td>
<td>Internal Cardero reference material</td>
</tr>
<tr>
<td>DH6701</td>
<td>8</td>
<td>0.5</td>
<td>Certified Commercial Standard, Brammer</td>
</tr>
<tr>
<td>Field Duplicates</td>
<td>90</td>
<td>5.3</td>
<td>Quarter Core</td>
</tr>
<tr>
<td>Preparation Duplicates</td>
<td>137</td>
<td>8.1</td>
<td>Split of course crush</td>
</tr>
<tr>
<td>Total QC Samples</td>
<td>393</td>
<td>23.2</td>
<td></td>
</tr>
</tbody>
</table>

SRK believes that the QA/QC sample insertion rates described above meet industry standard rates. Generally, SRK expects 5% blanks, 5% standards and 5% duplicates for an overall insertion rate of 15%. CIOUS has exceeded these thresholds for all sample types aside from blanks.

SRK noted in their review that the standard performance and internal standard analysis could be improved.

The internal standards did not have multi-laboratory round robin analysis and expected values for these standards have been calculated only through utilization as standard material and averaging results. This is not recommended and for further program, SRK recommends that multi-laboratory and round robin testing should be completed on all internal standards.

SRK has reviewed the results of the analytical QA/QC samples and found that the results are sufficient to provide confidence in the sampling and assay results.

11.3.3 Independent Verification Sampling

During the SRK site visits, independent verification samples were collected and sent to ALS for processing. Samples were collected from both the Longnose and Titac deposits.

In total, five independent samples from the Project Area were collected and processed. The results are shown in Table 11.2 and Figure 11.7. Even though only a small number of samples were collected, the samples showed very good correlation between the original Cardero TiO₂ and Fe₂O₃ assays, and the independent duplicate results.
Table 11.2: Assay Results for Verification Samples Collected SRK on the Longnose Project.

<table>
<thead>
<tr>
<th>Hole ID</th>
<th>From (m)</th>
<th>To (m)</th>
<th>Original TiO₂ (%)</th>
<th>SRK Duplicate TiO₂ (%)</th>
<th>Original Fe₂O₃ (%)</th>
<th>SRK Duplicate Fe₂O₃ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LN-8</td>
<td>51.82</td>
<td>54.86</td>
<td>18</td>
<td>17.55</td>
<td>35.2</td>
<td>34.9</td>
</tr>
<tr>
<td>LN-8</td>
<td>112.78</td>
<td>115.82</td>
<td>24.3</td>
<td>24.4</td>
<td>46.4</td>
<td>45.3</td>
</tr>
<tr>
<td>LN-8</td>
<td>67.06</td>
<td>70.10</td>
<td>14.6</td>
<td>14.75</td>
<td>25.9</td>
<td>26</td>
</tr>
<tr>
<td>LN-9</td>
<td>54.87</td>
<td>57.91</td>
<td>17.8</td>
<td>16.7</td>
<td>32.7</td>
<td>31.3</td>
</tr>
<tr>
<td>LN-10</td>
<td>73.15</td>
<td>76.20</td>
<td>28.1</td>
<td>26.5</td>
<td>54.3</td>
<td>50.5</td>
</tr>
</tbody>
</table>

Figure 11.7: Comparison of independent SRK verification samples

11.3.4 Independent Assay Verification

SRK independently verified 92% of the assay results by downloading the assay certificates directly from the laboratory and comparing the compiled results in an Access database. SRK found no errors in the TiO₂ and Fe₂O₃ analytical data.
12 Mineral Processing and Metallurgical Testing

Significant amounts of historical beneficiation work has been conducted by the Coleraine Minerals Research Lab ("CMRL") which is part of the University of Minnesota Duluth’s ("UMD’s") Natural Resources Research Institute ("NRRI"), located in Coleraine, Minnesota, USA. The work pre-dates the NI 43-101 standards and therefore is not compliant. However, the work was completed to high standards and will be useful in designing the future beneficiation work. This work was described in Section 5 of this report.

12.1 Recent Metallurgical Testwork

Since Cardero’s involvement in the project, little metallurgical analysis has been completed by Cardero. However, in December 2011, Davis Tube tests were completed in order to determine the proportion of magnetic material and the Fe analytical value within this magnetic concentrate. At this time, only preliminary results of these tests have been received.

Approximately 160 Longnose samples were selected for Davis Tube processing. Davis Tube tests utilize an electromagnet to separate material into magnetic and non-magnetic/para-magnetic material. Samples were selected to cover a wide range of grades as well as being spatially representative. Analytical pulp rejects were utilized for the tests. The samples were shipped to G&T Metallurgical ("G&T") in Kamloops BC.

At G&T each sample was assayed for Fe% (direct Fe% analysis as opposed to Fe₂O₃ that was completed in the main assay work). Then 10 g or 30 g of the material was selected for the tests. This material was pulp reject material (pulverized to 80% passing 200 mesh) and was not further re-crushed in any way by G&T. The material was separated into a magnetic and non-magnetic fraction by passing over a magnet set at 3000 gauss. The magnetic fraction was then weighed and the magnetic concentrate re-assayed for Fe%.

A total of 151 of these samples were from within the peridotite and pyroxenite domains. The results of this test were reviewed for each domain.

In a deposit with magnetite as the dominant Fe bearing mineral, this test provides data to calculate a regression of the proportion of magnetite expected at a range of Fe grades and the conversion of the Fe₂O₃ or Fe% analysis into a magnetite estimate. However, due to the fact that Fe partitions into ilmenite and a small but unknown amount of ilmenite would have partitioned into the magnetic concentrate, further work must be performed to properly quantify the magnetite content of these samples. A mineralogical study of a subset of these samples and concentrates would assist with determining the amount of ilmenite in the concentrate and TiO₂ assays of the concentrate would allow for determination of the titaniferous magnetite as well.

