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Digital Copy Only: Yes

Enclosures (indicate number of each):
- CD:
- DVD:
- Flash drive:
- Paper Maps:
- Other:

Received: 2015-01-23

Comments: 

Signed: [Signature]

Date: June 25, 2015
First Year Assessment Report

On

Research, Field Work, Map and Report Compilation

For Mineral Licenses 021614M and 021615M

Forming a part of the

Four Corners Mining Project
Southwest Brook, West – Central Newfoundland
NTS Map Sheet, 12B/08

Operated by

Four Corners Mining Corporation
P. O. Box 385
Clarke’s Beach, NL
A0A 1W0

Victor A. French, P. Geo
V.A. French Geological Consultants Inc.

Total Expenditures: $2,617.98 (21614M) and $2,617.98 (21615M)

January 23, 2015
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1.0 Introduction

This first year assessment report details work completed and expenditures incurred during the period November, 2013 to January 26, 2015 on Mineral licence 021614M and 021615M hereinafter “the property” and representing the newest of the 9 licences now comprising the Four Corners Iron Ore – Titanium- project “the FCP”, issued to owner and operator Four Corners Mining Corporation.

Four Corners Mining (FCMC) is majority owned by parent company Triple Nine Resources Limited (TNR) both of P.O. Box 385, Clarke’s Beach, NL, A0A 1W0 and both of which are privately owned junior exploration and mining companies incorporated under the laws of Newfoundland and Labrador. The FCP was originally owned by TNR who transferred owner–ship and title of the Project area to FCMC by letter of agreement.

The 2 licences each contain 12 claims aggregating a total of 24 full – sized mining claims staked in late 2013 and issued under the 2 licences on November 25, 2013. The 2 licences comprising the property are the south most licences in the FCP and are situated in the northeast quadrant of 1:50,000 National Topographic Series Map Sheet 12B/08, 1 of 4 map sheets on which sections of the FCP are located.

The North boundary of the property is located approximately 5 kms south of the Burgeo paved highway with the north most of the 2 claim blocks, licence 021614M, straddling the west flowing Barachois Brook, and the south claim block, licence 021615M located 1 km south of the brook. The north block can be accessed by foot traversing or ATV/Skidoo whereas access to the south block is more difficult, best served by air transportation.

The FCP was first recognized as a magnetite iron ore prospect in the early 1930’s by then local prospector John Keating of Stephenville Crossing. Work by a local prospecting group under the direction of Len Muise of Stephenville in 2009 identified...
vanadium and titanium mineralization associated with the magnetite. This new discovery by the prospecting group led to assembling the project, presently containing 399 claims, and the formation of TNR. Most of the exploration work on the FCP was completed from late 2009 to early 2012 and since then there has been intermittent, brief 1-2 week work programs.

This report is being submitted to mainly cover fieldwork by company personnel together with research work and compilations completed by the author. This work includes a literature review of historical and recent data, generated by industry and government surveys, both regional and site specific, map and report compilations for this submission (including a bibliography of earlier work), field work including repairs to and securing base trailer camp (extensively vandalized) and other related project costs including storage of drill core at Stephenville.

2.0 Property Location, Description and Accessibility

2.1 Property Location

The 24 claim property is a part of the much larger FCP which contains 399 full – size mining claims that mainly straddle the boundary between 1:50,000 scale NTS Map sheets, 12A/05 (Puddle Pond Sheet) and 12B/08 (Main Gut Sheet) overlapping north and east onto Map Sheets 12A/12 and 12B/09, located in western Newfoundland (Figure 1). The western boundary of the FCP is approximately 3 kms east of the Trans Canada Highway and its intersection with the Burgeo Paved Highway, Rte 480 which courses east through the FCP, a distance of approximately 22 kms form the west to east boundaries of the project area.

The property represents the 2 south most claim blocks of the 9 claim block project area with its north boundary approximately 5 kms south of the Rte 480. Both claim blocks comprising the property are on the Main Gut Map sheet.
Figure 1: Four Corners Project Location Map
2.2 Property Description

Licences 021614M and 21615M were issued to cover the 2 non-contiguous claim blocks of 12 full-sized mining claims each respectively the north and south blocks forming the property (Figure 2). Detailed descriptions of the 2 licences are presented on the Mineral Licence Inquiry Reports in Appendix I.

The North block along its north boundary is contiguous with 3 of the licences forming the FCP. This block is elongated east–west and straddles the east to west flowing, first order river Barachois Brook one of the several major rivers draining the region west into Bay St. George and the west coast of the island.

This river flows more or less along the south side of the project area, with the exception of licence 021615M, the second and south block of the property. This block, separated by a small block of claims owned by another stakeholder has its northeast corner 0.5km south of the southwest corner of licence 021614M. It is an irregular rectangle stretching 2.5 kms south with its south boundary representing the southern limit of the Four Corners Project.

2.3 Accessibility

The Burgeo Highway provides excellent access to the FCP as this paved secondary highway connects with the Trans-Canada highway just several kms west of the project and courses through the entire length of the FCP. South of the highway there is an extensive network of now disused forest inventory roads established over a period from the mid to late 20th century which crisscross principally through the eastern half of the property. One of these roads still useable intersects the Burgeo Highway in the southeast corner of License 017369M and along with the Burgeo Highway provides easy access to the property. This gravel road which was cleared of alder brush in 2011-2012 winds for approximately 7 kms allowing ATV access west through the south side of the property and facilitating foot traversing down the north slope of the Barachois Brook.
Figure 2: Claims Location Map
river valley into License 021614M. It is possible to access the south block by traversing across Barachois Brook during low water levels but the wide brook and the steep slopes of the river valley with cliff sections along the south slope make for difficult traversing. Access to this block is best serviced by helicopter or float plane.

3.0 Physiography

The FCP is located in the Long Range Mountains characterized by extreme relief, accentuated by the mountain range with peaks up to several hundred metres and the valley at lower elevations down to 30 metres ASL and reflecting drainage and structure. Keating Hill, a dominant topographic feature in the east half of the property, forms a prominent 3.5 km long NW – SE trending ridge, which reaches a peak elevation of 338 metres sloping steeply east to Southwest Brook valley and west to the Burgeo Highway reaching a base elevation of approx 60 metres along the River and presenting a maximum relief of approximately 280 metres (Plate 1). The south half of the property, south along the section of the Burgeo Highway through the property, is also characteristically rugged with hills steeply rising along moderate to cliff faced slopes from the valley floor and the Burgeo Highway. The rugged nature of the topography is compounded by the extensive talus, skirting many of the hills with frequent large boulders that range in size up to several metres.

The incised river valleys occupied by Southwest and Barchois Brook are the most notable topographic features in the area forming a pronounced linear trending east – west through the region (and the project area), dissecting the Long Range Mountains. Supporting a thick growth of mixed softwood & hardwood forest punctuated by numerous large pine, the linear drainage valleys are typical of the numerous E-W linears occupied by first order streams that typify western Newfoundland.
Located in an area of widespread forest growth, that was logged extensively during the latter half of the 20th century, these areas are now exasperated by a dense growth of immature fir and spruce with sections of extensive windfall making for extremely difficult traversing. The cover is a mix of hardwood forest of birch, mountain ash, poplar and alder profusely growing throughout the spruce and fir dominated softwood forest. Although there are sections of mature, harvestable softwood forest, logging operations were suspended due to prolific blister rust in the spruce (opt cite, Corner Brook Pulp and Paper).

Plate 1: Looking into the Southwest River Valley. Keating Hill is the sharply rising ridge along the east side and the more moderate hill along the west side is typical of the uplands area making up the west half of the property.

The principal drainage is west along the major first order rivers, Southwest and Barachois Brooks the main river stems for this area being fed by second order streams draining north and south. These rivers empty into St. George’s Bay. The smaller second order streams, often less than 1000 metres in length, drain the uplands, mountainous area.
Outcrop exposure is minimal within the U shaped to broad river valleys and the most extensive outcrop appears to be in the uplands portions of the project area. Many of the second order stream beds along the north and south facing, valley slopes have exposed the underlying bedrock. Talus / scree flanking the hills are dominated by large, angular to sub angular boulders frequently ranging up to several metres and interpreted to represent in situ weathering and slumping off the hills. Outcrop particularly along the ridge sections is generally exposed in thin moss and soil cover suggesting exposure in certain areas can be readily attained with grubbing or mechanical ditching.

Within the area of the 2 claim blocks forming the property being detailed in this report the east – west linear valley occupied by Barachois Brook is the dominant land form. This valley is bounded by steep forested slopes with the south slope generally steeper with cliff sections. Historical logging activities along the north slope indicate there is a widespread overburden cover which were exposed along road cuts on old established access roads reveal a thick cover up to several metres at these sections.

The south block is immediately south of the river valley in a moderately rugged uplands area punctuated by ponds fringing the block and up to 1.25 kms long with one pond large enough for float plane access. Scrub timber and intermittent outcrop characterize the area. The ponds are drained by small 2nd and 3rd order streams principally draining north into Barachois Brook.

