DOMINION DIAMOND

ANNEX III

GEOLOGY BASELINE REPORT FOR THE JAY PROJECT

GEOLOGY BASELINE REPORT FOR THE JAY PROJECT

Prepared for: Dominion Diamond Ekati Corporation

Prepared by: Golder Associates Ltd.

September 2014

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Abbreviations

Abbreviation	Definition
ALS	airborne laser scanning
ca.	circa
CSST	Central Slave Superterrane
CT	Contwoyto Terrane
DEM	digital elevation model
Dominion Diamond	Dominion Diamond Ekati Corporation
e.g.,	for example
Ekati Mine	Ekati Diamond Mine
EM	electromagnetic
et al.	and more than one additional author
HRDEM	high-resolution digital elevation model
HRT	Hackett River Terrane
i.e.,	that is
LiDAR	light detection and ranging
LSI	LiDAR Service International Inc.
N	north
NWT	Northwest Territories
Project	Jay Project
PVK	primary volcaniclastic kimberlite
Rb-Sr	rubidium-strontium
RVK	re-sedimented volcaniclastic kimberlite
SRT	Snare River Terrane
TFM	total field magnetic
TransK	transitional kimberlite
U-Pb	uranium – lead
UTM	Universal Transverse Mercator
VK	volcaniclastic kimberlite
VLF	very low frequency
W	west

Units of Measure

Unit	Definition
°	degree
%	percent
±	plus or minus
cm	centimetre
cpt	carats per tonne
Ga	giga-annum or billion years ago
ha	hectare
km	kilometre
km^2	square kilometre
km/h	kilometres per hour
m	metre
Ma	mega-annum or million years ago
masl	metres above sea level

1 INTRODUCTION

1.1 Background and Scope

Dominion Diamond Ekati Corporation (Dominion Diamond) is a Canadian-owned and Northwest Territories (NWT) based mining company that mines, processes, and markets Canadian diamonds from its Ekati Diamond Mine (Ekati Mine). The existing Ekati Mine is located approximately 200 kilometres (km) south of the Arctic Circle and 300 km northeast of Yellowknife, NWT (Map 1.1-1).

Dominion Diamond is proposing to develop the Jay kimberlite pipe (Jay pipe) located beneath Lac du Sauvage. The proposed Jay Project (Project) will be an extension of the Ekati Mine, which is a large, stable, and successful mining operation that has been operating for 16 years. Most of the facilities required to support the development of the Jay pipe and to process the kimberlite currently exist at the Ekati Mine. The Project is located in the southeastern portion of the Ekati claim block approximately 25 km from the main facilities and approximately 7 km to the northeast of the Misery Pit, in the Lac de Gras watershed (Map 1.1-2).

The Geology Baseline Report is one component of a comprehensive environmental and socio-economic baseline program to collect information about the natural and socio-economic environment near the Project. The objective of this report is to document the geological conditions before the construction, operations, and closure phases of the proposed Project.

This report is based on a detailed review, compilation, and interpretation of previously published geological work in the area (most recently documented in *Ekati Diamond Mine, Northwest Territories Canada, NI 43-101 Technical Report* [Dominion Diamond 2013]). An updated geological map of the Lac du Sauvage area within the Ekati Mine claim block was produced based on existing mapping as well as interpretation of high-resolution light detection and ranging (LiDAR) data, high-resolution orthophotos, and high-resolution airborne geophysical data.

LEGEND

- JAY PROJECT
- EXISTING MINE OR PROJECT
- TERRITORIAL CAPITAL
- POPULATED PLACE
- HIGHWAY
- ALL-SEASON ROAD
- WINTER ROAD
- TIBBITT TO CONTWOYTO WINTER ROAD
- NORTHERN PORTION OF TIBBITT TO CONTWOYTO WINTER ROAD
- TERRITORIAL/ PROVINCIAL BOUNDARY
- TREELINE
- WATERCOURSE
- WATERBODY

150 0 150

SCALE 1:6,000,000 KILOMETRES

REFERENCE

WATER OBTAINED FROM ATLAS OF CANADA
NATURAL RESOURCES CANADA, CENTRE FOR TOPOGRAPHIC INFORMATION, 2012
PROJECTION: CANADA LAMBERT CONFORMAL CONIC

DOCUMENT

GEOLOGY BASELINE REPORT

PROJECT

DOMINION DIAMOND

JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE

LOCATION OF THE JAY PROJECT

Golder Associates

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REVIEW	SM	16/09/14		

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LEGEND

- EKATI MINE FOOTPRINT
- DIAVIK MINE FOOTPRINT
- PROPOSED JAY FOOTPRINT
- KIMBERLITE PIPE
- WINTER ROAD
- TIBBITT TO CONTWOYTO WINTER ROAD
- NORTHERN PORTION OF TIBBITT TO CONTWOYTO WINTER ROAD
- ELEVATION CONTOUR (10 m INTERVAL)
- ESKER
- WATERCOURSE
- WATERBODY

REFERENCE

CANVEC © NATURAL RESOURCES CANADA, 2012
NATURAL RESOURCES CANADA, CENTRE FOR TOPOGRAPHIC INFORMATION, 2012
DATUM: NAD83 PROJECTION: UTM ZONE 12N

DOCUMENT

GEOLOGY BASELINE REPORT

3 0 3

SCALE 1:150,000 KILOMETRES

PROJECT

DOMINION DIAMOND

JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE

EKATI PROPERTY MAP

Golder Associates

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REVIEW	SM	16/09/14		

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1.2 Objectives

The purpose of the Geology Baseline Report is to describe the existing geological conditions at the Project site. The objectives of the baseline report are as follows:

- describe the geological structure, and other relevant characteristics of the area;
- identify the geological composition of the host rock, and the Jay kimberlite pipe;
- describe known fractures and faults at the Project site; and,
- include maps and figures to illustrate geological features.

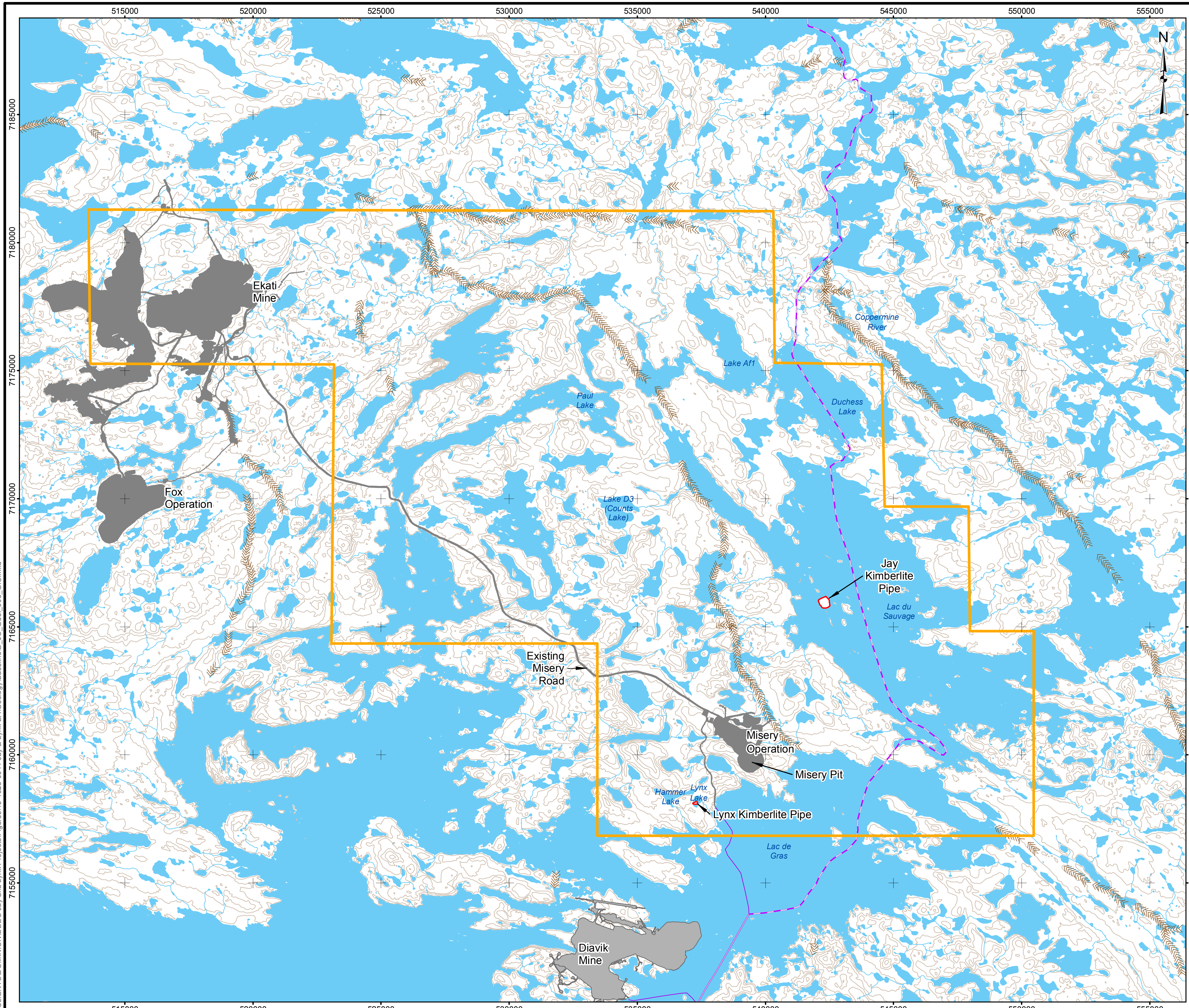
1.3 Baseline Study Area

The Project area is situated in an Arctic Climatic Region, at elevations ranging from 400 to 500 metres above sea level (masl). The topography is generally flat, and the terrain is typical Arctic tundra characterized by flat, wet, or swampy terrain with little vegetation.

The proposed new mining operations would develop the Jay pipe which is located in the southeastern portion of the Ekati Mine site, approximately 25 km southeast of the Ekati main camp, and approximately 7 km northeast-east of the Misery Pit, below the waters of Lac du Sauvage.

The baseline study area is approximately 540 square kilometres (km^2) and includes the existing Ekati operation plus the Project footprint (Map 1.3-1). The locations of the Ekati Mine, Misery Haul Road, Misery Pit operations, and Jay pipe in Lac du Sauvage are shown in Map 1.3-1.

The centre of the proposed Jay pipe is located at approximately 7165733 m northing, 542395 m easting (Universal Transverse Mercator [UTM] Zone 12), and approximately 1.2 km from the west shoreline of Lac du Sauvage.



LEGEND

- EKATI MINE FOOTPRINT
- DIAVIK MINE FOOTPRINT
- KIMBERLITE PIPE
- WINTER ROAD
- TIBBITT TO CONTWOYTO WINTER ROAD
- NORTHERN PORTION OF TIBBITT TO CONTWOYTO WINTER ROAD
- ELEVATION CONTOUR (10 m INTERVAL)
- ESKER
- WATERCOURSE
- WATERBODY
- BASELINE STUDY AREA

REFERENCE

CANVEC © NATURAL RESOURCES CANADA, 2012
NATURAL RESOURCES CANADA, CENTRE FOR TOPOGRAPHIC INFORMATION, 2012
DATUM: NAD83 PROJECTION: UTM ZONE 12N

DOCUMENT

GEOLOGY BASELINE REPORT

3 0 3
SCALE 1:150,000 KILOMETRES

PROJECT
DOMINION DIAMOND
JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE

LOCATIONS OF KIMBERLITE PIPES IN THE BASELINE STUDY AREA

Golder Associates

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REVIEW	SM	16/09/14		

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2 METHODS

2.1 Airborne Laser Scanner – High-Resolution Digital Elevation Model

In the current study, an airborne laser scanning (ALS) derived high-resolution digital elevation model (HRDEM) was used to detect possible regional and local structural features that characterize the Lac du Sauvage area. Specifically, HRDEMs from 2013 ALS surveys done by Aurora Geosciences Ltd. were analyzed.

The ALS-HRDEM data were collected in 12 flights between July 23 and August 1, 2013, at an average flight height of 700 m above ground level and a forward speed of 230 kilometres per hour (km/h). The data were projected onto the UTM Zone 12 coordinate system (LSI 2013). The central meridian of UTM Zone 12 is located at 111°W longitude.