Regression of the Davis Tube results has been utilized to adjust the Fe₂O₃ values reported in the Mineral Resource statement (Table 1 and Table 13.8). This regression has reduced the values in order to account for the Fe contained within the ilmenite as well as silicates. However, without mineralogical analysis of the samples and magnetic concentrate, the results are not conclusive enough to be used to definitively quantify magnetite without the risk of double counting iron already accounted for in the ilmenite values.
13 Mineral Resource Estimates

13.1 Introduction


The mineral resource model prepared by SRK considers 24 core boreholes drilled, and in the case of historic drilling re-sampled, by CIOUS during the period of 2009 through 2011. The resource estimation work was completed by Michael D. Johnson, P.Geo (APEGBC, No. 39423) an appropriate “independent qualified person” as this term is defined in NI 43-101. The effective date of the resource statement is January 19, 2012.

This section describes the resource estimation methodology and summarizes the key assumptions considered by SRK.

In the opinion of SRK, the resource evaluation reported herein is a reasonable representation of the global TiO₂ and Fe₂O₃ Mineral Resources found in the Project at the current level of sampling. The mineral resources have been estimated in conformity with generally accepted CIM “Estimation of Mineral Resource and Mineral Reserves Best Practices” guidelines and are reported in accordance with the Canadian Securities Administrators’ National Instrument 43-101. Mineral resources are not Mineral Reserves and do not have demonstrated economic viability. There is no certainty that all or any part of the Mineral Resource will be converted into a Mineral Reserve.

The database used to estimate the Project Mineral Resources was thoroughly audited by SRK. SRK is of the opinion that the current drilling information is sufficiently reliable to interpret with confidence the boundaries for Ilmenite and magnetite mineralization and that the assay data are sufficiently reliable to support a Mineral Resource estimate.

Surpac® version 6.2 was used to construct the geological solids, prepare assay data for geostatistical analysis, construct the block model, estimate metal grades and tabulate mineral resources. The Geostatistical Software Library (“GSLib”) family of software were used for geostatistical analysis. Surpac® was used for the variography analysis and Leapfrog® version 4.2 was utilized in the solid model creation.

This section describes the work undertaken by SRK and key assumptions and parameters used to prepare the Mineral Resource model for the Project.

13.1.1 Ilmenite and Mineral Resources of Industrial Minerals

The Longnose deposit is primarily of interest for ilmenite and to a lesser extent magnetite. Ilmenite is a titanium–iron oxide with a chemical formula of TiFeO₃, containing approximately 32% Ti and 37% Fe. The other significant source mineral for Ti is rutile, which has a chemical formula of TiO₂ and is believed to be only a minor constituent of this deposit.

Magnetite within the Longnose deposit is made up of pure magnetite and titaniferous magnetite. Titaniferous magnetite has the chemical formula TiFe₂O₄ (50% Fe, 31% Ti) while pure magnetite is Fe₃O₄ (72% Fe). The ratio of titaniferous to pure magnetite likely varies throughout the deposit.

Chemical analysis of titanium in any form is measured as TiO₂, while the current methods measure all iron as Fe₂O₃.
As stated above, the Mineral Resource has been quantified in terms of TiO$_2$ and Fe$_2$O$_3$, the analytical components of Ti and Fe. In any potential mining scenario, the Project would produce ilmenite (FeTiO$_3$) and potentially magnetite (TiFe$_2$O$_4$, Fe$_3$O$_4$) as a by-product.

The CIM guidelines highlight the special care that should be undertaken when developing a Mineral Resource estimate for an industrial mineral deposit. A list of considerations includes:

- These deposits differ from more common precious and base metal deposits;
- Customer specifications for industrial products are often based on both physical and chemical properties;
- An industrial mineral may have multiple market applications with different requirements or limits;
- The physical properties of an industrial mineral deposit may vary from deposit to deposits or within a single deposit;
- Use of multi-parameter estimation techniques may be desirable, such as the use of multiple indicators or co-kriging;
- Published specifications and standards for industrial minerals should be used as a guide and not replace detailed market investigations;
- Test results may be subject to scale-up effects and larger scale tests may be required; and,
- Identification of market price factors are critical in determining value for an industrial mineral.

Ilmenite concentrate should be viable for a variety of processes and uses such as pigment and metal markets.

Processing of OUI material to create an ilmenite concentrate would include crushing the rock to a specified size and then completing density separation to remove the silicates to a float waste product and concentrating the heavy oxides. The oxide concentrate would then be separated into a magnetic and non-magnetic fraction. An example of such a flow sheet is shown in Figure 13.1. The ilmenite would be concentrated into the non/para-magnetic fraction, ideally containing >50 % TiO$_2$ and recovering more than 70% of the TiO$_2$. Magnetic minerals/elements of potential economic benefit would include magnetite and potentially vanadium.

General sources, processes and end uses of titanium bearing material are shown in Figure 13.1. Ilmenite is most commonly used as a pigment in paints as well as in a metal alloy in lightweight component construction (aerospace, aircraft, auto industry and bicycles). Ilmenite can be viable for production into synthetic rutile, sorel slag and low-alkali slag, as well as pigments through the sulphate and chloride processes.

Based upon the work summarized in a paper by Westmount Mining (Westmount, 1990), ilmenite from the Longnose deposit would be a saleable as an ilmenite concentrate; however, may be priced at the lower end of the pricing spectrum due to magnesium levels. Beneficiation to a Sorel slag, low-alkali slag or synthetic rutile would, however, be advantageous and increase market options. This type of beneficiation will require significant further testwork.
Figure 13.1: Titanium feedstocks & uses (Westmont, 1990)

13.2 Resource Estimation Procedures
The resource evaluation methodology involved the following procedures:
- Database compilation and verification;
- Construction of wireframe models for the boundaries of the oxide mineralization;
- Definition of resource domains;
- Data conditioning (compositing and capping) for geostatistical analysis and variography;
- Block model creation, coding and grade interpolation;
- Resource classification and validation;
- Assessment of “reasonable prospects for economic extraction” and selection of appropriate cut-off grades; and

13.3 Resource Database
SRK audited and reviewed data provided by Cardero to create a Surpac® database from which the Mineral Resource estimation was based. The database includes the following tables:
- Drill hole collar information such as location and length;
• Downhole survey information such as direction and dip;
• Lithology information including rock group codes and interpreted geology;
• Downhole magnetic susceptibility data;
• Downhole specific gravity measurements; and,
• Chemical analytical (assay) records.

The data encompassed 27 drill holes, 544 downhole survey readings and 1695 assays. Lithology data was only available for the 15 “modern” holes completed by CIOUS in 2010 and 2011.