4.0 History of Land Tenure

The first record of Mineral Land ownership for the area is based on the 1941 report by R. Thomson in which he referenced the occurrence of magnetite and the prospect being discovered by John Keating of Stephenville Crossing, some ten years prior to the writing of his report and thereby indicating prospect status as early as 1931.
Further referencing Thomson’s report the prospect was specified to be located on Crown Land at least 1 mile east of then existing Reid Lot # 226, and therefore presumably not having Mineral Rights assigned during this period. (A reference by Keating’s son Charlie Keating, also of Stephenville Crossing, to a German company exploring the area in the early 1950’s, e.g 1951, appears to be not recorded). A cursory review of historical mineral titles for the area now covered by the property shows numerous stake-holders throughout the area with the Reid Newfoundland Railway Lot # 226, referenced by Thomson in 1941, being an example of a historical stake-holder, and Marathon PGM Corporation being a more recent stake-holder. It is worth noting that the Keating Hill section of the property, and site of the Keating iron ore prospect, appears to have a record of only 1 earlier stake-holder with License 3687 issued to Philip Saunders on April 24, 1986 this license expired in 1989 with no record of work at the end of the first year of ownership.

The original mineral licenses comprising the Four Corners Project, so named by the prospecting group led by Len Muise, were Licenses 14170M and 15551M, staked by Terrance Muise respectively on October 20, 2007 and October 10, 2008 per the records on file at the Mineral Claims Recorders Office. The FCP at that time did not include the old Keating Prospect as Mineral License 15249M was issued on July 29, 2008 to Roy Keating of Stephenville, NL and was configured to cover the original Keating Prospect discovered by Prospector John Keating in 1931. Pursuant to an agreement and the issuance of common shares in Triple Nine Resources Ltd. (TNR) the title of this mineral license was transferred 100% to TNR on December 8, 2009 recorded in Volume 23 Folio 177. Licenses 14170M & 15551M initially issued to Terrance Muise were transferred to TNR on January 11, 2010 recorded in Volume 23, Folio 181 and grouped together with License 15249M into Mineral License 17233M, issued on January 11, 2010.

In early 2010 TNR approached a local prospector, Shawn Rose of Stephenville, NL, and further to a purchase agreement dated January 4, 2010 the ownership of Mineral License 15342M was transferred by Rose to TNR, recorded in Volume 23 Folio 186. Subsequent to the acquisition of the mineral claims from Shawn Rose, Mineral License
15877M (registered to Sherry Dunsworth of Pasadena, NL on behalf of Marathon PGM Corporation of Toronto, ON) was also acquired 100% through a purchase agreement, dated January 22, 2010; this mineral license was also transferred to TNR recorded in Volume 22 Folio 157. The three licenses which then comprised the Four Corners Project, specifically 15342M, 15877M and 17233M, were then further grouped into current Mineral License 17369M, shown as being issued on Nov 19, 2007.

The FCP area was further increased by 70 claims extending the project area to the west, staked by V.A. French Geological Consultants Inc. registered under Mineral License 17894M, issued on August 18, 2010. This license was subsequently transferred to TNR on September 8, 2010, recorded in Volume 24, Folio 78. Two (2) separate Mineral Licenses 18188M & 18207M containing 62 & 8 claims each were respectively staked and issued on December 8, 2010 and December 9, 2010 to Victor A. French of Bay Roberts, NL in trust for TNR. Mineral Licence 18188M was transferred to Triple Nine Resources Ltd. on January 18, 2011, recorded in Volume 24, Folio 123. Upon issuance of Mineral License 18207M to Victor A. French this license was also transferred to TNR on April 12, 2011, recorded in Volume 24, Folio 157.

On April 8, 2011 a Transfer and Assignment Agreement was signed between Triple Nine Resources Ltd. and subsidiary company Four Corners Mining Corporation. This transfer was recorded by the Mineral Claims Recorders Office on April 12, 2011 and recorded in Volume 24, Folio 158.

License 019494M comprising 11 mineral claims was issued to V.A. French Geological Consultants Inc. on November 10, 2011 and transferred to Four Corners Mining Corp. on February 3, 2012 recorded in Volume 24/Folio 249 at the Mineral Claims Recorders Office.
5.0 Exploration History

The area now encompassed by the FCP and aligned or centered along the incised river valley of the west flowing, first order river Southwest Brook has received limited exploration probably due in part to the rugged and heavily vegetated, tree covered topography. (The regions north and south have been more actively explored with commodities such as gold and base metals being searched for to the north and gold, magnetite (iron), coal, gypsum and uranium to the south).

During the last quarter of the 20th century and to the present, exploration activities have focused along the Cabot Fault Zone / Baie Verte – Brompton Line trending NE-SW through western Newfoundland principally searching for gold, magmatic sulphide and Platinum Group Element mineralization. This work by various stake-holders also included surface and airborne investigations along the section of the Cabot Fault Zone now covered by the FCP. Other than these earlier work programs there is limited exploration history recorded in the area now forming the property.

Prior to an exploration program of detailed surface investigations, diamond drilling and helicopter supported Airborne ElectroMagnetic surveying, which commenced in the fall of 2009, the following is a summary of relevant exploration work.

The first record dates back to 1941 when R. Thomson published a short report entitled “Preliminary Report on C. H. McFatridge – J. Keating magnetite prospect, East of Stephenville Crossing, Nfld.”. Thomson states the prospect, presumably to be mainly centered on Keating Hill, “was noted by John Keating, of Stephenville Crossing, some ten years ago, while trapping”. He referenced all rocks seen in the vicinity are “of igneous origin appearing to be largely gabbro, but are variable”. With respect to the economic significance, Thomson summarized there was widespread occurrence of angular boulders of magnetite rich rock, up to 10 feet diameter and indicated there was an area of at least half a mile by half a mile with magnetite rich bodies indicated by float and isolated exposures.
The potential for magnetite was briefly investigated, “only about two and a half days on the prospect” from November 10th until November 16th, 1941 due to bad weather. The prospect was located on Crown Land, southwest of the southeast corner of Reid Lot # 226 referencing Mining Grants issued February 1938. Access was along a trail following the south side of Southwest Brook, the trail being a former lumber road of some 20 years old from the shoreline of Bay St. George, and thereby indicating logging activities in this area dating back to the early 1920’s, or earlier?

Rock sampling in 2009 by Len Muise along a ditch of the paved highway (in mineral license 017369M) resulted in the first report of vanadium mineralization contained in the magnetite rich rocks (Muise previously noted a vanadium value in a rock sample from this area in 1994). Follow-up surface sampling over approximately 1.2 kms along a northwest-southeast trend, to September 2009, further confirmed economic concentrations of vanadium which based on the conversion factor of 1.79 showed vanadium pentoxide grades up to 0.358% V₂O₅ with grades commonly above 0.10% and referenced in the 2009 photograph labeled Plate 2. Based on the preliminary evaluation by Thomson in 1941 and the 2007-2009 work completed by Muise and his prospecting team, (which identified new prospects peripheral to and southeast from the initial Keating Prospect) the magnetite enriched mineralized zone was demonstrated to extend at least 2.8 kms.

6.0 Regional Geology

The FCP straddles the trace of the rectilinear Cabot Fault Zone sited along the Baie Verte-Brompton Line, which slices northeast – southwest through the property. This major fault zone is a segment of the Baie Verte – Brompton Line, a globally significant, deep seated suture zone which can be geologically and geophysically traced from the southeastern United States to the British Isles. Hibbard (1983), describes this complex fault zone in western Newfoundland to separate pre-Middle Ordovician Miogepysnclinal metasedimentary rocks belonging to the Fleur-De-Lys Belt, a part of the Humber Tectonostratigraphic Zone, from pre-Middle Ordovician ultramafic and mafic
Four Corners Property shows potential for a high tonnage (250 M Tonnes) resource of ore grade vanadium with grades of 0.179%, and greater, $V_2O_5$ indicated from early sampling. Exposed in the hilly terrain, the mineralization has the right geology and size for a large tonnage open pit mine.

Plate 2: Left to Right Cofounders Gerry Hull, Victor Muise & Len Muise
Figure 3: Regional Geology Map
rocks of oceanic affinity which is part of the Dunnage Tectonostratigraphic Zone of central Newfoundland defined by Williams et al in 1988 (Figure 3). More recent mapping in this century shows the property is within the Notre Dame Subzone, the western segment of a more detailed division of the Dunnage Zone (van Staal et al 2005).