2.2 Bathymetry Data

Bathymetric surveys were conducted by Aurora Geosciences Ltd. in the summer of 2013 to build a bathymetric model of the Lac du Sauvage area (Aurora Geosciences Ltd. 2013). The bathymetric map was generated by combining lake depths that were determined using echo sounding and associated global positioning system locations (Aurora Geosciences Ltd. 2013). As for the ALS-HRDEM, the bathymetric digital elevation model provided by Aurora Geosciences Ltd. has a resolution of 1 m (Aurora Geosciences Ltd. 2013).

2.3 Orthophotos

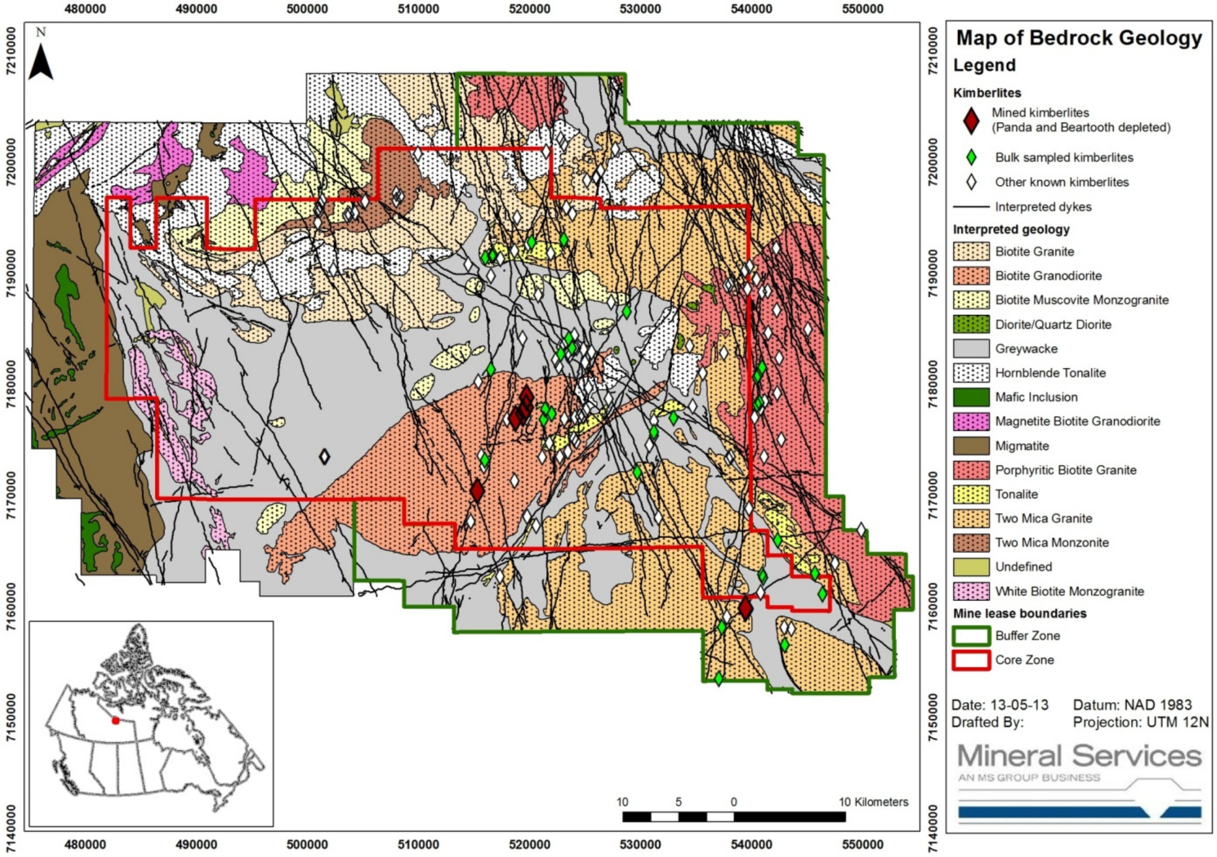
Digital orthophotos were used for large-scale mapping of geology and geological structures such as faults, joints, and lineaments. The orthophotos were obtained in 2013 from Aurora Geosciences Ltd.

The images were provided as ortho-mosaicked colour digital imagery with 0.20 m pixel resolution, and georeferenced onto the UTM Zone 12 coordinate system (LSI 2013).

2.4 Bedrock Geology Data

Bedrock geology interpretation of the Lac du Sauvage area was performed by reviewing the existing geological maps and geological data available for the Ekati claim block and the Lac du Sauvage area (Kjarsgaard 2001; Mineral Services Canada Inc. 2002; Stubley 2005; Aurora Geosciences Ltd. 2013; Dominion Diamond 2013) (Figure 2.4-1). The review used a geographical information system environment (ESRI ArcGIS 10.1 software) to interpret available data (Mineral Services Canada Inc. 2002; Aurora Geosciences Ltd. 2013; Dominion Diamond 2013).

Figure 2.4-1 Bedrock Geology of the Ekati Claim Block



Source: Amended from Dominion Diamond (2013).

2.5 Exploration and Geotechnical Investigation Holes

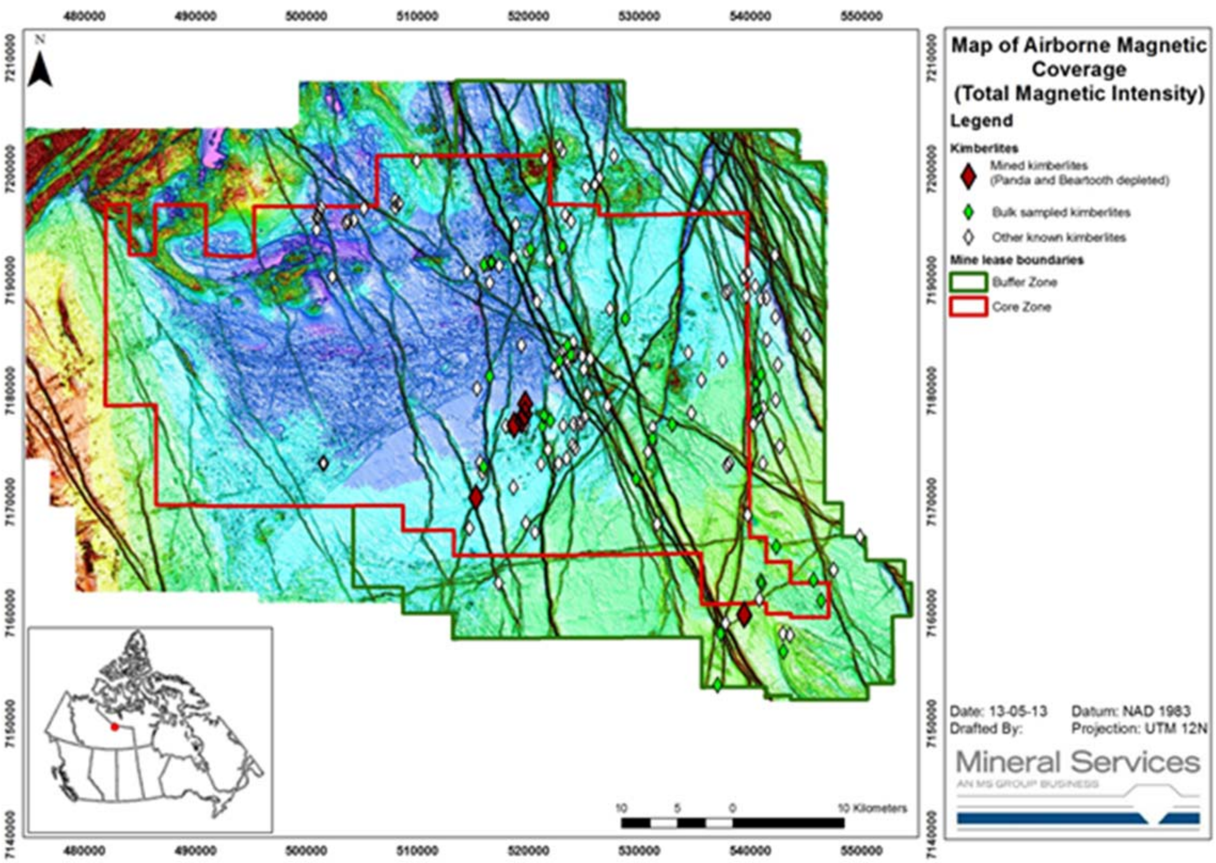
At the Jay pipe area, 11 delineation holes (JDC-01 to JDC-13; JDC-07 and JDC-12 abandoned) and 2 geotechnical holes (JDC-14 and JDC-15) totalling 3,077 m were drilled between 2005 and 2007 (Dominion Diamond 2013). In addition, 16 reverse circulation drill holes (five drilled in 1996 with a diameter of 12.25 inches, and eleven drilled in 2006 with a diameter of 17.5 inches) were completed at the Jay pipe area.

2.6 Geophysical Data

Geophysical data provided by Dominion Diamond contributed to the refinement of the geological interpretation of lithological boundary and mafic dyke mapping. Data derived from helicopter-borne total field magnetic (TFM) (Figure 2.6-1), electromagnetic (EM), and very low frequency electromagnetic (VLF-EM) surveys were used. The data were collected from 1991 to 2006 using the following three different acquisition systems (Dominion Diamond 2013):

- multi-frequency helicopter-borne DIGHEM[v] system, a high-sensitivity caesium vapour magnetometer, and VLF and EM systems used from 1991 to 1993;
- higher resolution TFM Minimag system used in 1996; and,
- a Falcon helicopter survey system including a gravity gradiometer, a horizontal gradient pair of magnetometers, and high-resolution Resolve EM coils used in 2006.

Figure 2.6-1 Airborne Magnetic Survey of the Ekati Claim Block



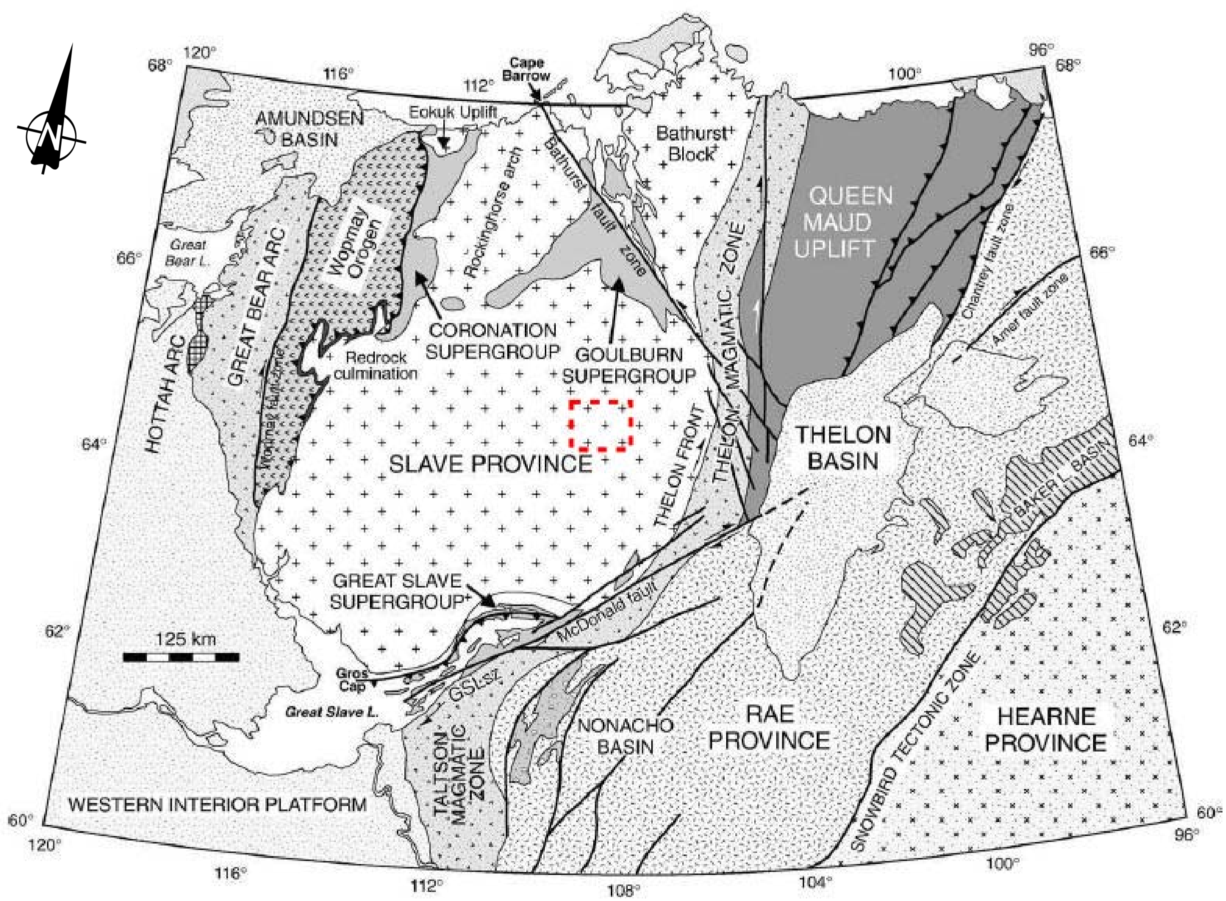
Source: Amended from Dominion Diamond (2013).