Three historical drill holes were not utilized for the Mineral Resource due to lack of significant CIOUS sampling in these holes. Neither the drill core nor the assay rejects were available for re-sampling. Historical assays in these holes were not used in the estimation, but did not contradict the results of the estimates.

Basic statistics for the drill hole assay and specific gravity data are presented in Table 13.1 and Table 13.2

<table>
<thead>
<tr>
<th>Table 13.1: Statistical Summary of assay results in the database</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Count</td>
</tr>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Standard Deviation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 13.2: Statistical summary of specific gravity data in the database</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Count</td>
</tr>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Standard Deviation</td>
</tr>
</tbody>
</table>

13.4 3D Modelling

Solid models were created to provide spatial limits for each of the mineralization domains within the Longnose deposit. The domains were largely created by interpretation of the drill hole lithology data from 2010/11 drill holes, in conjunction with analysis of the TiO₂ and Fe₂O₃ assay values from all holes. There historic holes lack the lithology data that the modern holes have, so assay data was used as a surrogate for geology where required.

The domains were broadly defined based upon the designation of drillcore intervals as peridotite or pyroxenite dominated oxide bearing ultramafic rocks, or country rocks. The two domains were created by generalizing the lithology, so each domain is dominated by either peridotite or pyroxenite material, but may contain shorter intervals of other rock types.

Surpac® 6.2 and Leapfrog® software was used to create the wireframes. The boundaries were limited to below the surface and/or overburden boundary and so that no overlap or gap is created between the two domains.
Topographic and overburden surfaces were modelled from the drill hole data. These surfaces were used to code the appropriate portions of the block model as air or overburden.

Figure 13.2 and Figure 13.3 show the interpreted domains in plan view and orthographic views.

Figure 13.2: Longnose three-dimensional ("3-D") model domains (100 m grid)

Figure 13.3: Longnose 3-D models with drill holes (50 m grid, looking northeast)
13.5 Bulk Density

The Longnose database contains 855 specific gravity ("SG") measurements, 501 of which fall within the interpreted boundary of the Longnose OUI deposit. 354 SG measurements lie outside the mineralization domains, while 186 measurements lie within the peridotite domain and 315 measurements lie within the pyroxenite domain.

Specific gravity was measured on core samples by Cardero using a laboratory scale and recording the mass of drill hole core pieces in air and water. Drill hole core was not covered by wax or plastic film prior to immersion; however, porosity is not likely to be an issue with this type of rock. No strong correlation between specific gravity measurements and TiO$_2$ or Fe$_2$O$_3$ assay results was noted. SG data was utilized to estimate bulk density.

13.6 Compositing

Drill hole assay sample lengths are summarized in Figure 13.4; a histogram of sample lengths. Approximately 60% of the samples are less than 2 m in length, so a compositing interval of 2 m was selected.

Figure 13.4: Histogram of sample lengths

Composites of 1 m or less were tagged as "short composites" and not used in the estimation process so they did not have an unrepresentative influence on the estimates. Since the domains are relatively thick in all directions and these short composites only occur at domain boundaries, they are not significant to the estimation process.
13.7 Evaluation of Outliers

Block grade estimates may be unduly affected by high grade outliers. Evaluation of the sample data for outliers which should be capped or otherwise restricted was completed by looking at cumulative probability graphs. These plots are shown for TiO\textsubscript{2} in both domains within Figure 13.5 and Figure 13.6.

Overall, the two domains show a relatively consistent trend of a single population from approximately 15% TiO\textsubscript{2} and above. At TiO\textsubscript{2} values less than 15%, there is evidence of mixing of lower grade material such as pyroxenite in the Peridotite domain or country rock (troctolites) material within either of the mineralized domains.

For the Peridotite domain, there is a significant lower grade population which has been included within the domain and accounts for approximately 20% of the samples. These samples are scattered throughout the deposit and cannot be modelled out at the current state of the data. The domain includes a very small percentage (< 5%) of very low grade (country rock) samples.

The pyroxenite domain also includes a lower grade population (< 8% TiO\textsubscript{2}) which accounts for approximately 5% of the samples. These samples are also mixed throughout the domain and cannot be easily modelled out at the current state of the data.

SRK determined that capping was unnecessary for both TiO\textsubscript{2} and Fe\textsubscript{2}O\textsubscript{3} in either domain.

![Peridotite Outlier Probability Plot](image)

**Figure 13.5: Peridotite Probability Plot (declustered composites)**
13.8 Statistical Analysis and Variography

13.8.1 Composite Statistics

Composite statistics for TiO$_2$ and Fe$_2$O$_3$ as well as sample statistics for specific gravity are described below.

**TiO$_2$ Composites Statistics**

Figure 13.7 and Figure 13.8 show histograms of the TiO$_2$ composites within each domain, as well as the basic statistics for each. The average peridotite TiO$_2$ value is 18.9%, while the average in the pyroxenite is 13.75%.
Figure 13.7: Peridotite composite histogram for TiO₂

Figure 13.8: Pyroxenite composite histogram for TiO₂
**Fe₂O₃ Composites Statistics**

Figure 13.9 and Figure 13.10 show the histograms of the Fe₂O₃ composites within each domain, as well as the basic statistics of each. The average peridotite Fe₂O₃ value is 41.12%, while the average in the pyroxenite is 30.32%.

![Peridotite Composite Histogram](image1)

**Figure 13.9: Peridotite Composite Histogram for Fe₂O₃**

![Pyroxenite Composite Histogram](image2)

**Figure 13.10: Pyroxenite composite histogram for Fe₂O₃**
13.8.2 Specific Gravity Sample Statistics

Figure 13.11 and Figure 13.12 show the histograms of the SG composites within each domain, as well as the basic statistics of each. The average peridotite domain SG is 3.64, while the average in the pyroxenite domain SG is 3.49. The surrounding country rock has an average SG of 2.97.

**Figure 13.11:** Longnose specific gravity histogram, peridotite domain

**Figure 13.12:** Longnose specific gravity histogram, pyroxenite domain
Variography

Kriging parameters were derived from variogram analysis completed on the composites for each metal (Table 13.3). A single variogram was used for both domains based upon the relatively limited data within any single domain. The nugget effects were established from downhole variograms. The nugget values are 12% of the total sill for both TiO$_2$ and Fe$_2$O$_3$ respectively. Note that the sill represents the grade variability at a distance beyond which there is no correlation in grade.