7.0 Property Geology & Mineralization

The geology underlying the area covered by the several mineral licenses comprising the property is detailed on 4 individual, 1:50,000 scale Map Sheets compiled by various authors and published by the Geological Survey of Canada (Figure 4). The intersection point or corner common to these 4 map sheets is in the northeast corner of the property; most of the property (>80%) is on NTS Map Sheet 12B/08 mapped by S.J. Pehrsson et al (2010) and this map labeled Main Gut – GSC Open File 1666 although mapped more than a decade ago is still not available as a final draft. Open File Map 1664 labeled Puddle Pond authored by van Staal et al (2005) and covering the eastern end of the property (and most of the area of the Keating Hill Prospect) shows the titanium and vanadium enriched magnetic mineralization is hosted in Unit SPc of the Silurian aged (circa 431) Puddle Pond Complex shown to be within the “Notre Dame/Dashwood Subzones”.

van Staal et al (2005) describes Unit SPc to be “foliated to unfoliated, mainly layered cumulative sequence of anorthosite, troctolite, olivine norite, norite, gabbro, and gabbronorite, olivine gabbro, and gabbro, with minor pyroxenite, with minor alteration to epidote, hornblende and / or actinolite and chlorite”. (Based on the limited aerial extent of this small intrusion shown to be up to 1 km wide and possibly less than 5 kms in strike length, this description suggests a very inhomogeneous composition for this relatively small intrusion – a result of pronounced compositional layering?).

Geological surface investigations completed since the fall of 2009 have generally observed Unit SPc to be only variably textured, fine to medium grained gabbro weathering a buff to dark brown grey, with the darker phases typical of the more highly
magnetite – titanium - vanadium mineralized sections. The scarp face exposures are observed to be covered by widespread, rusty (limonite) staining which based on earlier observations and sampling results is emanating off iron oxide (magnetite) titanium and vanadium enriched, mineralized layers or zones within the intrusive complex; this staining is displayed on the scarp face shown in Plate 3. The mineralized zones are moderately to strongly magnetic and this magnetism is produced by concentrations of magnetite varying from disseminated to massive (> 25%) magnetite. (Two polished thin sections show a concentration of 50 to 60% magnetite in a silica gangue).

The 4,047.70 metres of drill core completed to date at the Keating Hill Zone appears to confirm the GSC mapping results and the extent of Unit SPc. Visually, this unit intersected in drill core appears to be principally foliated to unfoliated gabbro with lesser anorthosite interlayers. Hole FC-11-02, one of the drill holes drilled grid northeast at the top of Keating Hill (UTM location 426017 E – 5368494 N at elevation 334 m ASL) positioned to drill through to the contact of the layered cumulative sequence did intersect the country rock mapped as Unit OSBtg at the contact location mapped by the GSC. This unit, mapped as a middle member of the Ordovician aged (circa 461 Ma) Southwest Brook Complex, in drill core resembles granodiorite and/or quartz diorite mapped on surface by Z. A. Szybinski, et al (2006) on Map Sheet 1668, labelled Little Grand Lake. (A suite of research samples have been selected for whole rock, Scanning Electron Microscope and petrography studies, currently in progress; therefore detailed lithological and mineralogical descriptions are pending upon completion of these studies, Q1 and Q2 – 2012).
Figure 4: Geology Map

Legend
- Mineral License of Interest
- Roads

TRIPLE NINE RESOURCES LTD.
Project: Four Comers
Lic. No. 17697M, 17698M, 17701M, 17702M & 17703M

Geology Map

Drawn: C. Nagels
Scale: 1:100,000
Datum: NAD27
Date: Jan 2010
Preliminary draft map GSC Open File # 1666, labelled Main Gut and pending final publication presents the geological mapping completed by Pehrson et al (2010). This map covered more than 80% of the current property area and together with the adjacent Puddle Pond Sheet to the east provides the main geological references for the area. Map Sheet 1668, labelled Little Grand Lake, Z. A. Szybinski, et al (2006), only takes in 2 claims in the extreme northeast corner of License 17369M – the northeast corner of the property and Map Sheet 4921, A.G. Brem, et al (2006) covers several sections totaling approximately 40 claims along the north boundaries of Licenses 17369M, 17894M and 18188M, north of and also straddling Southwest Brook and the Burgeo Highway.

Referencing these map sheets the geological units outlined within the property area going east to west across the 21 km wide property are:
<table>
<thead>
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<th>Unit</th>
<th>Brief Description</th>
<th>Age</th>
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<tr>
<td>NODPsm</td>
<td>Migmatitic Melarge – Dennis Pond Complex</td>
<td>Cambrian, &gt; 488 Ma</td>
</tr>
<tr>
<td>OSBtg</td>
<td>Tonalite, granodiorite, quartz diorite – Southwest Brook Complex</td>
<td>Ordovician, circa 461 MA</td>
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<tr>
<td>OSg</td>
<td>Biotite granodiorite or granite – Puddle Pond Complex(?) Ordovician -</td>
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<tr>
<td>Silurian</td>
<td></td>
<td></td>
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<tr>
<td>SPc</td>
<td>“Keating Hill” layered intrusion – Puddle Pond ComplexSilurian (circa, 431, Ma)</td>
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<tr>
<td>SPmi</td>
<td>Diorite, gabbro or diabase – Puddle Pond ComplexSilurian (circa, 431, Ma)</td>
<td></td>
</tr>
<tr>
<td>COopu</td>
<td>Ultramafic rocks – Dennis Pond Complex</td>
<td>Cambrian, &gt;488 Ma</td>
</tr>
<tr>
<td>NODPs</td>
<td>Granitoids and Metasediments – Dennis Pond ComplexCambrian, &gt;488 Ma</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(all located east of the Cabot Fault Tectonic Zone)</td>
<td></td>
</tr>
<tr>
<td>NOSgs</td>
<td>Tectonic Zone of greenschist mylonites and cataclasites Shown as lower</td>
<td></td>
</tr>
<tr>
<td>member of</td>
<td>Dennis Pond Complex</td>
<td></td>
</tr>
<tr>
<td>MNCBL</td>
<td>Undifferentiated basement rock – Corner Brook Complex(circa 1510 Ma)</td>
<td></td>
</tr>
<tr>
<td>MSMA</td>
<td>Pegmatite, anorthosite and gneiss – Steel Mountain Neoproterozoic and Older Complex</td>
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</tr>
<tr>
<td></td>
<td>(both of these unites are located west of the Cabot Fault Tectonic Zone)</td>
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</tbody>
</table>

The GSC map compilers show all of these units belong to the ’Notre Dame / Dashwoods Subzones’.

To date there has been limited mapping, and prospecting, within the property outside of the Keating Hill and the area fringing the hill.
The following is a copy of the text only from a report in progress by Dr. John G. Hinchey that provides the latest observations on the geology and mineralization of the area in his report titled “Geology and Genesis of the Keating Hill Fe-Ti-V Prospect, Main Gut Intrusion (12A/05, 12B/08), Western Newfoundland.” (Final Presentation of his maps, figures and plates were not available at the time the report was forwarded.) His draft report also includes sections on land tenure and earlier work, etc detailed in other sections of the assessment report.

The Geology and Genesis of the Keating Hill Fe-Ti-V Prospect, Main Gut Intrusion (12A/05, 12B/08), Western Newfoundland.

John G. Hinchey
Mineral Deposits Section

ABSTRACT

The Keating Hill Fe-Ti-V prospect is hosted within cumulate gabbroic to gabbronorite rocks of the Silurian Main Gut mafic intrusion of the Puddle Pond complex, straddling NTS map areas 12A/05 and 12B/08 in western Newfoundland. Although oxide mineralization was originally discovered in the area in the 1930’s, the first significant exploration activity was not conducted until 2009.

The prospect is host to two styles of oxide mineralization, both of which have different oxide textural relationships. The earliest type occurs as intercumulus oxides that formed through fractional crystallization processes from a hydrous hornblende oikocrystic gabbronorite unit. Oxide minerals in this style of mineralization locally accumulated through processes of
gravitational settling of intercumulus liquid to form stratigraphically defined layers of semi-
massive oxide. These layers display sharp basal contacts and gradational upper contacts. Oxide
mineralization is composed of inter-grown magnetite and ilmenite. The magnetite is devoid of
any spinel exsolution, and ilmenite contains titanomagnetite exsolutions. This style of
mineralization displays fractionated REE patterns with increased LREE on chondrite normalized
plots, and displays negative HFSE (Th, Nb, Zr, Hf) anomalies on primitive mantle normalized
trace element plots.

The second, genetically later, style of oxide mineralization is composed of semi-massive
to massive oxides which appear to have invaded partially solidified host rocks. It is interpreted
to have formed via liquid immiscibility from the same parental magma as that for the
intercumulus mineralization. Such an origin is at odds with more conventional models for oxide
accumulation in which gravitational density driven processes are the driving factors in the
formation of massive mineralization. Observations supporting the invasive style of
mineralization include: 1) sharp upper and lower contacts on the semi-massive to massive style
of mineralization, 2) disequilibrium textures between the oxide and silicate minerals, observed as
reaction rims and thermal erosive contacts, and 3) the local presence gabbroic inclusions
occurring in the semi-massive to massive oxide mineralization. As with the intercumulus
mineralization, this style of mineralization displays fractionated REE patterns with increased
LREE on chondrite normalized plots, but, in contrast to the intercumulus mineralization, it
displays positive HFSE (Th, Nb, Zr, Hf) anomalies on primitive mantle normalized trace element
plots.