3 REGIONAL GEOLOGY

3.1 Slave Tectonic Province

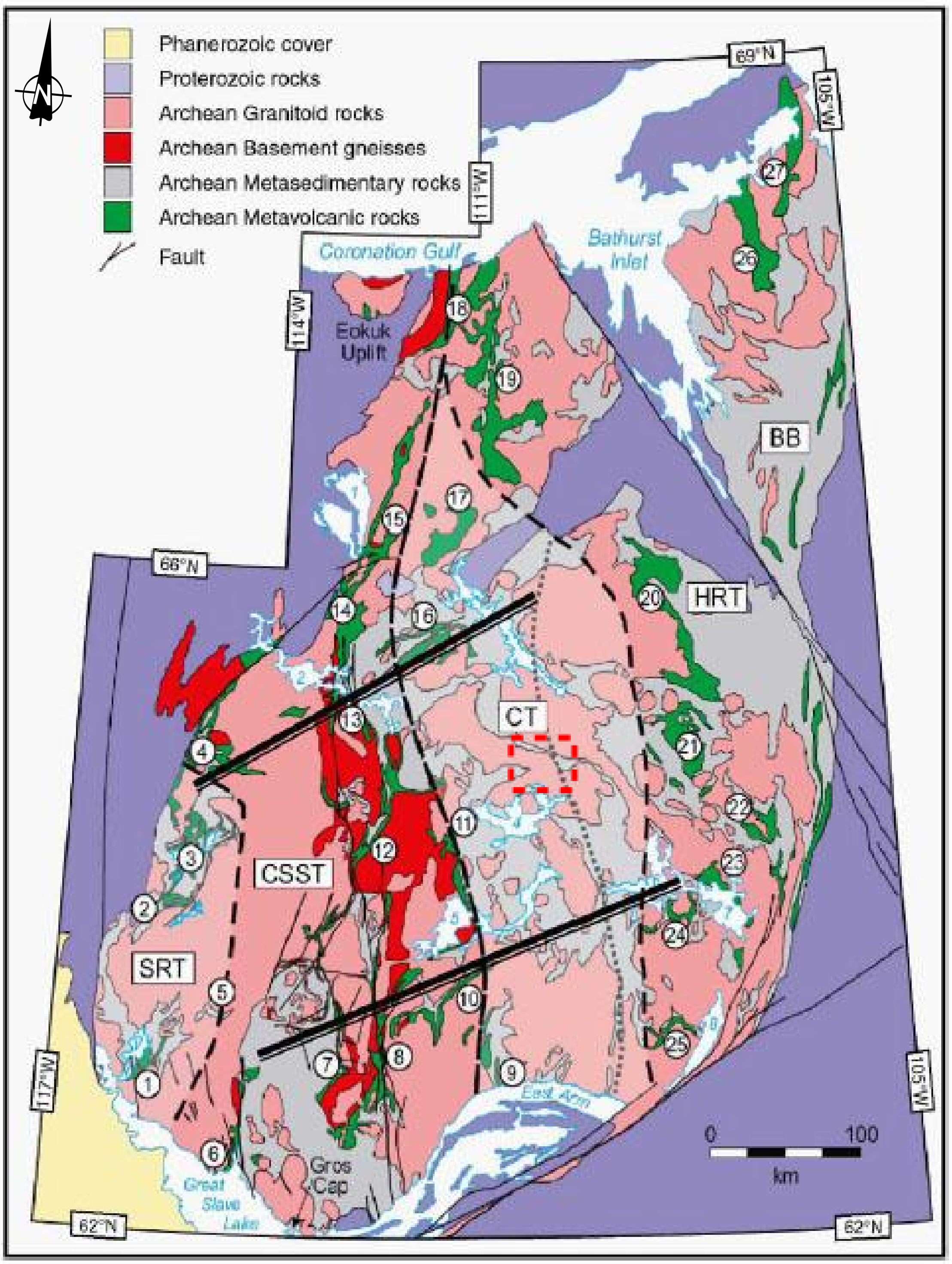
The Lac de Gras Kimberlite Cluster (area outlined with red dashes in Figures 3.1-1 and 3.1-2) intrudes the Slave Structural Province, which is located in the northwestern part of the Canadian Shield, between Great Slave Lake and Coronation Gulf. The regional geology is based largely on work by Hoffman (1989) and Helmstaedt (2009). The Slave Structural Province represents the exposed part of the Slave Craton, one of the Archean granite-greenstone building blocks of the Precambrian core of North America (Helmstaedt 2009; Dominion Diamond 2013).

Figure 3.1-1 Tectonic Setting of the Slave Structural Province of the Canadian Shield



Source: Amended from Hoffman (1989) and Helmstaedt (2009).

Figure 3.1-2 Terrain Map of the Slave Province



Source: Amended from Kusky (1989) and Helmstaedt (2009).

The Slave Province is subdivided into five main tectonic domains (identified by abbreviations in Figure 3.1-2), with at least four that can be considered as separated tectonic terranes (Helmstaedt 2009). The Mesoarchean nucleus of the province is the Central Slave Superterrane (CSST; age: 4.0 to 2.8 giga-annum [Ga]). The other tectonic domains defining the Slave Province are as follows:

- Hackett River Terrane (HRT; age 2,708 to 2,670 mega-annum [Ma]): arc-like volcanic and sub-volcanic rocks that are in structural contact with the eastern margin of the CSST in the northernmost part of the territory, where suturing is thought to have begun at 2,650 Ma;
- Contwoyto Terrane (CT): metasediments and volcanic slivers defining an accretionary prism (Kusky 1990) that structurally overlies the eastern part of the CSST;
- Neoarchean Bathurst Block (BB): located east of the northeastern part of the HRT and separated from it by metasediments domain; and,
- Neoarchean Snare River Terrane (SRT): juvenile Neoarchean terrain that sutures the CSST at the western boundary.

All lithostratigraphic units of the Slave Province have been identified in the CSST. Helmstaedt (2009) suggests that the Neoarchean greenstone-belt assemblages can be grouped into the Yellowknife Supergroup. Older and younger supercrustal assemblages are referred to as part of the pre- and post-Yellowknife Supergroup, respectively.

The pre-Yellowknife Supergroup consists of the following:

- pre-2.9 Ga volcano-sedimentary sequences (reserved at the Winter Lake and Napaktulik Lake greenstone belts); and,
- Late Mesoarchean circa (ca.) 2.85 Ga cover sequences referred to as Central Slave Cover Group (Bleeker et al. 1999).

The post-Yellowknife Supergroup consists of the following:

- late-orogenic polymictic conglomerates and sandstones having an age of approximately 2.6 Ga.

The crystalline basement rock of the Slave Province consists of ca. 4.0 to 2.58 Ga crust that cratonized between 2.58 and 2.51 Ga. The main part of the Slave Province has an elliptical shape, measuring 680 km in length and 460 km in width (Figure 3.1-1). A northeastern segment, the Bathurst or Hope Bay Block, is separated from the main part by the Bathurst fault zone and by gently to moderately folded Paleoproterozoic rock of the Goulburn Supergroup (Helmstaedt 2009; Figure 3.1-1).

Archean rocks of the Slave Province are surrounded by Paleoproterozoic orogenic belts, interpreted as suture zones that developed near passive margins, along which a larger Archean land mass had drifted apart in the Early Paleoproterozoic (Hoffman 1989). In the east, the oblique collision between the Slave and the Rae provinces induced the formation of the Thelon orogeny (Hoffman 1989; Figure 3.1-1). The Thelon magmatic zone is an arc that developed on Archean basement of the adjacent Rae Province.

The Slave Basement shows an increase in metamorphic grade and mylonitization towards the Thelon Front (Henderson and van Breemen 1991). Towards the Thelon Front, the characteristic pattern of bulbous plutons and irregular area of supracrustal rocks changes into a steeply dipping north-northeast trending zone of gneisses in which the Slave rocks become involved in the Paleoproterozoic deformation front (Henderson and van Breemen 1992).

The interaction between several episodes of regional deformation, along with local deformation events related to pluton emplacement, induced the development of multiple deformation structures within the supracrustal rocks of the Yellowknife Supergroup (Fyson and Helmstaedt 1988; Helmstaedt 2009).

Structural styles and trends are dominated by post-collision structures, with the accretion of Neoarchean juvenile terrains to the CSST under an east–west convergence (Helmstaedt 2009). The rapid thrust imbrication induced a crustal thickening during the Slave Province orogenesis (Pehrsson et al. 2000), causing the burial of the supracrustal rocks of the Snare River terrain to mid-crustal depth (regional deformational event called D_1).

The first post-accretion granitoid intrusive rocks, belonging to the Defeat magmatic suite, form a northeast trending belt in the southern part of the Slave Province (Davis and Bleeker 1999; Helmstaedt 2009). The Defeat magmatism (2,630 to 2,620 Ma in age) took place in an arc environment under a northwest-southeast convergence, as indicated by pre- to syn-magmatism S1-cleavage-related folds in metasediments of the Yellowknife domain. East–west convergence was re-established during a regional D_2 tectonic event, resulting in a crustal thickening under low-pressure and high-temperature metamorphisms.

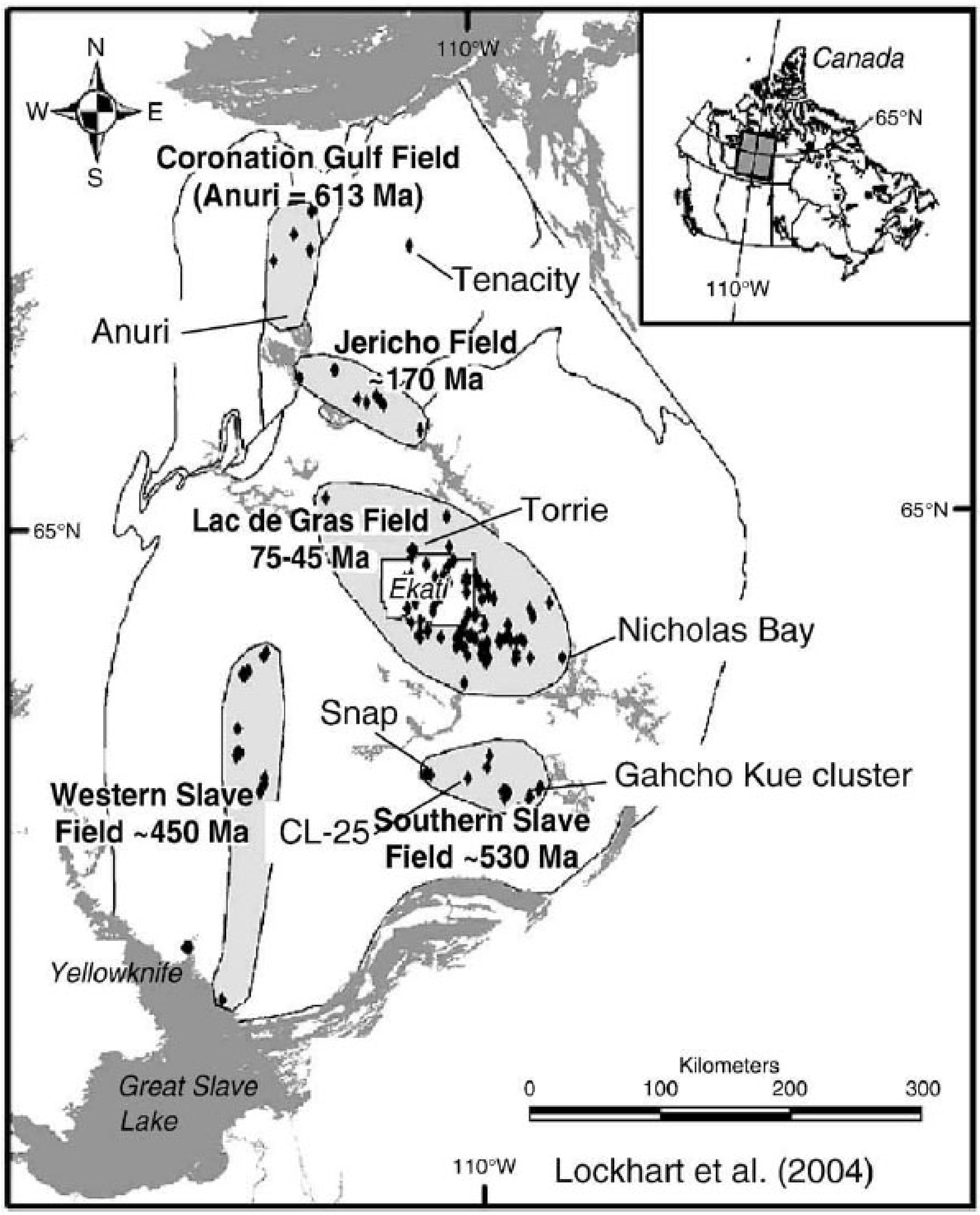
Metamorphic grade in Neoarchean supracrustal rocks ranges from greenschist to upper amphibolite facies in most of the province (Thompson 1978; Helmstaedt 2009). Links between metamorphism and plutonism are suggested by the spatial association between metamorphic isograds and granitoid plutons with the associated migmatitic domains (Helmstaedt 2009).