Table 13.3: TiO$_2$ and Fe$_2$O$_3$ variogram parameters for both Longnose domains

<table>
<thead>
<tr>
<th>Element</th>
<th>Nugget C0</th>
<th>Sill C1, C2</th>
<th>Surpac® Rotations Rule (LRL)</th>
<th>Ranges a1, a2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>around Z</td>
<td>around X</td>
</tr>
<tr>
<td>TiO$_2$</td>
<td>5</td>
<td>14 23</td>
<td>130 130 0</td>
<td></td>
</tr>
<tr>
<td>Fe$_2$O$_3$</td>
<td>12</td>
<td>29 53</td>
<td>135 135 0 350 146 22</td>
<td>70 29 22</td>
</tr>
</tbody>
</table>

A viable three-dimensional TiO$_2$ variogram was not apparent in the data; however, a shallowly east-dipping omnidirectional variogram was fit to the data in two-dimensions (Figure 13.14). It was decided that the downhole variogram would be utilized as a surrogate for determining the 3rd dimension ranges (Figure 13.15).
Figure 13.14: 2-D sub-horizontal component of the TiO₂ variogram

Figure 13.15: Sub-vertical component of the TiO₂ variogram (downhole)
Analysis of the Fe$_2$O$_3$ composite data resulted in a viable three-dimensional variogram, which are shown in Figure 13.16.

Figure 13.16: Major (top), semi-major and minor axis (bottom) Fe$_2$O$_3$ variograms

The ranges of continuity are generally longer for the Fe$_2$O$_3$ sample data (~350 m / ~100 m) compared to TiO$_2$ (~200 m / ~100 m).
13.9 Block Model and Grade Estimation

A block model was constructed to encompass the entire domain models as well as the surrounding rock. The block model was constructed in order to provide a matrix database which can be populated by data such as geology codes, density data and grade estimates.

The Longnose block model was created with the parameters described in Table 13.4.

Table 13.4: Block Model Summary

<table>
<thead>
<tr>
<th>Type</th>
<th>Y</th>
<th>X</th>
<th>Z</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Coordinates</td>
<td>5,267,800</td>
<td>571,500</td>
<td>50</td>
<td>UTM metres</td>
</tr>
<tr>
<td>Maximum Coordinates</td>
<td>5,269,100</td>
<td>572,900</td>
<td>500</td>
<td>UTM metres</td>
</tr>
<tr>
<td>Parent Block Size</td>
<td>20</td>
<td>20</td>
<td>10</td>
<td>metres</td>
</tr>
<tr>
<td>Min. Sub-block Size</td>
<td>5</td>
<td>5</td>
<td>2.5</td>
<td>metres</td>
</tr>
<tr>
<td>Rotation</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>degrees</td>
</tr>
<tr>
<td>Block Model Size</td>
<td>1,300</td>
<td>1,400</td>
<td>450</td>
<td>metres</td>
</tr>
<tr>
<td>Parent Blocks</td>
<td>65</td>
<td>70</td>
<td>45</td>
<td>blocks</td>
</tr>
<tr>
<td>Total Parent Blocks</td>
<td></td>
<td></td>
<td></td>
<td>204,750</td>
</tr>
</tbody>
</table>

Parent blocks were estimated, while sub-blocking was used only to improve volumetric accuracy only.

Key attributes of the block model included:

- Material code with a numeric value to represent domain or air, overburden or waste;
- TiO₂ grades as ID² and Ordinary kriging (“OK”) grade interpolations and averages of block composites;
- Fe₂O₃ grades as ID² and OK grade interpolations and averages of block composites;
- Various other ID² and OK estimation parameters such as number of samples, average distance to composites, kriging variance; and,
- Specific gravity data as interpolated using ID² methods.

Estimation was completed for both TiO₂ and Fe₂O₃ values using both ID² and OK methods. Estimation of specific gravity was also completed by ID² methods.

13.9.1 Grade Interpolation

Block grades were estimated by ordinary kriging into the domain models. All wireframe boundaries were treated as “hard” boundaries, meaning that blocks within a selected domain were only estimated by composites from within that domain.

TiO₂ and Fe₂O₃ grades were estimated in multiple passes with increasing search radii. Successive passes only calculated grades into blocks that had not been interpolated by the previous passes. Table 13.5 summarises the search ellipse parameters used to estimate metal grades into the model.
### Table 13.5: Search ellipse parameters (Rotations aligned with Search Ellipses)

<table>
<thead>
<tr>
<th>Metal</th>
<th>Search Pass</th>
<th>Empty Octants Allowed</th>
<th>Search Ellipse Size</th>
<th>Number of Composites</th>
<th>Max. Samples per DDH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>X (m)</td>
<td>Y (m)</td>
<td>Z (m)</td>
</tr>
<tr>
<td>TiO₂</td>
<td>1</td>
<td>4</td>
<td>125</td>
<td>125</td>
<td>63</td>
</tr>
<tr>
<td>TiO₂</td>
<td>2</td>
<td>6</td>
<td>200</td>
<td>200</td>
<td>100</td>
</tr>
<tr>
<td>TiO₂</td>
<td>3</td>
<td>8</td>
<td>250</td>
<td>250</td>
<td>125</td>
</tr>
<tr>
<td>Fe₂O₃</td>
<td>1</td>
<td>4</td>
<td>125</td>
<td>52</td>
<td>39</td>
</tr>
<tr>
<td>Fe₂O₃</td>
<td>2</td>
<td>6</td>
<td>200</td>
<td>83</td>
<td>63</td>
</tr>
<tr>
<td>Fe₂O₃</td>
<td>3</td>
<td>8</td>
<td>250</td>
<td>104</td>
<td>78</td>
</tr>
</tbody>
</table>

#### 13.9.2 Specific Gravity Interpolation

Block density data was interpolated from specific gravity point measurements using ID² methods. The estimate was created in two passes for each domain, including the “country rock” external to the mineralization.