Several of the Silurian mafic intrusions throughout central and western Newfoundland
contain minor occurrences of magmatic sulphide mineralization, but the Keating Hill prospect
represents a new style of magmatic oxide mineralization for the region. Other Silurian mafic intrusions throughout Newfoundland may have potential for mineralization of this type.

INTRODUCTION

PROJECT DESCRIPTION

The Keating Hill Fe-Ti-V prospect is located in the Notre Dame subzone of the Dunnage Zone, southwestern Newfoundland, and straddles the Puddle Pond (NTS 12A/05) and Main Gut (NTS 12B/08) map areas (Figure 1). The prospect is hosted by mafic intrusive rocks, denoted as unit Spc on Figure 1, of the ca 431 Ma. Puddle Pond complex (van Staal et al., 2005; Pehrsson et al., 2013) and contains disseminated to semi-massive and massive magmatic oxide mineralization. The style of mineralization is varied, from stratiform zones if possible intercumulus origin to massive material that appears invasive.

This report presents observations and interpretations derived from field and petrographic observations and lithogeochemical data. Information on mineral textures, and oxide mineral chemistry was obtained via SEM-MLA (scanning electron microscope – mineral liberation analysis) and electron microprobe methods.

PREVIOUS WORK AND EXPLORATION HISTORY

Regional Mapping Programs

Some of the earliest regional mapping in the area was conducted by Riley (1957) and Barnes et al. (1957) at a scale of 1 inch to 4 miles. The Keating Hill area was assigned as undivided granite and gneiss belonging to the Long Range igneous and metamorphic complex and no gabbroic
rocks were identified. Carew (1979) completed a B.Sc. honours thesis including field work, petrography and geochemical investigations, and described a cumulate norite body approximately 2.5 kilometers long in the vicinity of the Keating Hill property. He described the norite as containing spectacular magnetite-rich layering, oriented north-south with steep westerly dips, with individual layers up to 15 centimeters thick. He also described local examples of cross-bedding in the magnetite layers, which he suggested were formed by magmatic convective currents. The layered norite was differentiated from a more massive gabbroic intrusive body located immediately to the south, which was later dated at 431 +/- 2 Ma. (Dunning et al., 1990).

The area of the southern Long Range Mountains was the focus of a multi-year mapping program as part of the Canada-Newfoundland mineral development agreement from 1984-1989. Mapping completed by the Geological Survey of Canada is summarized in a 1: 100 000 scale map and accompanying notes (Currie and van Berkel, 1992 a and b). These authors assigned the host rocks to the Keating Hill prospect to the Silurian Main Gut intrusive complex, intruding into what they defined as the Central Gneiss subzone of the southern Long Range Mountains (Currie and van Berkel, 1992b). As with Carew (1979), these authors describe the rocks as being composed of massive, relatively unaltered gabbroic rocks with igneous layering defined by magnetite.

The area was most recently mapped again by the Geological Survey of Canada. The Puddle Pond map sheet (12A/5) was mapped by van Staal et al., 2005, and the Main Gut map sheet was mapped by Pehrsson et al., 2013. Both interpret the host to the Keating Hill prospect as unit Spc (Figure 1), defined as part of the Puddle Pond complex (ca. 431 Ma), and composed of a foliated to un-foliated, layered mafic cumulate sequence intruding Ordovician tonalite and granodiorite.
**Exploration History**

The earliest description of the Keating Hill prospect is by Thomson (1941), who was investigating a magnetite occurrence, found by a Mr. John Keating in the early 1930’s. He noted that all rocks in the area were of igneous origin and that magnetite occurred in many places as seams and crystals. He noted the occurrence of a black rock composed of magnetite, amphibole, and pyroxene with minor plagioclase that he suggested could have economic significance. He also noted that the magnetite-rich rock had sharp contacts with the surrounding gabbro, suggesting that the magnetite-rich rocks represented “segregations” in the gabbro.

Prospecting led by L. Muise from 2007 through to 2009 returned vanadium grades ranging up to 0.358% $V_2O_5$ (as with all vanadium grades quoted herein $V_2O_5$ was calculated as $V_2O_5\% = 1.78 * V$ (ppm)) associated with magnetite-rich gabbroic rocks (French and Mugford, 2010). After property visits by V. French in 2009, the map staked licenses eventually became part of exploration licenses held by Triple Nine Resources. The company has completed extensive prospecting, geochemical, and geophysical work, and approximately 4000 meters of diamond drilling on the property (e.g. see French and Mugford, 2010, [http://triplenineresources.com](http://triplenineresources.com)). This work identified a potentially significant Fe-Ti-V mineralized zone on the property. Most of the work and interpretations presented in this report are derived from the detailed logging of diamond drillcore from the area. Core used for this report is presently stored in the Department of Natural Resources core library in Buchans.

**REGIONAL OVERVIEW**

The Keating Hill Fe-Ti-V prospect is located within the Notre Dame Subzone of the Dunnage Zone of the Newfoundland Appalachians (Figure 1). The rocks in this area formed along the
peri-Laurentian margin of the ancient Iapetus ocean (Williams, 1995), as part of the continental Notre Dame arc (Whalen et al., 2006), and associated remnant ophiolitic rocks. Ordovician to Silurian plutonic rocks are abundant and represent varied environments (e.g. Currie and van Berkel, 1989; Lissenberg et al., 2006; Whalen et al., 2006; van Staal et al., 2007). Plutonic rocks have been linked to west-directed subduction beneath the Laurentian margin (Lissenberg et al., 2005, van Staal et al., 2007), which was responsible for several magmatic episodes. These include voluminous tonalite plutonism (ca. 466 – 459 Ma), as well as ophiolite accretion to the Laurentian margin (e.g. Lissenberg et al., 2006; Whalen et al., 2006). Closure of the main tract of the Iapetus Ocean juxtaposed the peri-Laurentian rocks with those of peri-Gondwanan affinity (e.g. Victoria arc, Zagorevski et al., 2007). Continued accretion of outboard terrains (e.g. Ganderia) via west-directed subduction coincided with the waning stages of the Notre Dame arc. The magmatic history eventually culminated with widespread Silurian magmatism that includes the host rocks of the Keating Hill prospect (Puddle Pond complex).

**KEATING HILL PROPERTY**

**LOCAL GEOLOGY AND MINERALIZATION**

The Keating Hill prospect is hosted by the 431 Ma. Puddle Pond complex (van Staal et al., 2005; Pehrsson et al., 2013), which outcrops over a geographically large area (units Spmi and Spc on figure 1; previously grouped and referred to as the Main Gut intrusion (Carew 1979) or the Main Gut complex (van Berkel, 1987)). The oxide mineralization at the Keating Hill prospect is hosted in the unit Spc on Figure 1. Unit Spc outcrops as a northwest-southeast trending lens-shaped layered intrusion exposed over approximately 5 x 1 kilometers (van Staal et al., 2005; Pehrsson et al., 2013); within which cumulate layers NW-SE and dips approximately 55-60
degrees west. The unit is described as “a foliated to un-foliated, mainly layered cumulate sequence of anorthosite, troctolite, olivine norite, norite, gabbronorite, olivine gabbro, and gabbro, with minor pyroxenite” (van Staal et al., 2005; Pehrsson et al., 2013). However, rock types observed in this study generally lack olivine, and this general description encompasses rocks farther to the east that are more mafic (e.g. see Hinchey, 2013). Outcrop observations and examination of five diamond drill holes indicates a layered sequence of leucogabbro, leucogabbronorite, gabbro, gabbronorite, and hornblende oikocrystic gabbronorite (Plate 1a). Olivine-bearing rock types were only very locally observed towards the bottom of some diamond drill holes (e.g. FCP-04-10) and in the vicinity of Neil’s Prospect, which occurs at a lower topographic elevation compared to the main Keating Hill prospect (Figure 1). Although all rock types commonly contain some oxide minerals, the gabbronorite and hornblende oikocrystic gabbronorite contain the most significant oxide mineralization. Magnetite and ilmenite occur either as intercumulus disseminations, or as semi-massive to massive invasive mineralization (Plate 1b and c).

Contacts between rock types in drillcore are generally sharp and are defined by variations in silicate mineral phases, grain size variations, or variations in the proportion of oxide minerals. Aside from local chilling at contacts between coarse grained gabbro and other rock types, chilled contacts are typically absent, suggesting largely synchronous development of intrusions. Many contacts in diamond drill core are defined by faults. Pegmatitic segregations have sub-ophitic to ophitic textures, and contain crystals up to 4 cm long. Most rock types contain primary hornblende, biotite or phlogopite, suggesting that these were hydrous magmas. Rocks are generally fresh, and generally unfoliated.
Oxide mineralization is mostly hosted by the hornblende oikocrystic gabbronorite, with some semi-massive oxide mineralization hosted in gabbro. Oxides are composed of magnetite and ilmenite, and are commonly associated with minor magmatic sulphide blebs composed of pyrrhotite and pyrite, with lesser chalcopyrite and pentlandite. Visual estimates range from approximately 5% oxides for weakly disseminated and intercumulus mineralization up to greater than 60-70 % oxides for semi-massive to massive mineralization.