3.2 Kimberlites in the Slave Province

Helmstaedt (2009, 2014) indicates approximately 350 kimberlites have been discovered in the Slave Province that belong to at least six age groupings (Eocambrian, Cambrian, Ordovician-Silurian, Permian, Jurassic, and Cretaceous/Eocene; Figure 3.2-1). The major kimberlite fields are located within two corridors: a north-northeast trending corridor (including the western Slave and Coronation Gulf fields) and a less defined north-northwest trending central corridor encompassing the Southern Slave, Lac de Gras, and Jericho fields (Helmstaedt 2009; Figure 3.2-1). All the kimberlites, with the exception of the Tenacity pipe, occur within the CSST (Helmstaedt 2009). Diamond-bearing kimberlite pipes are restricted to the north-northwest trending central corridor within the Contwoyto Terrane (Figure 3.2-1). The diamond-bearing kimberlite pipes of the Project are within the Lac de Gras kimberlite field.

In the Lac de Gras region, no Phanerozoic cover rocks remain. Palynology studies of fossil-bearing shale xenoliths and disaggregated mud material within the Ekati kimberlite and other bodies of the Lac de Gras field indicate the presence of late-Cretaceous and early-Tertiary cover sediments at the time of emplacement (ages ranging from 45 to 75 Ma; Nowicki et al. 2004; Dominion Diamond 2013).

Figure 3.2-1 Kimberlite Fields of the Slave Province



Source: Amended from Lockhart et al. (2004) and Helmstaedt (2009).

~ = approximately; Ma = mega-annum or million years ago; ºN = degrees north; ºW = degrees west.

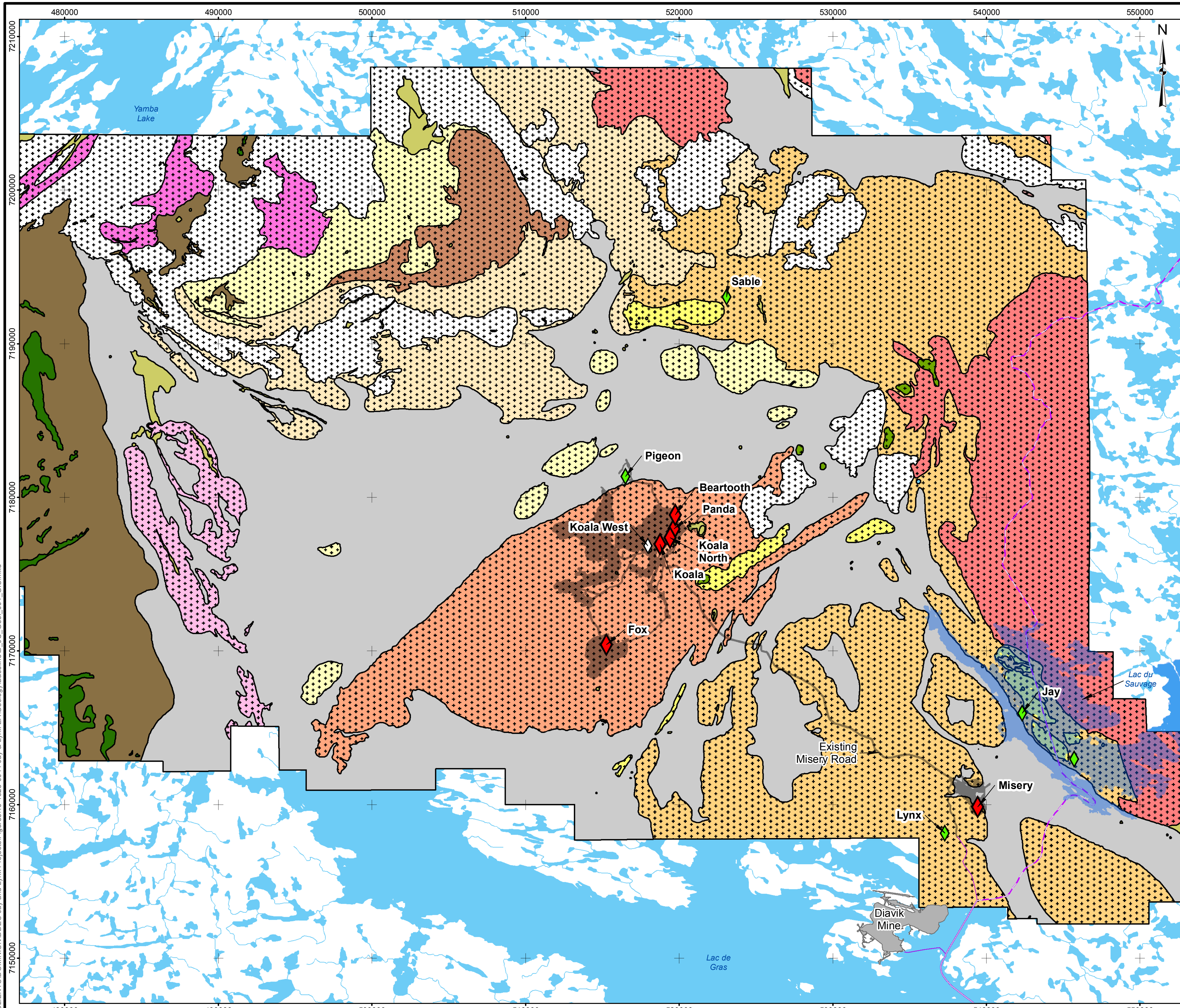
Thermal studies showed that the earlier sediments (ca. 90 to 100 Ma) were buried to depth exceeding 1,100 m, while the younger sediments suggest a considerably shallower burial depth, less than 200 m (Nowicki et al. 2004). This suggests a substantial erosion event had taken place by the time of kimberlite eruption (Stasiuk et al. 2003; Sweet et al. 2003; Nowicki et al. 2004). Preserved bedded wood-bearing horizons have been found to depth of hundreds of metres within some of the kimberlite pipes, suggesting that the current exposure level of these bodies is unlikely to be more than a few hundred metres below the original surface (Nowicki et al. 2004; Dominion Diamond 2013).

3.3 Geology of the Ekati Claim Block

Bedrock mapping of the Ekati claim block and surrounding area was undertaken by the Geological Survey of Canada between 1994 and 2001 (Thompson and Kerswill 1994; Kjarsgaard 2001). A review of previously published and internal Dominion Diamond geological work, combined with a review of high-resolution aeromagnetic data, was performed by Helmstaedt in 2002 (Helmstaedt 2002).

The Ekati claim block is located above the eastward-dipping Archean suture in the central Slave Province (Figures 3.1-1 and 3.2-1). Rock types within the Slave Province and defining the bedrock units at the Ekati claim block can be assigned to three broad lithostratigraphic groups: metasedimentary schists, migmatites, and various syn- and post-tectonic intrusive inclusions (Nowicki et al. 2003; Nowicki et al. 2004; Helmstaedt 2009; Dominion Diamond 2013), made up predominantly of granite, granodiorite, and tonalite. In addition, five mafic Proterozoic dyke swarms, ranging in age from ca. 2.23 to 1.27 Ga, intrude the area (LeCheminant and van Breemen 1994; Kjarsgaard 2001; Nowicki et al. 2003; Nowicki et al. 2004; Helmstaedt 2009; Dominion Diamond 2013).

The main lithological units that can be distinguished in the Ekati claim block according to Mineral Services Canada Inc. (2002) and Dominion Diamond (2013) are described in the following sections (Map 3.3-1; Figure 2.4-1).



LEGEND

- EKATI MINE FOOTPRINT
- DIAVIK MINE FOOTPRINT
- WINTER ROAD
- TIBBITT TO CONTWOYTO WINTER ROAD
- NORTHERN PORTION OF TIBBITT TO CONTWOYTO WINTER ROAD
- WATERCOURSE
- WATERBODY
- MINED KIMBERLITE
- BULK SAMPLED KIMBERLITE
- OTHER KNOWN KIMBERLITE
- BIOTITE GRANITE
- BIOTITE GRANODIORITE
- BIOTITE MUSCOVITE MONZOGRANITE
- DIORITE/QUARTZ DIORITE
- GREYWACKE
- HORNBLENDE TONALITE
- MAFIC INCLUSION
- MAGNETITE BIOTITE GRANODIORITE
- MIGMATITE
- PEGMATITE
- PORPHYRITIC BIOTITE GRANITE
- TONALITE
- TWO MICA GRANITE
- TWO MICA MONZONITE
- UNDEFINED
- WHITE BIOTITE MONZOGRANITE

REFERENCE

BEDROCK GEOLOGY PROVIDED BY MINERAL SERVICES CANADA INC. 2012
NATIONAL TOPOGRAPHIC BASE DATA (NTDB) 1:250,000
DATUM: NAD83 PROJECTION: UTM ZONE 12N

DOCUMENT

GEOLOGY BASELINE REPORT

5 0 5
SCALE 1:250,000 KILOMETRES

PROJECT
DOMINION DIAMOND
JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE
BEDROCK GEOLOGY MAP
EKATI CLAIM BLOCK

Golder Associates

PROJECT		13-1328-0041	FILE No. B_JC_Geol_001_GIS	
DESIGN	CG	11/08/14	SCALE AS SHOWN	REV A
GIS	JE	16/09/14	MAP 3.3-1	
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REVIEW	SM	16/09/14		

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3.3.1 Metasedimentary Rocks

All outcropping supracrustal rocks are greywacke-mudstone turbidites of the Archean assemblage, typical of the upper Yellowknife Supergroup. They are widespread in the central and southern section of the Ekati claim block, ranging in metamorphic grade from upper greenschist facies to migmatites (Mineral Services Inc. 2002; Dominion Diamond 2013). The western part of the Ekati claim block is dominated by migmatites that reflect melting of metasediments due to widespread granite intrusion and associated heat input (Mineral Services Inc. 2002; Dominion Diamond 2013).

Metasedimentary rocks are described as grey-green weathering psammite-pelite assemblages that locally show well-preserved primary depositional structures (e.g., bedding, flame structures; Mineral Services Canada Inc. 2002). The thinly bedded (1 to 20 centimetres [cm]) and moderately sorted psammites (wackes) contain up to 10 percent (%) feldspar and are biotite-rich. They are interlayered with less abundant, finer-grained pelitic layers (phyllites) and with minor occurrences of graphite-bearing schists (Mineral Services Canada Inc. 2002; Dominion Diamond 2013; Helmstaedt 2014).