The search ellipse for the ID² estimates was aligned parallel to the Fe₂O₃ search ellipse, which is relatively similar to the trend of the TiO₂ search ellipse. Estimation of density outside the mineralization domains was completed with an isotropic search ellipse. Passes were completed at a search ellipse of 150 m and then 300 m in the longest direction.

Minimum samples were generally three on the first pass and two on the second pass with a maximum number of samples of eight and a maximum of three from any drill hole for all passes.

Country rock blocks that were not estimated were assigned an average value of 2.99 g/cm³.

Overburden blocks were assigned a value of 2.0 g/cm³, which is an estimated value and not based upon any project measurements.

#### 13.10 Model Validation

##### 13.10.1 Declustered Average Grades

In order to check for global bias between the sample data and the estimate, the global estimated grades for TiO₂ and Fe₂O₃ have been compared to the declustered average composite data. Cell declustering had been utilized for this exercise, using GSLib software.

The results of cell declustered average composite grades compared to zero cut-off OK estimated grades are shown in Table 13.5. Overall, the results compare well, with estimated grades within 5% of the declustered composites grades for all but the TiO₂ estimate in the pyroxenite domain.

In the case of the pyroxenite domain, the OK estimated grade is 12% higher than the declustered average to a volume within the Inferred Mineral Resource where drill holes having only penetrated partially through the mineralized zone and end in higher grade material. These higher grade assays at the end of these holes are extrapolated into a larger volume of material, where is reasonable to expect that higher grade mineralization exists.
Table 13.6: Declustered Average Grade compared to Estimated Grade at Zero Cut-off

<table>
<thead>
<tr>
<th>Domain</th>
<th>TiO₂ Declustered Grade (TiO₂ %)</th>
<th>OK Estimated TiO₂ Grade (TiO₂ %)</th>
<th>Fe₂O₃ Declustered Grade (Fe₂O₃ %)</th>
<th>OK Estimated Fe₂O₃ Grade (Fe₂O₃ %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyroxenite</td>
<td>13.8</td>
<td>15.4</td>
<td>30.4</td>
<td>30.4</td>
</tr>
<tr>
<td>Peridotite</td>
<td>18.9</td>
<td>18.7</td>
<td>41.0</td>
<td>41.2</td>
</tr>
</tbody>
</table>

13.10.2 Comparison of Well Informed Blocks

In order to validate how well the estimation process is estimating grades near samples, estimated blocks which also contain composite samples are selected ("well informed blocks"). The estimated grades for these blocks are compared to the average of the composite grades using a scatter plot. The scatter plots for TiO₂ and Fe₂O₃ within each of the pyroxenite and peridotite domains are shown in Figure 13.7 and Figure 13.18.

Overall, the estimates appear to reasonably represent the sample data with some smoothing of grades evident and expected.
13.10.3 Swath Plot Comparison of Estimates to Composites

Swath plots are used to compare the trends in composite grades, across the X, Y and Z axis, to the grade estimates.

Figure 13.19 and Figure 13.20 show the trends in TiO₂ composite, OK estimated and ID² estimated grades, for each of the pyroxenite and peridotite domains. Overall, the trends of the composites are reflected in the estimates; however, the estimates are smoother.

SRK believes that the swath plots reflect a reasonable correlation between sample and estimation trends. As well, the trends in the OK estimation are very similar to that of the ID² estimation.

Figure 13.19: Pyroxenite Domain TiO₂ Swath Plots

Figure 13.20: Peridotite Domain TiO₂ Swath Plots

A cross section of the Longnose OUI deposit showing drill holes and block model grades is shown in Figure 13.21. The correlation of the assays and the block model grades seems to visually align. Smoothing of the drill hole grade is evident in the model.
13.11 Fe₂O₃ estimate adjustment using Davis Tube data

As discussed in Section 12, Davis Tube tests were used to help quantify the amount of Fe which partitions to a magnetic fraction.

SRK utilized 151 Davis Tube tests in order to establish a relationship between assayed Fe %, and magnetite assumed to be contained within the magnetic fraction. The maximum amount of magnetite possible in the concentrate was calculated using the Fe % concentrate assay, using the conversion:

Maximum Magnetite% in Concentrate = 1.382 * Fe% in Concentrate.

This magnetite percentage in the concentrate was then multiplied by the total concentrate weight, to determine the potential weight of magnetite in the concentrate. The weight of the potential magnetite in the concentrate was divided by the starting sample weight to establish the maximum weight percent of magnetite in the starting sample.

Linear regression of the maximum magnetite content versus the Fe % head assay, was completed to determine the relationship between Fe % and Magnetite %. This was completed for both domains and the regression for the peridotite domain is presented in Figure 13.22.
Figure 13.22: Davis Tube regression, peridotite domain

The indicated regression for the peridotite and pyroxenite domains were:

Predicted Peridotite Domain Magnetite Grade % = 1.55 X Fe% - 22.5

Predicted Pyroxenite Domain Magnetite Grade % = 1.27 X Fe% - 10.5

Unfortunately, due to the uncertainty of the amount of ilmenite partitioning to the magnetic concentrate, as well as the amount of titaniferous magnetite, there is a risk that the predicted magnetite is overstated. SRK, therefore, adjusted the Mineral Resource Fe₂O₃ (Table 13.8) grade using the regression, but has not quantified the amount of magnetite at this time. Further mineralogical study and chemical analysis of the magnetic concentrates is required.

13.12 Mineral Resource Classification

Block model quantities and grade estimates for the Project were classified according to the CIM Definition Standards for Mineral Resources and Mineral Reserves (December 2005) by Michael D. Johnson, P.Geo. (APEGBC, No. 34923), an appropriate independent qualified person for the purpose of NI 43-101.

Mineral resource classification is typically a subjective concept; industry best practices suggest that resource classification should consider both the confidence in the geological continuity of the mineralized structures, the quality and quantity of exploration data supporting the estimates, and the geostatistical confidence in the tonnage and grade estimates. Appropriate classification criteria should aim at integrating both concepts to delineate regular areas at similar resource classifications.

SRK is satisfied that the geological modelling honours the current geological information and knowledge. The location of the samples and the assay data are sufficiently reliable to support
resource evaluation. The sampling information was acquired primarily by diamond (core) drilling on sections spaced at 50 m to 100 m.