Textural relationships between silicates and oxides vary. Locally, there is evidence for accumulation of oxides via density driven intercumulus liquid settling in a cumulate pile, resulting in an increase in the proportion of oxides towards the base of a mineralized interval, culminating in semi-massive oxide layers. These basal oxide layers have sharp lower contacts and gradational upper contacts. Other examples of semi-massive to massive oxides display sharp upper and lower contacts and appear to represent an oxide-rich liquid that has invaded an unconsolidated silicate mush. This interpretation is supported by the presence of plagioclase crystals (locally aligned) entrained in semi-massive oxides. The latter style of mineralization also locally includes discrete inclusions of gabbroic material containing minor oxides, which have sharp, well defined contacts. Such features also suggest an invasive style of mineralization (Plate 1d).

Concentrations of Fe₂O₃T, TiO₂ and V₂O₅ are highest in semi-massive mineralization hosted by hornblende oikocrystic gabbronorite. Examples of grades of mineralization from the property include diamond drill hole FCP-01-10 which intersected 21.82 % Fe₂O₃T, 5.08 % TiO₂, and 0.116 % V₂O₅ over 217 meters. Within this hole, which is mineralized throughout, there is a higher grade section of 28.9 meters grading 42.74 % Fe₂O₃T, 9.62 % TiO₂, and 0.227 % V₂O₅ (French and Mugford, 2010).
PETROLOGY

The primary igneous minerals are well preserved (Plate 2a-c). The mineral assemblage is dominated by medium-grained sub-euhedral plagioclase, orthopyroxene, clinopyroxene, and hornblende. Brown mica, magnetite, ilmenite, and minor phases such as sulphide and apatite are also present. Olivine forms anhedral crystals in some of the mineralized rocks, but appears to be limited to deeper parts of the intrusion. The main host rock to the oxide mineralization contains large (cm-scale) intercumulus hornblende oikocrysts, containing smaller cumulus plagioclase and pyroxene crystals, as well as brown mica (Plate 2a). The oikocrysts are less obvious in the invasive style of semi-massive to massive mineralization, but this may reflect difficulty of observation due to the increased percentage of oxide minerals, or the absorption of silicate phases by the invasive oxide liquid (see below). In some examples, hornblende oikocrysts are still plainly visible in semi-massive mineralization (Plate 3), confirming the common host. The intercumulus minerals observed, in addition to the hornblende oikocrysts, are apatite, zircon and monazite. The mineralized rocks contain abundant variably textured magnetite and ilmenite, with minor magmatic sulphide.

The coarse grained gabbroic rocks commonly display an ophitic to sub-ophitic texture in which pyroxene surrounds plagioclase, whereas the main host to the oxide mineralization commonly displays a poikilitic texture with plagioclase and pyroxene as cumulus minerals within hornblende oikocrysts.

Oxide Mineralization

Oxide mineralization, occurring as inter-grown magnetite and ilmenite, occurs in a variety of habits. Mineralization is predominantly hosted within the hornblende oikocrystic gabbronorite,
with only minor examples of significant concentrations of oxides occurring in gabbro. Oxides occur as intercumulus space fillings between cumulate silicate minerals in disseminated styles of mineralization (Plates 2c and 4a), with this style of mineralization locally becoming semi-massive through processes of intercumulate liquid settling. The disseminated oxides are commonly accompanied by apatite, zircon and monazite (see below). In semi-massive to massive mineralization, oxide minerals completely enclose silicate minerals, with abrupt upper and lower contacts with the host hornblende oikocrystic gabbro-norite (Plates 2b and 4b). The textures suggest that this mineralization is invasive. This suggests that Fe-Ti-V oxides formed both through direct precipitation from the parental magma, and also formed a Fe-Ti-V oxide liquid that separated immiscibly from the host magmas. In the latter case, reaction rims composed of variable amounts of hornblende, mica, and/or olivine are ubiquitous between the oxide minerals and the silicate phases dominated by plagioclase and pyroxene (Plates 5 a, b). In addition, the latter style of mineralization commonly displays plagioclase crystals that have been thermally eroded, and embayed/resorbed, by the Fe-Ti-V oxide liquid. These features appear as scalloped or embayed contacts where plagioclase twins and grain boundaries are cut off, and as such the observed reaction rims could not represent late stage interstitial minerals (Plates 6 a, b). Such reactions rims also locally occur in the former style of mineralization, but are not ubiquitous. These textures and reaction rims are indicative of hydrous magmas, and suggest that a dense iron-rich oxide melt or liquid was injected into a silicate crystal mush at a relatively late stage of crystallization. This style of oxide mineralization contrasts with the stratiform oxide-rich disseminated layers within the layered intrusion. The stratiform mineralization appears to have a primary magmatic origin where oxides crystalized from a relatively late-stage interstitial oxide liquid. The local presence of rounded sulphide droplets within oxide minerals in both styles of
mineralization also points to a dominant magmatic control on the mineralizing processes (e.g. Plate 4 a, b).

The textural relationships amongst oxide minerals are also variable, with two main types. In the first type, oxide mineralization in which early formed ilmenite crystals contain fine lamellae of titanomagnetite (see below), is inter-grown with magnetite crystals devoid of internal intergrowths (Plate 4a). In the second type, relatively coarse-grained blebby oxide intergrowths contain early crystallized ilmenite (free of any internal intergrowths) and occur with magnetite containing spinel exsolutions (Plate 4b). These textural subtypes correspond to the disseminated intercumulus and to the invasive semi-massive to massive mineralization, respectively. Initial petrographic observation tentatively identified the lamellae within the ilmenite as being composed of magnetite based on the observation that the lamellae were isotropic whereas the ilmenite is anisotropic, and this has been confirmed through subsequent SEM-MLA and electron microprobe work (see below).

**SEM-MLA**

One thin section of the disseminated intercumulus style of mineralization was examined using scanning electron microscopy – mineral liberation analysis techniques at Memorial University. Results suggested that the lamellae in the ilmenite are composed of Ti-rich magnetite, and as observed petrographically, the lamellae decrease in abundance as the contact with pure magnetite is approached (Plates 7 a, b). In addition, the SEM-MLA analysis also identified abundant apatite and zircon in association with the intercumulus oxide mineralization (Plate 7 a, b), and confirmed petrographic observations of sulphides. Although the iron and titanium contents of minerals could be confirmed, it was not possible to define vanadium
distribution using the SEM-MLA techniques. As such, additional mineral composition evaluations were conducted via electron microprobe methods.

**Electron Microprobe analysis**

Further investigations were conducted by wavelength-dispersive x-ray spectrometry methods using a Cameca microprobe at Carleton University, under the guidance of Mr. Peter Jones. Two samples were analyzed; one from the disseminated inter-cumulate mineralization displaying the lamellae in the ilmenite (the same sample as used for SEM-MLA), and one from the semi-massive to massive style of mineralization that does not contain lamellae in ilmenite. This work was aimed at determining the composition of the lamellae within the ilmenite of the intercumulus mineralization, and also to document any contrasts in Fe, Ti, V, and other trace element abundances between the two styles of mineralization. Analytical results are given in Table 1, with FeO and Fe₂O₃ calculated based on stoichiometric considerations following the methods of Droop (1987). The fact that the vanadium K-alpha x-ray line is partially overlapped by the titanium K-beta x-ray line required careful analysis to determine vanadium concentrations. Careful selection of background positions for the analysis of vanadium in the presence of high titanium essentially eliminated this problem, and analyzed synthetic standards containing high titanium (MnTiO₃ and TiO₂) gave essentially a value of zero for vanadium.

As suggested by petrographic work and SEM-MLA analysis, electron microprobe work confirmed that the lamellae in the ilmenite from the disseminated style of mineralization are magnetite, but also contain significant titanium (Table 1). When plotted on a TiO₂-FeO-Fe₂O₃ (with subordinate oxides included) ternary diagram, the titanomagnetite lamallae compositions fall on the solid solution tie line between pure stoichiometrically calculated magnetite and
ulvospinel; indicative of ionic substitution (Figure 2). In contrast, all ilmenite compositions plot towards the pure stoichiometrically calculated ilmenite composition of the tie line representing the solid solution between ilmenite and hematite (Figure 2). This result is different than that determined by Actlabs (reported on in French and Mugford, 2010) who, based on SEM-MLA analysis, reported that the lamallea were composed of hemo-ilmenite.

There are also variations in the compositions of the magnetite and ilmenite from the two styles of mineralization (Table 1). As noted above, magnetite occurs in three different forms: 1) as coarse magnetite in the disseminated mineralization, 2) as fine lamellae within ilmenite in the disseminated mineralization, and 3) as coarse magnetite with spinel exsolutions in the semi-massive to massive style of mineralization.