Because the contacts are all intrusive, the lower contact of the original stratigraphic sequence and the nature of underlying rocks are unknown. The structural geometry, stratigraphic subdivision, and thickness of the metasediments are also unknown (Mineral Services Canada Inc. 2002; Dominion Diamond 2013; Helmstaedt 2014).

3.3.2 Archean Plutonic Rocks

All granitoid plutonic rocks present in the area are intrusive into the supracrustal rocks of the Yellowknife Supergroup. Three different groups of plutons can be distinguished based on their timing relative to regional deformation and metamorphism (Davis et al. 1994; Mineral Services Canada Inc. 2002; Dominion Diamond 2013). The three groups are described as follows:

- Group 1 is defined by deformed and recrystallized, dominantly tonalitic and trondhjemitic plutons, yielding uranium – lead (U-Pb) zircon ages between 2,682 and 2,649 Ma. This group is interpreted to have pre-dated the regional, syn-metamorphic D_2 fabric.
- Group 2 (pre- to syn-tectonic intrusions) is made up of massive to foliated, dominantly tonalitic plutons, yielding U-Pb zircon ages approximately 2,608 Ma, and is interpreted to have intruded syn- to late D_2. Syn-tectonic (ca. 2.64 to 2.60 Ga) diorites, tonalites, and granodiorites occur predominantly in the central and northern portions of the Ekati Mine claim block, while post-tectonic (ca. 2.59 to 2.58 Ga) granites (two-mica granite and biotite granite) form large plutons in the eastern and northeastern portions of the Ekati Mine claim block.
- Group 3 consists of massive biotite- and muscovite-biotite-bearing granites that yielded U-Pb ages between 2,599 and 2,582 Ma, postdating D_2 and peak regional metamorphism. Mineral Services Canada Inc. (2002) and Wright (1999) suggest that the main phase of the batholith is a massive, medium-grained rock composed of up to 45% of plagioclase; up to 25% quartz; 5% to 15% pinkish-orange grey, irregular patches of interstitial potassium feldspar; and 10% to 15% dark green to black subhedral plates of biotite. Commonly, biotite is altered to chlorite. Tourmaline, zircon, and minor rutile are common accessories. Kjarsgaard (2001) reports a crystallization age of ca. 2,611 Ma for a sample taken from the north-central portion of the Koala batholith.

3.3.3 Proterozoic Mafic Dykes

Five major Proterozoic mafic dyke swarms occur on the Ekati claim block, based on field geological mapping and aeromagnetic image interpretations (Mineral Services Canada Inc. 2002; Dominion Diamond 2013). The three oldest swarms, called Malley (2.23 Ga), MacKay (2.21 Ga), and Lac de Gras (2.03 Ga), are related to the Paleoproterozoic breakup of a larger Archean craton, of which the Slave Craton is a remnant (LeCheminant and van Breemen 1994; Mineral Services of Canada Inc. 2002; Helmstaedt 2009).

The collisional event that welded the Slave Craton into Laurentia is responsible for the onset of the Mesoproterozoic MacKenzie dyke swarm (1.27 Ga). A fifth dyke swarm, called “305” swarm, is interpreted to be related to the MacKenzie swarm (Mineral Services Canada Inc. 2002).

The preferential trends that characterize the different dyke swarms allow their differentiation both in the field and through image analysis. A summary of orientation and age of the five dyke swarms is presented in Table 3.3-1.

Table 3.3-1 Mafic Dyke Swarms Near the Ekati Mine

Dyke Swarm Name	Preferential Trend (degree)	Width (m)	Age (Ga)
"305" dyke swarm	305	10 to 30	uncertain
MacKenzie	330 to 340	up to 50	1.27
Lac de Gras	190	20 to 60	2.03
MacKay	80	up to 50	2.21
Malley	45	20 to 40	2.23

Source: Mineral Services Canada Inc. (2002).
m = metre; Ga = giga-annum or billion years ago.

Most of the dykes located within the Ekati claim block belong to the MacKenzie dyke swarm. These dykes reach up to 50 m in width and radiate from a mantle plume source located 700 km to the northwest. In the Lac de Gras area, this swarm strikes from 320° to 340°, with variable spacing. Only a few through-going structural lineaments are observed parallel to the MacKenzie dykes, suggesting that they were intruded along fractures formed simultaneously with lateral emplacement (Mineral Services Canada Inc. 2002; Wright 1999).

Along with the MacKenzie dykes, the Lac du Savage area shows also the presence of the “305” dykes. This dyke swarm, defined by 10 to 30 m wide dykes, does not show a continuous array. The “305” dykes resemble the MacKenzie dykes, and the number of structural lineaments that are parallel to them suggests that “305” dykes are related to the MacKenzie event (Mineral Services Canada Inc. 2002). The deviation of their orientation from the radiating pattern of the MacKenzie swarm could be explained by magma emplacement along pre-existing fractures.

3.3.4 Kimberlites

Approximately 150 kimberlite bodies have been discovered on the Ekati claim block, including the Panda, Koala, Koala North, Beartooth, Fox, and Misery pipes, which have supported mining operations. Including those on the Ekati claim block, more than 240 kimberlite bodies have been found in the region that has become known as the Lac de Gras kimberlite field (Mineral Services Canada Inc. 2002; Helmstaedt. 2009; Dominion Diamond 2013; Map 3.3-1).

The petrographic and geochemical characteristics of the Ekati kimberlites indicate that they belong to the petrographic class “Group-1 kimberlites” (Mitchell 1986; Nowicki et al. 2004). Field and Scott Smith (1999) suggest that the “Lac de Gras style” kimberlites represent one of at least three end-member models of kimberlite emplacement, designated “Type 3.” These kimberlites are characterized by relatively small, steep-sided, diatreme-like morphologies and, in particular, a predominance of relatively xenolith-poor, commonly bedded volcaniclastic kimberlite (VK) lithologies (Nowicki et al. 2004). These features indicate different emplacement and infilling processes to those that generated the characteristic root zones and diatreme of “southern African style” (Type 1) kimberlite or that formed the large shallow craters of “Prairie type” (Type 2) kimberlite, typical of the Fort a la Corne area in Saskatchewan, Canada (Nowicki et al. 2004).

The kimberlites represent the only Phanerozoic igneous activity on the Ekati claim block. Kimberlites show an apparent preference of plutonic hosts and are associated with lineaments (faults or dykes) of various orientations (Wright 1999; Nowicki et al. 2004; Dominion Diamond 2013). Age dating of more than 30 kimberlites at Ekati by rubidium-strontium (Rb-Sr) and U-Pb methods indicates a range of emplacement from ca. 45 to 75 Ma (Mineral Services Canada Inc. 2002; Heaman et al. 2004; Nowicki et al. 2004; Dominion Diamond 2013).

The majority of the pipes occur beneath lakes and are small, mostly less than 5 hectares (ha) but can extend to as much as 20 ha (Nowicki et al. 2004; Dominion Diamond 2013).

The infill of the kimberlites on the Ekati claim block can be broadly classified into six rock types (Dominion Diamond 2013):

- magmatic kimberlite – hypabyssal;
- tuffisitic kimberlite;
- primary volcaniclastic kimberlite (PVK);
- olivine-rich volcanoclastic kimberlites (VK);
- mud-rich, re-sedimented volcaniclastic kimberlite (RVK); and,
- kimberlitic sediments.

The Lac de Gras pipes are typically dominated by olivine-rich and xenolith-poor VK in which grading and sorting may be recognized to great depth (Mineral Services Canada Inc. 2002; Dominion Diamond 2013). In logging and geological models of the Ekati kimberlites, a broad distinction has been made between variably bedded, coarse- to fine-grained RVK (olivine and ash-rich tuff) and generally more homogeneous, olivine-rich, primary VK that typically contain abundant juvenile lapilli (Mineral Services Canada Inc. 2002; Dominion Diamond 2013). Typical diatreme facies material is rare, and only observed in the Fox pipe, where it is covered by a quartz-bearing epiclastic phase (Mineral Services Canada Inc. 2002).

Re-sedimented volcaniclastic kimberlite represents pyroclastic material that has been transported (e.g., by gravitational slumping and flow processes), likely from the crater ring into the open pipe, with the incorporation of surficial material (mudstone and plant material) (Dominion Diamond 2013).

Fine-grained sediments have been preserved as xenoliths and disaggregated material in kimberlite, which indicates that sedimentary cover was present at the time of the kimberlite emplacement.

While occasional peripheral kimberlite dykes are present, geological investigations did not provide any evidence for the presence of complex root zones or markedly flared crater zones of the kimberlites (Dominion Diamond 2013).

Economic mineralization is mostly limited to olivine-rich re-sedimented volcaniclastic and primary volcaniclastic types. The diamond grade is highly variable, with estimated average grades ranging from less than 0.05 carats per tonne (cpt) to more than 4 cpt (bulk sample estimates) (Dominion Diamond 2013). Approximately 10% of the 150 known kimberlite pipes in the Ekati claim block are of economic interest or have exploration potential (Dominion Diamond 2013). According to SRK Consulting (2007), the Ekati kimberlites contain rare, fine-grained disseminated pyrite (less than 0.5%) and abundant calcite.

4 PROJECT AREA GEOLOGY

4.1 Lithologies

Along with diamond-bearing kimberlite pipes, the Lac du Sauvage area has four principal rock types: metasedimentary rocks, two-mica granite, tonalite, and mafic dykes (Map 4.1-1). The kimberlites at Lac du Sauvage are located in proximity to the contact between the granitic rock and the metasediments (Maps 4.1-1, 6.1-1).

The description of the main lithological units of the Project area is based on Helmstaedt (2002), as well as the data published by Mineral Services Canada Inc. (2002), Nowicki et al. (2003, 2004), and Dominion Diamond (2013). The different lithological units are described in the following sections and are shown in Map 4.1-1.

4.1.1 Metasediments

Archean-aged (greater than 2.66 Ga) metasedimentary rocks in the Project area consist of grey-green weathering psammite-pelite assemblages, which were produced by metamorphism of muddy to sandy rocks (Mineral Services Canada Inc. 2002; Dominion Diamond 2013). Psammite (also known as wacke) is thinly bedded, biotite rich, and contains up to 10% feldspar. The psammite units are interlayered with finer-grained phyllites and minor graphite-bearing schists.

The metasediments typically contain trace (less than 0.5%) fine-grained disseminated pyrite (FeS_2), pyrrhotite ($Fe_{[1-x]}S$), and chalcopyrite ($CuFeS_2$), but can occur locally at concentrations of up to 5% on a centimetre scale (Nowicki et al. 2003; Dominion Diamond 2013). Carbonate minerals, including primarily calcite ($CaCO_3$), dolomite ($[Ca,Mg]CO_3$), and, to a lesser extent, siderite ($FeCO_3$) occur as fracture fillings (Nowicki et al. 2003; Dominion Diamond 2013; Golder 2014).