Portions of the Project mineral resource has been classified as Indicated and Inferred. Generally, the core of the deposit has been sufficiently drilled to warrant Indicated classification, while the periphery and deeper eastern mineralization has been classified at Inferred.

The criteria used to classify blocks as Indicated included:

- estimated in the first estimation pass;
- blocks estimated by more than 8 composites; and,
- blocks with average distances to their composites of less than 100 m.

SRK feels that blocks which conform to these criteria have demonstrated geological continuity and sufficiently dense sampling data to support mine planning. Blocks that met these criteria were selected and then volumes, which were dominated by these blocks and formed a cohesive and generally continuous volume, were coded as Indicated through the creation of a solid containing those blocks. In this way, the Indicated material has been interpreted to avoid disseminated blocks coded as Indicated interspersed with Inferred.

Blocks that did not conform to these criteria and fell outside the interpreted Indicated volume were classified as Inferred.

Approximately 44 % of the Mineral Resource is classed as Indicated with the remaining 56% classed as Inferred. The blocks comprising the Mineral Resource are shown in plan view in Figure 13.22, with the blocks colour coded by resource classification.

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**Figure 13.23:** Mineral Resource blocks coloured by Mineral Resource classification (100 m grid)
13.13 Mineral Resource Statement

CIM Definition Standards for Mineral Resources and Mineral Reserves (December 2005) defines a mineral resource as:

“(A) concentration or occurrence of diamonds, natural solid inorganic material, or natural solid fossilized organic material including base and precious metals, coal, and industrial minerals in or on the Earth’s crust in such form and quantity and of such a grade or quality that it has reasonable prospects for economic extraction. The location, quantity, grade, geological characteristics and continuity of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge”.

The “reasonable prospects for economic extraction” requirement generally implies that the quantity and grade estimates meet certain economic thresholds and that the mineral resources are reported at an appropriate cut-off grade taking into account extraction scenarios and processing recoveries. In order to meet this requirement, SRK considers that major portions of the Project are amenable for open pit extraction.

In order to determine the quantities of material offering “reasonable prospects for economic extraction” by a potential open pit, SRK used a pit optimizer (Gemcom Whittle® 4.4) and reasonable mining assumptions to evaluate the proportions of the block model that could be “reasonably expected” to be mined from an open pit.

For this exercise, TiO₂ values were converted to Ilmenite grades by dividing by 0.5264. Fe₂O₃ estimates provided no value in the pit optimizer by setting price and recovery to zero.

The optimization parameters (Table 13.7) were selected based on experience and benchmarking against similar projects. The reader is cautioned that the results from the pit optimization are used solely for the purpose of testing the “reasonable prospects for economic extraction” by an open pit and do not represent an attempt to estimate Mineral Reserves. There are no Mineral Reserves defined for the Project.

The results are used as a guide to assist in the preparation of a Mineral Resource statement and to select an appropriate resource reporting cut-off grade.

Table 13.7: Assumptions Considered for Conceptual Open Pit Optimization.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>TiO₂ : Ilmenite Ratio</td>
<td>0.5264:1</td>
<td>n/a</td>
</tr>
<tr>
<td>Ilmenite Price</td>
<td>170</td>
<td>$US per tonne</td>
</tr>
<tr>
<td>Mining Cost</td>
<td>2.50</td>
<td>US$ per tonne mined</td>
</tr>
<tr>
<td>Processing</td>
<td>8.00</td>
<td>US$ per tonne of feed</td>
</tr>
<tr>
<td>General and Administrative</td>
<td>1.00</td>
<td>US$ per tonne of feed</td>
</tr>
<tr>
<td>Mining Dilution</td>
<td>0</td>
<td>percent</td>
</tr>
<tr>
<td>Mining Loss</td>
<td>0</td>
<td>percent</td>
</tr>
<tr>
<td>Overall Pit Slope</td>
<td>50</td>
<td>degrees</td>
</tr>
<tr>
<td>Ilmenite Process Recovery</td>
<td>70</td>
<td>percent</td>
</tr>
<tr>
<td>Magnetite Process Recovery</td>
<td>0</td>
<td>percent</td>
</tr>
</tbody>
</table>

With industrial minerals such as ilmenite, product pricing is subject to many more modifying factors than precious or base metals. SRK has utilized a consensus of market forecasts to choose this ilmenite price. SRK believes that site specific product pricing is unrealistic at this stage of the project.
Project. SRK feels that pricing risks are offset by not planning for the potential value of magnetite which would reasonably be an expected as a by-product at such a deposit. As well, ilmenite pricing as low at $100 per tonne of ilmenite had little effect on the blocks contained within the conceptual pit shell.

SRK considers that the blocks located within the conceptual pit envelope show “reasonable prospects for economic extraction” and are well quantified, and therefore can be reported as a Mineral Resource. When running the optimizer, SRK found that the entire mineralized domains fell within the shell; therefore the optimization process essentially placed no constraints on the Mineral Resource.

The Mineral Resource statement is summarized in Table 13-8.


<table>
<thead>
<tr>
<th>Category (Open Pit**)</th>
<th>Estimated Quantity</th>
<th>Estimated Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>TiO₂</td>
</tr>
<tr>
<td></td>
<td>Mt</td>
<td>%</td>
</tr>
<tr>
<td>Indicated</td>
<td>58.1</td>
<td>16.6</td>
</tr>
<tr>
<td>Inferred</td>
<td>65.3</td>
<td>16.4</td>
</tr>
</tbody>
</table>

* Mineral resources are reported in relation to a conceptual pit shell. Mineral resources are not mineral reserves and do not have demonstrated economic viability. All figures are rounded to reflect the relative accuracy of the estimate. All composites have been capped where appropriate.

** Open pit (near surface) mineral resources are reported at a cut-off grade of 8% TiO₂. Cut-off grades are based on a price of US$170 per tonne of ilmenite back calculated to TiO₂ and recoveries of 70 percent, without considering revenues from other metals including Fe.

*** Reported Fe₂O₃ has been lowered to reflect the amount of Fe estimated contained within ilmenite and silicates, based upon Davis Tube testing. At this time, accurately quantifying the amount of magnetite contained within this estimate is not possible.