The coarse-grained magnetite in both styles of mineralization has higher proportions of FeOT compared to the magnetite lamellae in the disseminated mineralization, which contain significantly higher titanium (Table 1). V₂O₅ concentrations are elevated in all three styles of magnetite mineralization, with averages ranging from 0.46 – 0.62 wt %. The titanomagnetite lamellae in the disseminated intercumulus mineralization and the coarse-grained magnetite in the semi-massive to massive mineralization have the highest concentrations (Table 1). Coarse magnetite from the semi-massive to massive style of mineralization also contains increased proportions of MgO and MnO (Table 1); representing partial substitution for Fe²⁺ compared to the disseminated style of mineralization.

Ilmenite compositions also vary in FeOT and TiO₂ compositions, with the coarse grained massive ilmenite in the semi-massive to massive mineralization having TiO₂ and lower FeOT than the ilmenite with titanomagenite lamellae in the disseminated intercumulate mineralization.
(Table 1). There is also substantially more MgO and MnO in the coarse-grained semi-massive to massive variety of ilmenite mineralization (Table 1). In terms of V$_2$O$_5$ contents, the coarse-grained ilmenite displaying the titanomagnetite lamellae in the disseminated intercumulate mineralization contains significantly more vanadium than the ilmenite in the semi-massive style of mineralization (Table 1). However, electron microprobe work shows that some of the ilmenite contains very fine-scale magnetite lamellae (e.g. lamellae within lamellae), and these might be the host for the vanadium.

**LITHOGEOCHEMISTRY**

**INTRODUCTION AND LIMITATIONS**

A representative suite of all plutonic rock types from the Keating Hill prospect were analyzed for major, trace and rare earth elements at the GSNL geochemical laboratory. Major elements were analyzed via ICP-OES-fusion methods; the majority of trace elements were analyzed via ICP-MS-fusion methods, with the remainder of the trace elements being analyzed via ICP-OES-4-acid methods. The full geochemical dataset and analytical methods used for each element will be released in a subsequent open file report. All samples presented in this report were collected from diamond drill core from five drillholes on the Keating Hill prospect (total of 61 samples).

Before attempting to present and interpret lithogeochemical data from this study, it is important to explain some of the limitations of the data. The rocks discussed within this report have cumulate textures, and as such the determined chemical compositions do not represent any parental magma liquid composition. The original magma composition has been modified by
processes such as fractional crystallization and mineral accumulation, and it is difficult to assess results in terms of magmatic evolution processes. As all rocks also contain variable amounts of oxide and sulphide minerals, major and trace elements such as TiO₂, FeO, Fe₂O₃, Ni, and Cu are strongly influenced by the proportion of mineralization.

**MAJOR AND MINOR ELEMENTS**

Most samples from the Keating Hill prospect have low loss on ignition values (< 0.8 %), a result consistent with the generally fresh nature of the rocks. The data show large ranges in major element concentrations; illustrated through the use of Harker diagrams (Figure 3) and drillhole chemostratigraphy (Figure 4). Concentrations of Fe₂O₃ (total), TiO₂, and V₂O₅ all show strong negative correlations with SiO₂, indicative of Fe-Ti oxide control (Figure 3 a, b, and c). This is also observed on the chemostratigraphic profile illustrated in Figure 4 in which the semi-massive oxide units plot with significantly increased proportions of Fe₂O₃, TiO₂, and V₂O₅. A positive correlation exists both between Al₂O₃ and CaO when plotted against SiO₂; with the more leucocratic samples having the higher concentrations of Al₂O₃ and CaO indicative of cumulate plagioclase control (Figure 3 d and e). P₂O₅ against SiO₂ shows a set of samples with relatively high P₂O₅ concentrations indicative of cumulus apatite as observed petrographically, whereas the bulk of the samples have lower P₂O₅ values (<1 wt %) displaying a positive trend against SiO₂, indicative of control by cumulus apatite as well as trapped liquid (Figure 3f).

Plots of Fe₂O₃ vs TiO₂ and Fe₂O₃ vs V₂O₅ show positive correlations indicative of magnetite-ilmenite control (Figure 5 a and b). A similar pattern is observed in the plot of TiO₂ vs V₂O₅ (Figure 5c). It is noted that the samples of the oxide-rich gabbro/gabbronorite (lacking the hornblende oikocrysts) plot with a slightly higher relative concentration of V₂O₅ and a slightly
lower relative concentration of TiO$_2$ compared to the trends defined by most rocks (Figure 5 a, b, and c); perhaps indicative of a primarily magnetite control on vanadium concentrations. A positive correlation between Ni and Cu (Figure 5d) suggests that these elements are controlled by one dominant phase (e.g. base-metal sulphide), as expected based on petrographic observations.

**TRACE ELEMENTS**

Concentrations of total rare earth elements (REEs) show positive correlations with P$_2$O$_5$ contents in most rocks (Figure 6a); indicative of the control that minerals such as apatite and monazite exert on abundance of REEs. In contrast, concentrations of other trace elements, most notably the high field strength elements such as Hf, Zr, Nb and Ta do not display a positive correlation with P$_2$O$_5$; suggesting that there are other controls on their distribution. (Hf versus P$_2$O$_5$ displayed in Figure 6b; other HFSE plots not shown).

Rare Earth Element concentrations in rock types range in abundance from approximately 2 to 300 times chondrite, with the coarse grained gabbroic rocks having the highest concentrations and the semi-massive oxide mineralization having the lowest concentrations (Figure 7). The overall high concentrations of REE are interpreted to be linked to variable concentrations of intercumulus trapped liquids in the cumulate rocks; as observed through the SEM-MLA work described above. The extraordinarily high concentrations in the coarse grained rocks are related to the presence of cumulus apatite. REE patterns from all rock types display similar normalized patterns with the light REE being enriched relative to the middle and heavy REE (Figure 7 a-d). All rocks display positive europium anomalies attributed to ubiquitous cumulate plagioclase.
The concentrations of other trace elements are displayed on primitive mantle normalized extended trace element plots in Figure 8 a-d. Excluding the low field strength elements rubidium and barium, most trace element concentrations range from approximately 0.5 to 100 times primitive mantle (Figure 8 a-d). The primitive mantle normalized spider diagrams illustrate a number of common features between most rock types, with the semi-massive to massive mineralization showing variations in the patterns for some elements. All rock types, with the exception of the semi-massive to massive mineralized rocks, consistently display negative anomalies with respect to the high field strength elements (Th, Nb, Zr, Hf) and positive anomalies with respect to Ba, Sr and sometimes P (Figure 8 a-d). In contrast, the semi-massive to massive mineralized hornblende oikocrystic gabbro-norite commonly displays lower relative concentrations of most trace elements compared to the other associated weakly mineralized rocks, but they display positive primitive mantle normalized anomalies for Nb, Ta, Zr, and Hf (Figure 8a). Of interest, as with most of the trace elements, the semi-massive mineralized gabbro-norite contains lower relative concentrations of P than the other rock types. This would suggest that the HFSE (Nb, Ta, Zr, and Hf) are controlled by some other mineral phase than the phosphates apatite or monazite. The most likely explanation is that they are hosted within the oxide mineralization (e.g. see Nielsen and Beard, 2000; Bai et al., 2012). Accepting the presumption that the semi-massive to massive mineralization is hosted by the same hornblende oikocrystic gabbro-norite that contains the intercumulus oxide mineralization; these relationships are easily viewed in figure 9 a and b. Figure 9a compares the semi-massive mineralization patterns with that of the average pattern derived from all of the hornblende oikocrystic gabbro-norite with inter-cumulate mineralization, whereas Figure 9b normalizes the compositions
of the semi-massive to massive invasive mineralization samples to the average composition of the hornblende oikocrystic gabbronorite.

SUMMARY AND DISCUSSION

The Silurian magmatic oxide mineralization at the Keating Hill prospect represents a new style of mineralization for the island of Newfoundland. Although numerous examples of magmatic sulphide occurrences have been described from mafic Silurian-Devonian intrusions in central and western Newfoundland (e.g. Kerr, 1999; Hinchey, 2013), the Keating Hill prospect is dominated by oxide mineralization.

STYLES OF MINERALIZATION

There appears to be at least two styles of oxide mineralization, both of which are hosted by a hornblende oikocrystic gabbronorite that is interpreted to represent a single intrusive rock unit. There is an early magmatic oxide mineralization style developed by fractional crystallization processes involving the gravitational settling and sorting of intercumulus oxide liquids, and a later style in which immiscible oxide liquid was injected into the cumulate pile forming massive oxide layers or lenses that appear to be invasive.