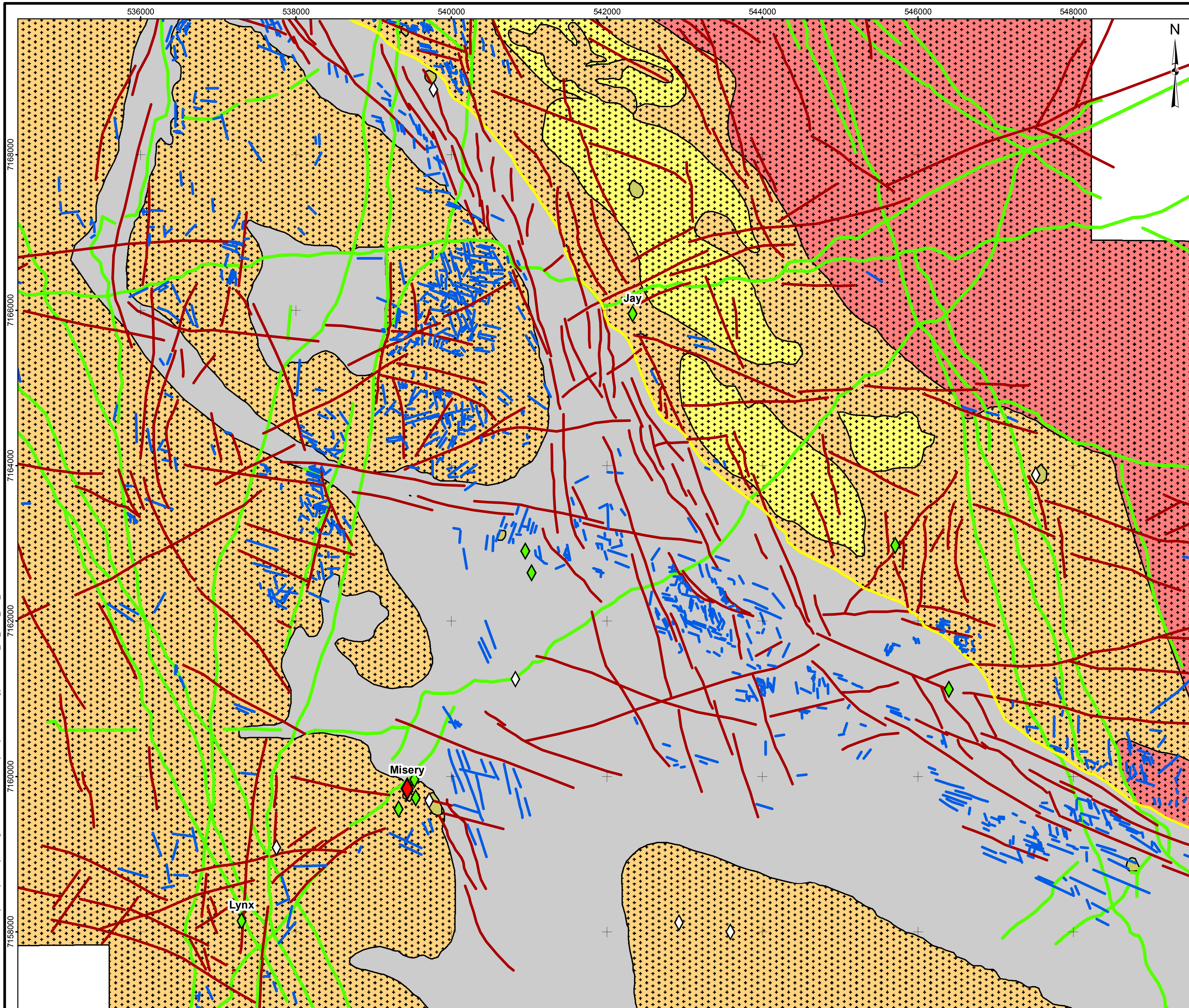
4.1.2 Migmatites

Contact zones between metasedimentary rocks and granitoid bodies are usually defined by sediment-derived migmatites. Near the transition from metasediments to granitoid intrusions, a migmatitic leucosome defines the zone in the metapelitic layers. As the amount of leucosome increases, the psammitic layers are affected, producing a gneissose rock made up of remnants of psammitic layers and foliated lenses of biotite-sillimanite melanosome in a relatively homogeneous matrix of quartz, feldspar, cordierite, and biotite (Mineral Services Canada Inc. 2002). Compositional layers may be complexly folded on the small scale.

4.1.3 Granites

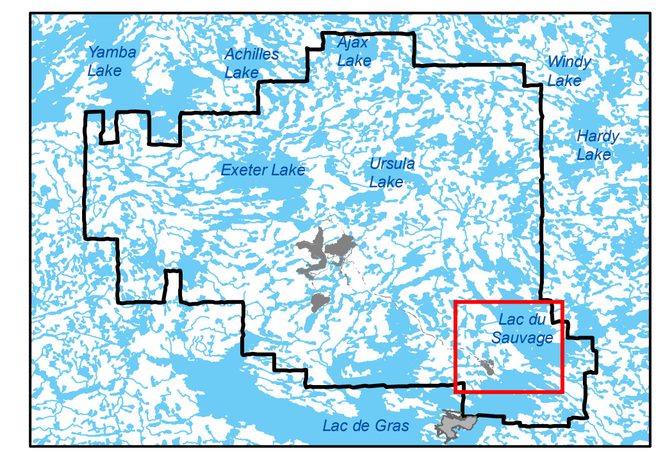
The Project area is dominated by the presence of post-tectonic intrusions, composed mainly of two-mica granite and biotite granite. Presence of syn-tectonic intrusions (tonalites) dominates the eastern section of the Lac du Sauvage area.

Locally, the granitoids may contain biotite-rich mafic xenoliths and rare cubic pyrite grains, but are generally medium- to coarse-grained and weakly foliated to massive, with a modal composition of 40% quartz, 45% feldspar, and 15% biotite. Granitoid rocks hosts rare (less than 0.5%), disseminated sulphide minerals, including pyrite and chalcopyrite (SRK Consulting 2007). Carbonate minerals (unspecified) occur as fracture fillings (Golder 2014).



LEGEND

- EKATI CLAIM BLOCK
- EKATI MINE FOOTPRINT
- DIAVIK MINE FOOTPRINT
- WATERCOURSE
- WATERBODY
- MINED KIMBERLITE
- BULK SAMPLED KIMBERLITE
- OTHER KNOWN KIMBERLITE
- FAULT
- POTENTIAL STRUCTURAL CONTROLLED CONTACT
- JOINT
- DYKE
- METASEDIMENTS
- PORPHYRITIC BIOTITE GRANITE
- TONALITE
- TWO MICA GRANITE
- UNDEFINED



REFERENCE

BEDROCK GEOLOGY PROVIDED BY MINERAL SERVICES CANADA INC. 2012
DATUM: NAD83 PROJECTION: UTM ZONE 12N

DOCUMENT

GEOLOGY BASELINE REPORT

1 0 1

SCALE 1:50,000 KILOMETRES

PROJECT

DOMINION DIAMOND

JAY PROJECT
NORTHWEST TERRITORIES, CANADA

TITLE

BEDROCK GEOLOGY MAP
LAC DU SAUVAGE

Golder Associates

PROJECT	13-1328-0041		FILE No. B_JC_Geol_002_GIS
DESIGN	LZ	15/01/14	SCALE AS SHOWN REV A
GIS	LZ/LR	16/09/14	
CHECK	CG	16/09/14	MAP 4.1-1
REVIEW	SM	16/09/14	

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4.1.3.1 Two-Mica Granite

Two-mica granites have sharp intrusive contacts with the older tonalites and are intruded by porphyritic biotite granite of the Duchess granite (Map 4.1-1). The nature and geometry of the contact between the two-mica granite and the metasedimentary rocks at the Project area is still under investigation (Dominion Diamond 2013; Helmstaedt 2014).

The two-mica granite are defined as fine- to medium-grained granites with a distinctive white to light-grey weathered surface and typically consist of approximately equal proportions of quartz, plagioclase, and K-feldspar, and muscovite and biotite. According to Dominion Diamond (2013), the two-mica granite contains 3% to 15% biotite and muscovite. Numerous coarse-grained dykes and small stocks of tourmaline-bearing pegmatites accompany them (Dominion Diamond 2013). Garnet, cordierite, and sillimanite occur in association with inclusions of metasediments.

These granites are generally massive, but locally have a contact-parallel planar fabric near the margins. High-strain zones within this granite have been observed in the northwest arm of the Lac du Savage (Mineral Services Canada Inc. 2002).

4.1.3.2 Porphyritic Biotite Granite

Porphyritic biotite granite occurs in the Duchess granite, a large batholith at the eastern boundary of the Project area, and as a separate intrusion near Ajax Lake, along the northern claim group boundary. The Duchess granite, which is clearly intrusive into the adjacent two-mica granite, thus appears to be one of the youngest Archean intrusive units in the region (Mineral Services Canada Ltd. 2002).

The rocks are described as light red to pinkish white weathering, medium- to coarse-grained, K-feldspar-rich granite. The length of the K-feldspar ranges from 1 to 3 cm, and the texture varies from porphyritic to megacrystic, with the K-feldspar locally displaying a preferred orientation. The rocks contain 5% to 10% biotite. Primary biotite appears to be absent, but apparently secondary muscovite, replacing biotite, is common.

This granite is massive and lacks any signs of penetrative deformation (Mineral Services Canada Inc. 2002).

4.1.3.3 Tonalite

Tonalite occurs in the Project area as elongated bodies within the two-mica granite on the eastern part of the Lac du Sauvage area. It consists of approximately 45% plagioclase, 42% quartz, up to 10% biotite, and traces of K-feldspar (Wright 1999; Mineral Services Canada Inc. 2002; Dominion Diamond 2013).

4.1.4 Pegmatite

The intrusive bodies described in the previous sections are accompanied by pegmatitic bodies showing variable extensions and geometries. The pegmatites may be related mainly to the granitoid bodies belonging to the Group 3 suites of intrusions (Mineral Services Canada Inc. 2002; Dominion Diamond 2013). At the contact zones between granitoid units and metasediments, elongate bodies of coarse-grained biotite plus muscovite pegmatite intruded the metasediments along brittle features opened along the foliation planes. Mainly tourmaline-bearing coarse-grained dykes define pegmatites accompanying the two-mica granite intrusions.

4.1.5 Mafic Dykes (Diabase)

The Lac du Sauvage area is intersected by three main mafic dyke swarms (Kjarsgaard 2001; Mineral Services Canada Inc. 2002; Stubley 2005; Aurora Geosciences Ltd. 2013; Dominion Diamond 2013). Based on their orientation, the dykes belong mainly to the Malley, MacKenzie, and Lac de Gras dyke swarms. No clear indication is available of the discontinuity sets that dissect the mafic dykes in this area. The dykes characterizing the Project area are considered to be near vertical with sharp or fractured contacts of variable orientation (Dominion Diamond 2013). The dykes within the Project area are very dark grey to black, fine-grained, and contain a variable percentage of magnetite and traces of pyrite and chalcopyrite, with lesser amounts of pyrrhotite (Dominion Diamond 2013).

4.1.6 Jay Kimberlite Pipe

The Jay kimberlite pipe (Jay pipe) was discovered in April 1993 by diamond drilling of a pronounced airborne geophysical anomaly. In 2005, two delineation core holes intersected the pipe. Nine delineation core holes and two geotechnical holes totalling 3,077 m were completed at the Jay pipe in 2007. The geotechnical holes drilled to the southwest of the kimberlite detected a large regional structure and the presence of regional geological contacts. Two campaigns of reverse circulation drilling (1996 and 2006) provided geological data, diamond grade estimates, and diamond parcels for valuation (Dominion Diamond 2013).

The Jay pipe is hosted within granitic rocks, ranging from granite to granodiorite in composition. A regional contact with meta-sedimentary rocks occurs to the west, and a diabase dyke trending approximately east–west occurs to the north of the pipe. Regional structures interpreted from geophysics extend east–west to the north of the Jay pipe and north–south to the west of the pipe. The east–west structure to the north of the Jay pipe is partly associated with the diabase dyke; however, other zones of increased jointing have also been recognized in two core holes. The north–south structure is associated with the metasediment–granite contact and reoccurs throughout the 80 m drilled intersection of metasediments.

The Jay pipe is under Lac du Sauvage, overlain by approximately 30 m of water and 5 to 10 m of overburden.

The plan surface area of the Jay pipe is approximately 13 ha, and it has an east–west extent of 375 m and a north–south extent of 350 m. The Jay pipe has a roughly circular outline in plan view and a steep-sided vase shape. The sides of the pipe appear to be roughly planar with minor concavities and bulges based on interpretation of drilling results. The shape, particularly the north side, is believed to be coincident with geological structures.

The Jay pipe is divided into the following three domains:

- Re-sedimented volcaniclastic kimberlite (RVK): uppermost 110 to 170 m in stratigraphic thickness. Small-scale chaotic bedding is present, defined by waves of silty to sandy laminates and variations in olivine abundance. Variable amounts and sizes of black, pale grey, blue-grey, blue-green, brown, and tan mudstones and siltstone xenoliths are present. In core intersections, the RVK domain is composed of repeating, large-scale graded mega-beds defined by mud, breccia, and olivine content. The upper portion of the mega-beds is composed of olivine-poor, mud- and clay-rich unconsolidated mudstone to RVK. Small-scale bedding is present but is very-fine grained. Rare shale breccia is present.
- Transitional kimberlite (TransK): 30 to 70 m thick package of interbedded RVK and volcaniclastic kimberlite (VK) material of varying degrees of alteration. The transition from RVK to TransK is indistinct and is marked by the appearance of small interbeds of fresh to highly altered, dark to pale coloured VK.
- Primary volcaniclastic kimberlite (PVK): primarily olivine-rich, competent, grey-blue to green PVK with partially altered olivine set in a serpentinized matrix. The upper contact of the VK domain is marked by the absence of RVK and presence of highly altered, pale-coloured VK material. Small, irregularly shaped, mudstone and granitic xenoliths are present, but decrease in abundance with depth.