As stated above, the Mineral Resource has been quantified in terms of TiO₂ and Fe₂O₃, the analytical components captured for assays of titanium and iron. The Fe₂O₃ values have been reduced to reflect Fe found within silicates and within the ilmenite associated with the TiO₂; however, accurately quantifying magnetite is not possible at this time as further mineralogical work will be needed. In any potential mining scenario, the Longnose Project would produce ilmenite (FeTiO₃) and may produce titaniferous magnetite (TiFe₂O₄) and magnetite (Fe₃O₄) as a by-product. Using Cardero’s Davis Tube test results, historic mineralogy and metallurgy reports, reasonable assumptions regarding mineralogy of the deposit, estimates of the quantity of ilmenite were made.

The contained ilmenite in the Mineral Resource is summarized in Table 13.9

Table 13.9: Summary of Longnose Project Ilmenite content

<table>
<thead>
<tr>
<th>Category</th>
<th>Quantity</th>
<th>Ilmenite Grade</th>
<th>Contained Ilmenite</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mt</td>
<td>% (FeTiO₃)</td>
<td>Mt.</td>
</tr>
<tr>
<td>Indicated</td>
<td>58.1</td>
<td>31.5</td>
<td>18.30</td>
</tr>
<tr>
<td>Inferred</td>
<td>65.3</td>
<td>31.2</td>
<td>20.40</td>
</tr>
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</table>
13.14 Grade Sensitivity Analysis

The mineral resources of the Longnose Project are sensitive to the selection of the reporting cut-off grade. To illustrate this sensitivity, the block model quantities and grade estimates within the conceptual pit used to constrain the mineral resources are presented in Table 13.10 at different TiO$_2$ cut-off grades. The reader is cautioned that the figures presented in this table should not be misconstrued with a Mineral Resource Statement. The figures are only presented to show the sensitivity of the block model estimates to the selection of cut-off grade. Figure 13.24 presents this sensitivity as grade tonnage curves.

Table 13.10: Global block model quantities and grade estimates* at various TiO$_2$ cut-off grades, Longnose Project.

<table>
<thead>
<tr>
<th>Cut-off Grade</th>
<th>Quantity</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>TiO$_2$ (%)</td>
<td>(Mt)</td>
<td>TiO$_2$ (%)</td>
</tr>
<tr>
<td>5</td>
<td>125.1</td>
<td>16.4</td>
</tr>
<tr>
<td>6</td>
<td>125.0</td>
<td>16.4</td>
</tr>
<tr>
<td>7</td>
<td>124.7</td>
<td>16.4</td>
</tr>
<tr>
<td>8</td>
<td>123.4</td>
<td>16.5</td>
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<tr>
<td>9</td>
<td>121.5</td>
<td>16.6</td>
</tr>
<tr>
<td>10</td>
<td>117.0</td>
<td>16.9</td>
</tr>
<tr>
<td>11</td>
<td>109.8</td>
<td>17.3</td>
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<tr>
<td>12</td>
<td>101.8</td>
<td>17.8</td>
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<tr>
<td>13</td>
<td>93.2</td>
<td>18.3</td>
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<tr>
<td>14</td>
<td>85.0</td>
<td>18.7</td>
</tr>
<tr>
<td>15</td>
<td>76.7</td>
<td>19.2</td>
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<tr>
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<td>58.0</td>
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<td>19</td>
<td>37.1</td>
<td>21.4</td>
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<td>20</td>
<td>26.6</td>
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<tr>
<td>25</td>
<td>2.4</td>
<td>26.9</td>
</tr>
<tr>
<td>30</td>
<td>0.2</td>
<td>30.8</td>
</tr>
</tbody>
</table>

* The reader is cautioned that the figures in this table should not be misconstrued with a Mineral Resource statement. The figures are only presented to show the sensitivity of the block model estimates to the selection of cut-off grade.
Figure 13.24: Grade Tonnage Curves for the Longnose.
14 Adjacent Properties

The Project is situated at the western edge of the Duluth geological complex, bordering on the archean Granite-Greenstone Terraines of the Canadian Shield.

This area is a prolific mining area, including several massive Taconite (Iron ore) mines of the Mesabi Range. The western margin of the Duluth Complex contains a series of Cu-Ni deposits in close proximity to the Project. These Cu-Ni deposits include Teck's Mesaba deposits and Polymet's NorthMet deposit. These deposits lie near the basil contact between the Duluth Complex and the underlying older Precambrian rocks.

There are also numerous OUI bodies similar to Longnose within 20 km of the Project Area. The closest is Longyear which lies 1 km north of the Project Area. Section 17 OUI deposits lie about 2 km north of the Project Area and Section 22 lies 5km south-southwest. CIOUS's other OUI ilmenite project, Titac (formerly called "Section 34"), which is similar but smaller and lower grade than the Project, lies approximately 40 km south of the Project Area.
15 Other Relevant Data and Information

There is no additional data or information not contained in this report which is relevant to the Project.
16 Interpretation and Conclusions

The Longnose deposit is an ultramafic intrusion significantly enriched in ilmenite and magnetite oxides. The deposit is flat lying and provides a geometry that should be amicable to open pit mining. The Longnose deposit is approximately 700 m long in the north-south direction, 600 m wide in the east-west direction and 150 m thick.

The Longnose OUI is geologically interpreted to be late-stage intrusion that cuts early Duluth Complex intrusives and is associated with magmatism generated by the 1.1 billion year old Midcontinent Rift system. The drilling program conducted in 2010 and 2011 by CiOUS confirmed strong titanium-iron-oxide mineralization at the Project Area. The Longnose OUI is hosted by troctolitic rocks of the Partridge River intrusion.

The Longnose intrusion is stratigraphically simple, consisting of a core of olivine-rich dunitic and peridotitic rocks containing disseminated titanium-iron oxide mineralization with horizons of massive and semi-massive oxide throughout, that is enveloped by pyroxenitic rocks, which contain much less mineralization. Disseminated titanium-iron oxide mineralization is continuous, and the horizons of massive and semi-massive oxide may link up to form layers that dip moderately coincident with dip of the overall intrusion. The dominant oxide mineral is ilmenite with lesser amounts of titanomagnetite.