The first style of mineralization is represented by intercumulus oxide mineralization that appears to have a magmatic origin. This style of mineralization is similar to that envisioned for primary magmatic sulphide deposits that share many textural relationships with the oxide mineralization discussed herein.
The second, perhaps more economically important, style of mineralization occurs as semi-massive to massive oxides. This style of mineralization has abrupt upper and lower contacts with the host hornblende oikocrystic gabbro-norite. The oxide mineralization fills spaces between, or more commonly totally encloses silicate minerals dominated by plagioclase and pyroxene. The massive oxide mineralization also locally contains inclusions of more leucocratic gabbro with much less oxide mineralization. Initial field observations of hand specimens suggested that the plagioclase crystals were of cumulate origin based on their elongated and lath-type shapes; however subsequent petrographic investigations displayed distinct mineralogical textures that suggested silicate-oxide disequilibrium conditions. This textural evidence supports the theory that the oxide minerals crystallized from an oxide-rich melt or liquid that was injected into a plagioclase-rich crystal mush. Hence, the semi-massive to massive oxide mineralization did not form through simple fractional crystallization processes as envisaged for the intercumulus mineralization.

It should be noted that although the semi-massive to massive mineralization is interpreted to have formed after the silicate minerals had formed into a crystal mush, the mineralization is still broadly magmatic in origin. The large density contrast between such an oxide-rich melt or liquid and the host silicate rocks would physically limit the potential migration distances that any oxide melt could travel. It is postulated that the oxide liquid that was injected into the silicate crystal pile was most likely derived from the same magma chamber that produced the host rocks. Oxide mineral chemistry variations between the styles of mineralization (see above), and the higher concentrations of high field strength elements in massive mineralization, may indicate derivation from different magma pulses or batches.
It is not clear why this magmatic system developed into oxide-rich mineralization. The increased proportions of oxide minerals is most likely related to variations in the Fe₂O₃/FeO ratio of parental liquids, which in turn is related to temperature, oxygen fugacity, and the water content of the magma. The presence of hornblende and biotite suggests that the intrusions were very hydrous and this was likely an important factor. The presence of rounded magmatic sulphide blebs in equilibrium with the oxide minerals constrains the upper limit for oxygen fugacity.

Well studied examples of similar styles of mineralization occur in intrusions related to the ca 260 Ma. Emeishan Large Igneous Province in SW China (e.g. see Zhou et al., 2005; Pang et al., 2008; Bai et al., 2012; Zhou et al., 2013; Song et al., 2013; and Howarth et al., 2014). Many of these studies also describe contrasting models and styles of oxide mineralization that resemble those described in this report, supporting the notion that two or more generations and styles of oxide mineralization may be feasible within one magmatic system.

**CONCLUSIONS**

Results from this study provide several important conclusions about the oxide mineralization observed at the Keating Hill prospect:

1) There are two different styles of oxide mineralization present. Although these are distinct in oxide mineral chemistry and textures etc., they are both interpreted to have formed in the same magma chamber through magmatic processes.

2) Disseminated intercumulus oxide mineralization is easily explained through processes of fractional crystallization and evolution of inter-cumulate liquids, but the formation of the invasive style of semi-massive to massive oxide mineralization is more complicated. The working model of formation involves development of an
immiscible hydrous Fe-Ti rich liquid, which was subsequently injected into a crystal
mush to produce discrete semi-massive to massive mineralized zones.

3) Results imply that other Silurian mafic intrusions in central and western
Newfoundland may have potential to host similar oxide-rich mineralization as that
observed at the Keating Hill prospect, although examples have yet to be documented.

4) Observations of contrasting oxide compositions and textures between the two
mineralization styles may be important for evaluation of metallurgical characteristics
of this mineralization. The bulk of the vanadium is hosted within the massive
magnetite and the titanomagnetite lamellae in the ilmenite of the disseminated
intercumulus mineralization.

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2010: First and third year assessment report on geological, geochemical, geophysical, trenching and diamond drilling exploration for licenses 17369M and 17894M on claims in the Southwest Brook area, southwestern Newfoundland, 3 reports, [NFLD/3237]

Hinchey, J.G.
2013: The geology and genesis of the Silurian Portage Ni-Cu and Ordovician Range Cu-Co showings, Southwestern Newfoundland (NTS map area 12A/05): Preliminary results. In Current

Kerr, A.


Lissenberg, C.J., van Staal, C.R., Bedard, J.H., and Zagorevski, A.


Lissenberg, C.J., McNicoll, V.J., and van Staal, C.R.


Nielsen, R.I. and Beard, J.S.


Pehrsson, S.J., Brem, A.G., and van Staal, C.R.

2013: Geology, Main Gut, Newfoundland and Labrador; Geological Survey of Canada Open File 1666, scale 1:50 000. Doi. 10.4095/292182
Riley, G.C.

Sun, S.S. and McDonough, W.F.

Thomson, R.

van Berkel, J.T.


Williams, H.


Zagorevski, A., van Staal, C.R., and McNicoll, V.J.

9.0 List of Personnel and Contractors

The following is a list of personnel and contractors used during the work program.

<table>
<thead>
<tr>
<th>Name</th>
<th>Serviced Rendered</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employees</td>
<td></td>
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</tr>
<tr>
<td>Danny Muise</td>
<td>Field Technician - Labourer</td>
<td>St. Georges, NL</td>
</tr>
<tr>
<td>Boyd Verge</td>
<td>Field Technician</td>
<td>Rocky Harbour, NL</td>
</tr>
<tr>
<td>Contractors</td>
<td></td>
<td></td>
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<tr>
<td>V.A. French Geological</td>
<td>Geology, Research and Report Compilation</td>
<td>Bay Roberts, NL</td>
</tr>
<tr>
<td>Harvey Gale &amp; Son Ltd.</td>
<td>Core Storage</td>
<td>Stephenville, NL</td>
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</tbody>
</table>

Table 1: Employee and Contract Services

10.0 Work Description and Discussion of Results

The work completed during the report period consisted of both field and office components. The field work was carried out intermittently throughout the summer and fall of 2014. On June 19th and 20th employees Danny Muise and Boyd Verge completed reconnaissance work in the property area assisted by ATV travel along the historical logging access road which runs through Mineral Licences 019494M and 19968M just north of the property. This road was brushed out earlier in 2011 and 2012 to allow access to the then south licences of the FCP and was last used in the summer of 2013 during mapping, prospecting and sampling including mapping completed by Dr. John Hinchey.

The purpose of the 2 day work assignment was to carry out prospecting traverses over the 2 claim blocks and establishing a traverse route from the access road into the north block and across Barachois Brook into the south block. Water levels in the brook were high and did not
permit traversing across the brook into the south half of the north block and accessing the south brook.

The 2 blocks were staked to cover sections of round available along the trace of the Cabot Fault Zone and the trend of several outcrop and float samples sites during the 2013 samplings yielded weakly to moderately anomalous platinum palladium and gold mineralization on claim blocks 019494M and 017369M north of the property (French and Mugford, 2014). The purpose of the field visit to the property was to prospect the area for both oxide and PGE mineralization. The work carried out by the 2 person prospecting crew included cutting and clearing windfall out of the woods access road used for ATV access into the work area and prospecting the North Block – License 021614M. Their prospecting was limited to a narrow section of the claim block along the north bank of Barachois Brook and toe of the south facing slope fringing the brook. Deep overburden cover along the slope and heavy tree growth encountered along the slope and a paucity of outcrop in the high waters along the brook impeded prospecting. Outcrop was not available for sampling and there are no prospecting results to report.

The weakly anomalous PGE and gold mineralization detected by geologist Jonathan Rodway during the 2013 work program is associated with “slivers” of ultramafic rocks within the Cabot Fault Zone. Rodway described the host as being brownish weathering, dark green to black, strongly chlorite altered, ultramafic, possibly lherzolite in composition (French and Mugford, 2014). Samples collected by Rodway also yielded weakly to moderately anomalous values in copper up to 0.21% Cu and weakly elevated nickel. The zone of metal enrichment based on the sample distribution is 1.5 kms in length with potential for a greater strike along the northeast and southwest strike directions, and towards the 2 blocks comprising the property covered in this report, southwest of the mineralized samples. The mineralized zone is in an area of extensive soil and vegetation cover masking the underlying bedrock and this thick soil and forest cover persists to the southwest and extensively covering the north slope of the river valley, and the north boundary area of licence 021614M – the north block.

Ultramafic rock have been previously recorded in the area of the newly discovered PGE mineralization. In one of the very few historical reports from this area R.V. Stewart in 1988
reported “ultrabasics” from the area successfully sampled by Rodway. Stewarts work program focused on prospecting for gold along the Cabot Fault Zone and resulted in identifying weakly to moderately anomalous gold values (Stewart, 1988). Mainly in quartz veins at sites north and remote to the zone sampled by Rodway, Steward did report 1 gold value of 29 ppb from the “ultrabasics” and the area of the PGE mineralize ultramafic identified by Rodway who also observed quartz veins within the area. A total of 8 weak gold assays ranging between 8 and 129 ppb were reported by Actlabs from the Rodway samples, and referencing his sample descriptions all appear to be hosted in the mafic – ultramafic rocks associated with pyrite and chalcopyrite, (PGE mineralization in chalcopyrite enriched rocks has been referenced in the region by earlier workers; Len Muise, pers.comm).