These domains are sub-horizontal and are interpreted to extend the width of the pipe. Boundaries between the domains are transitional in nature (Dominion Diamond 2013).

5 QUATERNARY GEOLOGY

Multiple periods of glaciation during the Quaternary era have affected the Lac de Gras area (Dredge et al. 1994; Nowicki et al. 2004). Nowicki et al. (2004) attribute current observed glacial features to the last (Late Wisconsin) glaciation. Glacial deposits in the Ekati area are predominantly tills thought to be associated with the Late Wisconsinan Laurentide Ice Sheet (Nowicki et al. 2004; Dominion Diamond 2013). These till deposits range in thickness from veneers (less than 2 m) to blankets (2 to 5 m) to hummocky deposits (more than 5 m up to 15 m). Glaciofluvial deposits are also present, the most prominent being an extensive network of sinuous eskers that transect the Ekati claim block and feed into a large southeast–northwest trending trunk esker.

Lacustrine deposits occur in association with the numerous lakes on the claim block. Thin alluvial deposits have formed along streams, and pond deposits have accumulated in shallow depressions.

6 STRUCTURAL GEOLOGY OF THE PROJECT AREA

A quantitative evaluation of the orientation of the brittle structures (faults, joint, lineaments) affecting the investigated area was not conducted as part of this study. However, ALS-HRDEM shaded relief image interpretation and the review of the available literature data allowed a preliminary evaluation of the structural setting of the investigated area.

As stated in the previous section, the Jay kimberlite pipe is emplaced at the contact between the metasediments and the two-mica granite (Map 6.1-1). The main structural feature that characterizes the area is the northwest-southeast trending contact between the metasedimentary host rock and the two-mica granite that runs mainly below Lac du Sauvage. Several studies (Mineral Services Canada Inc. 2002; Stubley 2005; Helmstaedt 2009, 2014) suggest that the emplacement of the two-mica granite in this sector of the Slave Province is structurally controlled. Granites intruded the metasediments along steeply dipping northwest–southeast trending faults, resulting in a sheet-like type of intrusion. Thus, the Lac du Sauvage area is likely defined by a steeply dipping contact zone between the metasediments and the two-mica granite (Helmstaedt 2014).

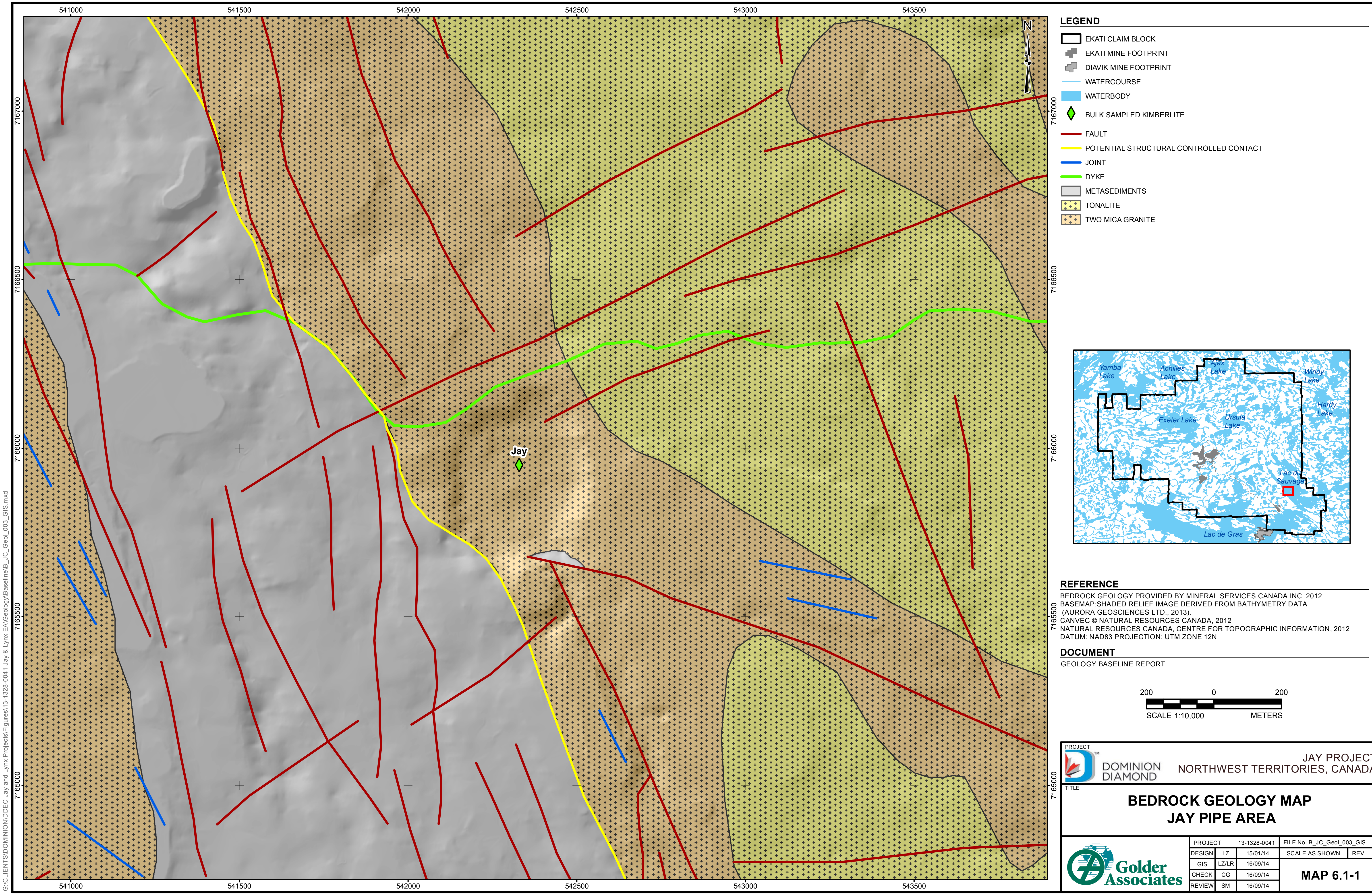
Diamond drill holes drilled in the Jay pipe area seem to support this interpretation. The contact appears to be defined by an intermixing zone of granite and metasediments over a substantial depth interval of at least 60 m. According to Helmstaedt (2014) and Golder's 2013 interpretation of the existing diamond drill holes (Golder 2013), there is no clear indication of the presence of the brittle feature (fault) that allowed the intrusion of the two-mica granite.

Mineral Services Canada Inc. (2002) reported a systematic study of the brittle structures conducted by Wright (1999) in the central sector of the Ekati claim block that included part of the Koala Batholith and metasedimentary rocks north of it. This systematic study and the ALS-HRDEM shaded relief image interpretation shows that the lithology outcropping in the investigated area (metasediments, two-mica granite, and tonalite) are crosscut by discrete fractures (both faults and joints). The fractures span a wide range of different orientations but with a strong predominance of east-northeast and north–south strike direction (Map 4.1-2). ALS-HRDEM shaded relief images show that the detected brittle structures are generally heterogeneously distributed within the investigated area, with some local clusters especially near the Jay pipe (Maps 4.1-1, 6.1-1).

Faults mapped on ALS-HRDEM shaded relief images and orthophoto images are defined mainly by straight traces, with a continuity that can reach hundreds of metres. Fault-parallel joint sets are expected to be persistent and interconnected, and may be vertically and horizontally continuous.

According to Wright (1999), ALS-HRDEM shaded relief image interpretation, and Golder's experience at the Ekati and Diavik mining operations, the structural setting of the Project area is defined by the following:

- a northeast–southwest trending regional fault set and associated parallel joint set;
- a north (mainly north-northwest)–south (mainly south-southeast) trending regional fault set and associated joint set; and,
- a mainly northwest–southeast trending fault set, most likely related to the northeast-southwest trending set.



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Jay
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LEGEND
EKATI CLAIM BLOCK
EKATI MINE FOOTPRINT
DIAVIK MINE FOOTPRINT
WATERCOURSE
WATERBODY
BULK SAMPLED KIMBERLITE
FAULT
POTENTIAL STRUCTURAL CONTROLLED CONTACT
JOINT
DYKE
METASEDIMENTS
TONALITE
TWO MICA GRANITE
Yamba Lake
Achilles Lake
Ajax Lake
Windy Lake
Hardy Lake
Exeter Lake
Ursula Lake
Lac du Sauvage
Lac de Gras
REFERENCE
BEDROCK GEOLOGY PROVIDED BY MINERAL SERVICES CANADA INC. 2012
BASEMAP:SHADED RELIEF IMAGE DERIVED FROM BATHYMETRY DATA
(AURORA GEOSCIENCES LTD., 2013).
CANVEC © NATURAL RESOURCES CANADA, 2012
NATURAL RESOURCES CANADA, CENTRE FOR TOPOGRAPHIC INFORMATION, 2012
DATUM: NAD83 PROJECTION: UTM ZONE 12N
DOCUMENT
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JAY PROJECT
NORTHWEST TERRITORIES, CANADA
TITLE
BEDROCK GEOLOGY MAP
JAY PIPE AREA
Golder Associates
PROJECT 13-1328-0041
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GIS LZ/LR 16/09/14
CHECK CG 16/09/14
REVIEW SM 16/09/14
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Although not detectable by ALS-HRDEM shaded relief image interpretation, shallow-dipping or horizontal joints may be present. Such joints are common throughout northern regions that have been glaciated and may be the result of isostatic rebound following glacial retreat.

6.1 Geology of the Jay Pipe Area

As stated in the previous section, the contact between the two-mica granite and the metasediments is interpreted to be steeply dipping toward the east. The contact can be defined by an intermixing zone over a substantial depth interval. East of the Jay pipe, the two-mica granite is intruded by a small tonalite pluton. Helmstaedt (2014) suggests that the contact between the granite and the tonalite is a steeply dipping tight lithological discontinuity.

The ALS-HRDEM shaded relief image interpretation of the Jay pipe area has indicated the following structural orientations:

- An east-northeast trending fault set follows a regional fault set. Despite its regional importance, the fault north of the Jay pipe does not show any field evidence of any major deformation along it (either brittle or ductile; Helmstaedt 2014). Thus, this fault is not considered to be characterized by a thick fault damage zone.
- A southeast trending fault set, which intersects the east-northeast trending one, is potentially responsible for the two-mica granite pluton emplacement. The interaction between these two fault sets may result in a rock mass with a high degree of fragmentation along the northwest corner of the future Jay Pit. Unlike the east-northeast trending fault, the east-southeast trending fault set seems to have accommodated some regional deformation. According to Helmstaedt (2014), thicker fault damage zone (approximately 40 to 60 m) and ductile deformation features may be expected on faults belonging to this fault set.

The mineralogy of the fault infill material has not been defined.

The Jay pipe area is characterized by the presence of a mainly east-west trending mafic dyke located north of the Jay pipe. The ALS-HRDEM data and TFM and EM geophysical data show a surficial width ranging from 90 to 100 m. The surficial dyke trace becomes winding at the contact between the metasediments and the two-mica granite. The presence of north-northwest trending features within the metasediments (contact zone, faults, and foliation planes) may have potentially controlled the dyke intrusion. Due to the main dyke trend, it is possible to classify it as a mafic dyke belonging to the Malley dyke swarm.

At this stage of the investigation there is no clear indication of i) the local orientation of the foliation of the metasediments, ii) the local joint set pattern cutting both the metasediments and the granitic rock, or iii) the thickness of the contact parallel magmatic foliation within the two-mica granite that has potentially developed due to pluton emplacement. Incipient or pervasive contact parallel magmatic foliation within the two-mica granites may occur with proximity to the contact, increasing the local anisotropy of the rock masses, especially on the west wall of the future Jay Pit.