The exploration data for the Project is robust; viable to support the Mineral Resource defined within this document. The data has been well validated and has been found to be repeatable. Overall, correlation of the mineralization between drill holes is reasonable and it is expected that the Mineral Resource accurately represents the TiO$_2$ and Fe$_2$O$_3$ mineralization. Based on the TiO$_2$ estimates and the mineralogy of the deposit, the amount of ilmenite has been quantified. Potentially viable iron products (titaniferous-magnetite / magnetite) have not been quantified at this time.

Ilmenite and, to a lesser extent titaniferous magnetite, is used as a source material for titanium used as pigments and as a metal alloy. Rutile is the ideal source material for titanium as it contains a nearly twice as much Ti as ilmenite; however, ilmenite is by far the more common source.

Ilmenite is an industrial mineral and there are risks and uncertainties associated with this ilmenite resource, many of which are common to industrial mineral deposits. Industrial minerals have special risks that are not typically associated with precious or base metal mines. Special concerns include mineralogy of material, deleterious elements (such as silica, calcium, magnesium and manganese), and special market factors such as market size or proprietary technology. Because of these and other issues, industrial mineral deposits can carry additional risks compared to more common metal products.

Historic tests have indicated that a viable ilmenite concentrate could be created from the processing of Longnose material, although higher than ideal magnesium levels may reduce the product price somewhat. The ilmenite may be sold as a concentrate to an existing ilmenite processor as the deposit is amicable to shipping due to its proximity to rail and a short haul to bulk ports on the western shore of Lake Superior. As well, local beneficiation could be considered, particularly when other nearby OUI bodies are considered for increased scale. The main hurdle to overcome with future exploitation of the Longnose deposit revolves around metallurgical optimization to create the highest grade concentrate while reducing potential magnesium contamination of the concentrate or
utilizing a beneficiation process that can handle the higher magnesium values. As further economic analysis of the Project is completed, solving these processing issues will be a focal point of the work.

Ilmenite and magnetite are industrial minerals and subject to the specifics of a relatively limited market with very special restrictions on saleable products. Although it is reasonable to expect that the Longnose deposit mineralization can be concentrated into a potentially saleable product, a huge amount of data collection and analysis must be completed before more detailed economic assessment can be completed. The relative amounts of ilmenite, titaniferous magnetite and magnetite have yet to be fully understood, which prevents quantifying magnetite within the Mineral Resource.

Based upon the significant amount of historical research completed on the Project, a relatively simple processing flow sheet for ilmenite concentrate, a recent increase in demand for Ilmenite, and the projects close proximity to other bulk mines and inexpensive shipping routes; SRK believes that the Project meets the criteria for having reasonable prospects of economic extraction.
17 Recommendations

The drilling program conducted in 2010 and 2011 conducted by CIOUS has confirmed strong titanium-iron-oxide mineralization at the Project Area. The Project merits additional work.

The exploration data for the Project should be expanded and SRK recommend the following work:

- a comprehensive mineralogical study of the oxide and sulfide mineralization should be conducted to confirm the specific oxide minerals present throughout the defined mineralization;
- metallurgical testwork in conjunction with the mineralogical studies, to assist with better understanding of ilmenite and magnetite recovery, project economic analysis and provide an update to the work completed in the 1990s;
- completion of a preliminary economic assessment to assist with further exploration and provide project specific economic criteria;
- further study of the other elements, such as vanadium, magnesium and silica contents and how they are distributed through the deposit;
- a relatively small infill drilling program consisting of 3-5 drill holes; and
- a small step-out drilling program targeting the southern part of the intrusion consisting of 3-5 drill holes.

The Longnose intrusion is fairly well defined by historic drilling, and has been further defined by the drilling conducted by CIOUS in 2010 and 2011. However, some infill drilling is warranted to better define the boundaries of the peridotite domain as well as the pyroxenite domain to the northwest. As well, further step-out exploration drilling is recommended in the southeastern area of the Project Area. This drilling should consist of approximately 6-10 holes 100-300 m drill holes, totaling approximately 1500-2500 m.

In all ongoing drill programs, basic geotechnical data should be recorded in order to provide data to assist with economic analysis and preliminary investigations into potential open pit limits.

Mineralogical studies in conjunction with metallurgical testwork and further chemical analysis should be completed to provide a better understanding of the Ti and Fe bearing minerals and their relative proportions. During the current analysis, Ti has been assumed to be dominantly contained within Ilmenite.

A preliminary economic assessment is recommended. This is particularly important for an industrial mineral deposit, is relatively uncommon, and there is a specialized market for titanium products. Economic assessment can begin to qualify potential pitfalls for the project as well as help to set some project specific economic criteria that can assist with further drilling programs.

A 2011 budget to complete the recommended work program is presented in
Table 17.1: Estimated Cost for the Exploration Program Proposed for the Longnose Project.

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Estimated Cost (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mineralogical studies and analytical data</td>
<td>50,000</td>
</tr>
<tr>
<td>Metallurgical analysis and testwork</td>
<td>150,000</td>
</tr>
<tr>
<td>Preliminary economic assessment analysis</td>
<td>150,000</td>
</tr>
<tr>
<td>Geophysical Survey</td>
<td>30,000</td>
</tr>
<tr>
<td>Longnose step-out drilling (3-5 holes/900-1500m @ $165/m*)</td>
<td>200,000</td>
</tr>
<tr>
<td>Longnose infill drilling (3-5 holes/600-1000m @ $165/m*)</td>
<td>130,000</td>
</tr>
<tr>
<td>Acquisition of additional mineral leases/property boundary survey</td>
<td>40,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>750,000</strong></td>
</tr>
</tbody>
</table>

*Drilling cost per meter includes: Site and Trail preparation, drilling, sampling, facility/vehicle lease, and staffing.
18 References


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19 Date and Signature Page

This technical report was written by the following “Qualified Persons”. The effective date of this technical report is January 19th, 2012.

<table>
<thead>
<tr>
<th>Qualified Person</th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michael D. Johnson, P.Geo</td>
<td>“original signed”</td>
<td>January 27, 2012</td>
</tr>
</tbody>
</table>

Reviewed by

“Original signed”

Dr. Wayne Barnett, Pr.Sci.Nat
Project Reviewer

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.