The region encompassing the FCP and the property with the exception of geological mapping and airborne geological surveys completed by the Geological Survey of Canada and the Newfoundland Geological Survey dating back to the early 20\textsuperscript{th} century has been sparsely worked. There are only a few industry work programs recorded for the immediate area of the FCP along the 22 km section of the Burgeo Highway which the project is located south to the Barachois Brook river valley. Research and compilation work completed for this report shows the first recorded mineral exploration – geology report for the area now making up the FCP was written by geologist R. Thomson December 8, 1941. His brief report of several pages (including a referenced sketch?) summarized a field visit to the C.H. McFairdge – J. Keating Magnetic Prospect from November 10-16\textsuperscript{th}, 1941 (note McFairdge is misspelled, should be McFatridge), in which he noted the prospect was discovered by prospector John Keating of Stephenville Crossing “some 10 years before”.

Charlie Keating, a son of John Keating and a co-founder of Triple Nine Resources/Four Corners Mining Corporation advised the Newfoundland and Labrador Government in the early 1950’s (1951 est) invited a German based company to visit the historical Keating prospect. Mr. Keating recalls that in June month of the year the company visited the prospect using a float equipped bush plane to land on a nearby pond and that as a young boy he accompanied his father and the German filed team on his visit. He also recalls the company showed great interest and
mentioned they were interested in returning the following year for further evaluation and a suggested drilling program (Charlie Keating, pers.comm.).

The report by Stewart (1988) referenced above appears to be the next record of exploration in the area now covered by the 399 claims comprising the FCP; this work by Stewart focused on gold exploration and not the magnetite (oxide) mineralization discovered some 60 years earlier by John Keating. The next exploration attention to the area of note and related to the oxide mineralization, are prospecting activities by project co-founders Len Muise and Gerry Hull, both of Stephenville in 1998. Their work was focused on sampling the historical Keating Magnetite Prospect located along the Burgeo Paved Highway, to determine the quality/grade and density of the magnetite rich zone. (Their interest was sampling the prospect to determine if it was of sufficient quality/density for ballast requirements in the construction of the Hibernia Gravity Based production platform. The Bishop Property of higher density magnetite located approx. 35 kms west was ultimately sourced for the ballast).

During the work completed by Muise and Hull samples were also assayed for other metals including vanadium and these assays detected concentrations of vanadium pentoxide up to 1223 ppm (0.12%) and within economic grades. These assays went un-noticed for years until Muise became aware of the rising value and the importance of vanadium as a strategic metal for use in electric cards and high capacity electric batteries or storing energy from wind and solar generated power. Consequently he revisited the prospect in 2008-2009 and during resampling not only re-confirming historical iron ore enrichments discovered by J. Keating but also the widespread distribution of potentially economically important vanadium throughout the Keating Hill Prospect area (now labelled Keating Hill), and the detection of strong titanium enrichments. Thus it was on the basis of the work by Muise, Hull and their prospecting team (which included John Keating’s son Charlie and grandson Roy Keating) that the Four Corner’s Project, now including the 2 latest claim blocks comprising the property covered in this report was assembled.

This literature review demonstrated the area of the FCP prior to commencement of claim staking in the area by Muise and his group in late 2007 received very little recorded exploration with the reports by Thomson in 1941 and Stewart in 1988 being the only records of note to the
specific site of the Four Corners Project. There are records of regional surveys, especially for
gold in the 1980’s ad 1990’s along the Baie Verte – Brompton Line (the major rectilinear fault
zone in western Newfoundland of which the Cabot Fault is a segment) but focused north and
south of the FCP. A regional lake sediment survey completed by Marthon PGM Corporation in
2008 and covering a large area west and south of the FCP did take in what is now the southwest
section of the FCP, (Dunsworth, 2008).

The survey results did identify several sample sites containing weakly to moderately
anomalous concentrations of palladium and platinum from small ponds situated in close
proximity to the estimated 1.5 km long weak PGE and gold mineralized zone identified by
Rodway during the 2013 work program.

The somewhat clustering of these few lake sediments sites in the area of the ultramafic
“slivers” and the PGE – gold mineralization samples suggest this area is worthy of exploration
follow-up on the results of these two preliminary surveys.

This report also include expenditures for maintenance and repair costs related to repairing
and securing the project basecamp along the Burgeo Highway. These costs include labour and
transportation expenses paid to Danny Muise of St. Georges plus materials such as plywood
needed to secure door and window openings damaged during extensive damage and pilfering at
the Burgeo Highway base camp consisting of 7 trailers and wooden framed core shed; this
damage and pilfering occurred throughout the report period and particular during the 3rd and 4th
quarters of 2014. Also included are charged paid to Harvey Gale and Son Ltd for core storage at
Stephenville and also services rendered for removing valuable equipment such as the diesel
generating plant to their storage yard in Stephevnille Crossing.
## 11.0 List of Expenditures

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<tr>
<th>Item</th>
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<th>021615M</th>
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<td><strong>1. Field work and prospecting</strong></td>
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<td>249.08</td>
<td>249.08</td>
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<td><strong>4. Literature Review and Compilations</strong></td>
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<td>Brenda Yetman – report typing</td>
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<td>Crystal Mugford – Figures</td>
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12.0 References


Appendix I

Mineral Rights Inquiry Report
**Mineral Rights Inquiry Report**

**Thursday, January 22, 2015**

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<td>Four Corners Mining Corporation</td>
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<td>Map Sheet No(s):</td>
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**Comments:**

**Mapped Claim Description:**

Beginning at the Northeast corner of the herein described parcel of land, and said corner having UTM coordinates of 5 366 000 N, 419 000 E; of Zone 21; thence South 1,000 metres, thence West 3,000 metres, thence North 1,000 metres, thence East 3,000 metres to the point of beginning. All bearings are referred to the UTM grid, Zone 21. NAD27.

**Land Claims (effective 2005/12/01):**

- LISA: 0.00%
- LIL: 0.00%
- VBP: 0.00%
- Crown: 100.00%
Extensions: None

Work Reports: None

$2,400.00 to be expended on this license by 2014/11/25

Licence Transfers: None

Partial Surrenders: None

This Licence replaces Licence Number(s): None

This Licence is replaced by Licence Number(s): None

Work Report Descriptions: None

Detailed breakdown of projected required expenditure:

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<th>Actual Year</th>
<th>Actual Expenditure</th>
<th>Work Year</th>
<th>Excess Expenditure</th>
<th>Claims</th>
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<td>1</td>
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# Mineral Rights Inquiry Report

**Thursday, January 22, 2015**

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<tr>
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<tbody>
<tr>
<td>File Number:</td>
<td>775:4145</td>
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<tr>
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<td>Four Corners Mining Corporation</td>
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<tr>
<td>Licence Holder:</td>
<td>Four Corners Mining Corporation</td>
</tr>
</tbody>
</table>
| Address:                 | P.O. Box 385  
                           Clarkes Beach, NL  
                           Canada, A0A 1W0 |
| Licence Status:          | Issued                      |
| Location:                | Southwest Brook, West - Central NL |
| Electoral Dist.:         | 12 Burgeo-La Poile          |
| Recorded Date:           | 2013/10/24                  |
| Issuance Date:           | 2013/11/25                  |
| Renewal Date:            | 2018/11/25                  |
| Report Due Date:         | 2015/01/26                  |
| Org. No. Claims:         | 12.0000                     |
| Cur. No. Claims:         | 12.0000                     |
| Recording Fee:           | $120.00                     |
| Receipt(s):              | 58104743 (2013/10/24) $120.00 |
| Deposit Amount:          | $600.00                     |
| Deposit:                 | 58104743 (2013/10/24) $600.00 |
| Map Sheet No(s):         | 12B/08                      |

**Comments:**

**Mapped Claim Description:**

Beginning at the Northeast corner of the herein described parcel of land, and said corner having UTM coordinates of 5 364 500 N, 415 500 E; of Zone 21; thence South 500 metres, thence East 500 metres, thence South 1,000 metres, thence West 500 metres, thence South 500 metres, thence West 500 metres, thence South 500 metres, thence West 1,000 metres, thence North 1,500 metres, thence East 1,000 metres, thence North 1,000 metres, thence East 500 metres to the point of beginning. All bearings are referred to the UTM grid, Zone 21. NAD27.

**Land Claims (effective 2005/12/01):**

| LISA: 0.00% | LIL: 0.00% | VBP: 0.00% | Crown: 100.00% |
Extensions: None

Work Reports: None

$2,400.00 to be expended on this license by 2014/11/25

Licence Transfers: None

Partial Surrenders: None

This Licence replaces Licence Number(s): None

This Licence is replaced by Licence Number(s): None

Work Report Descriptions: None

Detailed breakdown of projected required expenditure:

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<tr>
<th>Actual Year</th>
<th>Actual Expenditure</th>
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<th>Excess Expenditure</th>
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