7 SUMMARY

The Project area is situated in an Arctic Climatic Region, at an elevation of approximately 465 masl (ranging from 400 to 500 masl). The topography is generally flat, and the terrain is typical Arctic tundra characterized by flat, wet, or swampy terrain with little vegetation.

The Ekati claim block is located above the eastward-dipping Archean suture in the central Slave Province. The bedrock geology comprises supracrustal rocks (metamorphosed greywacke-mudstone turbidites) of the Neoarchean post-Yellowknife Supergroup that are intruded by syn- to post-tectonic plutons, made up predominantly of granite, granodiorite, and tonalite. In addition, five mafic Proterozoic dyke swarms, ranging in age from ca. 2.23 to 1.27 Ga, intrude the area. The Lac du Sauvage area is intersected by several mafic dykes, belonging mainly to the Malley, MacKenzie, and Lac de Gras dyke swarms. No clear indication is available on local joint set pattern that characterizes the mafic dykes in this area.

The regional structural setting of the Jay Project area is defined by the following:

- a northeast–southwest trending regional fault set and associated parallel joint set;
- a north (mainly north-northwest)–south (mainly south-southeast) trending regional fault set and associated parallel joint set; and,
- a mainly northwest–southeast trending fault set, most likely related to the northeast–southwest trending one.

The Project area contains four principal rock types: metasedimentary rocks, two-mica granite, tonalite, and mafic dykes.

The local structural setting is characterized by the following faults:

- an east-northeast trending fault set that follows the regional fault trend; and,
- a southeast trending fault set, which intersects the east-northeast trending one and may be responsible for the two-mica granite pluton emplacement.

The mineralogy of the fault infill material has not been characterized.

Shallow-dipping or horizontal joints may be present. Such joints are common throughout northern regions that have been glaciated and may be the result of isostatic rebound following glacial retreat.

The main structural feature that characterizes the entire investigated area is the northwest–southeast trending contact between the metasedimentary rocks and the two-mica granite. The thickness of the metasedimentary rocks is not known, and the nature of the contact between the metasediments and the two-mica granite has been debated. The emplacement of the two-mica granite in this sector of the Slave Province may have been structurally controlled. Granites intruded the metasediments along steeply dipping northwest–southeast trending faults, resulting in a sheet-like type of intrusion. Diamond drill holes drilled in the Jay pipe area suggest that the contact may be defined by an intermixing zone of granite and metasediments over a substantial depth interval. An apparent zone of mixed granite and metasediments of approximately 60 m seems to define the intrusive contact.

The mafic dykes that cut the lithologies outcropping in the investigated area are defined by variable thickness, with a mean value of approximately 50 m. These dykes are generally steeply dipping, and the contacts between the dykes and the host rocks is expected to be tight.

Currently there is no clear indication of i) the local orientation of the foliation of the metasediments, ii) the detailed fracture network cutting both the metasediments and the granitic rock, or iii) the thickness of the contact parallel magmatic foliation within the two-mica granite that has potentially developed due to pluton emplacement. Incipient or pervasive contact parallel magmatic foliation within the two-mica granites has to be expected approaching to the contact, increasing the local anisotropy of the rock masses, especially on the west wall of the future Jay Pit.

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9 GLOSSARY

Term	Definition
Accretionary prism	Sediments that are accreted onto the non-subducting tectonic plate at a convergent plate boundary.
All-season road	An all-season road is a road that is motorable all year by the prevailing means of rural transport.
Alluvium, alluvial deposit	A general term for all detrital material deposited or in transit by streams, including gravel, sand, silt, clay, and organic debris, and all variations and mixtures of these.
Amphibolite facies	Amphibolite facies is a result of continuing burial and thermal heating after greenschist facies is exceeded. Further burial and metamorphic compression (but little extra heat) will lead to granulite facies metamorphism; with more advanced heating the majority of rocks begin melting in excess of 650°C to 700°C in the presence of water.
Arctic tundra	Arctic tundra occurs in the far Northern Hemisphere, north of the taiga belt. The word "tundra" usually refers only to the areas where the subsoil is permafrost, or permanently frozen soil.
Baseline	Background or reference; conditions before Project development.
Basement rock	Rock generally considered to be tectonically stable.
Bedrock	The solid rock (harder than 3 on Moh's scale of hardness) underlying soils and the regolith in depths ranging from zero (where exposed to erosion) to several hundred metres.
Biotite	Common phyllosilicate mineral within the mica group, with the approximate chemical formula $K(Mg,Fe)_3AlSi_3O_{10}(F,OH)_2$.
Blanket	A mantle of unconsolidated materials thick enough to mask minor irregularities in the underlying unit but which still conforms to the general underlying topography. As used in this report, a blanket is generally greater than 100 cm thick and has a surface form similar to a particular material's genesis.
Brittle structure	Planar features, which have experienced displacement, such as faults and fractures zones.
Breccia	A fragmental rock whose fragments are angular.
Cambrian	First geological period of the Paleozoic Era, lasting from 541.0 ± 1.0 to 485.4 ± 1.9 million years ago; is succeeded by the Ordovician.
Canadian Shield	Large area of exposed Precambrian igneous and high-grade metamorphic rocks (geological shield) that forms the ancient geological core of the North American continent (North American or Laurentia craton), covered by a thin layer of soil. It is an area mostly composed of igneous rock which relates to its long volcanic history. It has a deep, common, joined bedrock region in Eastern and central Canada and stretches north from the Great Lakes to the Arctic Ocean, covering over half of Canada.
Chlorite	Phyllosilicate mineral commonly found in igneous rocks as an alteration product of mafic minerals such as pyroxene, amphibole, and biotite.
Cleavage	Type of planar rock feature that develops as a result of deformation and metamorphism. The degree of deformation and metamorphism along with rock type determines the kind of cleavage feature that develops. Generally these structures are formed in fine grained rocks composed of minerals affected by pressure solution.
Contact zone	Zone where plutonic igneous rock intrude into the surrounding rock. Contact refers to the effect on rocks of conductive or convective heat transfer.
Craton	Part of the Earth's crust that has been stable and little deformed for a prolonged period of time.
Cretaceous	Period of geologic time beginning 135 million years ago and ending 65 million years ago.
Diabase	A dark coloured, fine- to medium-grained igneous intrusive rock.
Diatreme	A diatreme is a breccia filled volcanic pipe that was formed by a gaseous explosion. Kimberlite volcanic pipes associated with diamond occurrences are usually considered to be volatile charged piercement structures or diatreme volcanic features from the lower crust or upper mantle.

Term	Definition
Diatreme facies	Middle unit of three distinct units into which geologists have divided kimberlites, based on their morphology and petrology.
Dyke	Sheet of rock that formed in a crack in a pre-existing rock body.
Eocambrian	Term that refers to the latest (youngest) portion of time in the Precambrian Eon or to the uppermost Precambrian sediments which were continuously deposited across the Precambrian-Cambrian time boundary.
Eocene	Major division of the geologic timescale and the second epoch of the Paleogene Period in the Cenozoic Era. It lasts from 56 to 33.9 million years ago.
Epiclastic	It defines the texture of mechanically deposited sediments consisting of detrital material from pre-existent rocks.
Eskers	An esker is a long, winding ridge of stratified sand and gravel believed to form in ice-walled tunnels by streams which flowed within and under glaciers. After the retaining ice walls melt away, stream deposits remain as long winding ridges.
Facies	In geology, a facies (metamorphic facies) is a set of metamorphic mineral assemblages that were formed under similar pressures and temperatures.
Fault	Planar fracture or discontinuity in a volume of rock, across which there has been displacement along the fractures as a result of earth movement.
Fault damage zone	Damaged area around the fault produced during slip.
Feldspar	Group of rock-forming tectosilicate minerals that make up as much as 60% of the Earth's crust. Feldspars crystallize from magma as veins in both intrusive and extrusive igneous rocks and are also present in many types of metamorphic rock.
Fines	Silt and clay particles.
Fluvial	Relating to a stream or river.
Foliation	Repetitive layering in metamorphic rocks. Each layer may be as thin as a sheet of paper, or over a metre in thickness. The word comes from the Latin *folium*, meaning "leaf," and refers to the sheet-like planar structure.
Footprint	The proposed development area that directly affects the soil and vegetation components of the landscape.
Geochemistry	The chemistry of the composition and alterations of solid matter such as sediments or soil.
Geology	The study of the Earth’s crust, its structure, the chemical composition and the physical properties of its components.
Giga-annum	The unit of 10^9 or one billion years.
Glaciofluvial deposit	Deposit pertaining to a stream or river deriving its water from the melting of ice. The water reworks sedimentary material originally carried by the ice, and deposits it in valleys
Gneiss	Type of rock formed by high-grade regional metamorphic processes from pre-existing formations that were originally either igneous or sedimentary rocks. It is foliated (composed of layers of sheet-like planar structures). The foliations are characterized by alternating darker and lighter coloured bands, called "gneissic banding."
Granite	A coarsely crystalline igneous intrusive rock composed of quartz, potassium feldspar, mica, and/or hornblende.
Granitoid	Rocks with a composition the same as, or similar to granite.
Granodiorite	A group of coarse-grained plutonic rocks intermediate in composition between quartz diorite and quartz monzonite.
Greenstone belt	Zones of variably metamorphosed mafic to ultramafic sequences with associated sedimentary rocks that occur within Archean and Proterozoic cratons between granite and gneiss bodies.

Term	Definition
Greenschist facies	Greenschist facies results from low temperature, moderate pressure metamorphism. Temperatures of approximately 400°C to 500°C (750°F to 930°F) and depths of approximately 8 to 50 kilometres (5 to 31 miles) are the typical envelope of greenschist facies rocks. The equilibrium mineral assemblage of rocks subjected to greenschist facies conditions depends on primary rock composition.
Greywacke	Variety of sandstone generally characterized by its hardness, dark colour, and poorly sorted angular grains of quartz, feldspar, and small rock fragments or lithic fragments set in a compact, clay-fine matrix. It is a texturally immature sedimentary rock generally found in Palaeozoic strata.
Hypabyssal	Applied to medium-grained, intrusive igneous rocks that have crystallized at shallow depth below the Earth's surface.
Hornblende	Complex inosilicate series of minerals (ferrohornblende – magnesiohornblende). It is not a recognized mineral in its own right, but the name is used as a general or field term to refer to a dark amphibole.
Hummocky	A very complex sequence of slopes extending from somewhat rounded depression or kettles or various sizes to irregular to conical knolls or knobs. There is a general lack of concordance between knolls and depressions.
Intrusive rock	Also called plutonic rock, is an igneous rock formed from magma forced into older rocks at depths within the Earth's crust, which then slowly solidifies below the Earth's surface, though it may later be exposed by erosion.
Isostatic rebound	Rise of land masses that were depressed by the huge weight of ice sheets during the last glacial period, through a process known as isostasy.
Joint set	Group of joints showing near parallel orientation.
Jurassic	Geologic period and system that extends from 201.3± 0.6 to 145± 4 million years ago, from the end of the Triassic to the beginning of the Cretaceous.
Kimberlite	Igneous rocks that originate deep in the mantle, and intrude the Earth's crust. These rocks typically form narrow pipe-like deposits that sometimes contain diamonds.
Kimberlite diatreme	Kimberlite diatremes are 1 to 2 km deep, generally carrot-shaped bodies, which are circular to elliptical at surface and taper with depth. The dip contact with the host rocks is usually 80 to 85 degrees. The zone is characterized by fragmented volcaniclastic kimberlitic material and xenoliths plucked from various levels in the Earth's crust during the kimberlites journey to surface.
Kimberlite pipe	Vertical structures on which kimberlites occur in the Earth's crust.
Lacustrine	Sediment that have been transported or deposited by water or wave action. Generally consisting of stratified sand, silt or clay deposited on a lake bed or moderately well sorted and stratified sand and coarser material.
Lithology	The systematic description of sediment and rocks, in terms of composition and texture.
Mafic	A term to describe minerals that contain iron and magnesium.
Mafic dyke swarm	Large geological structure consisting of a major group of parallel, linear, or radially oriented dykes intruded within continental crust. They consist of several to hundreds of dykes emplaced more or less contemporaneously during a single intrusive event and are magmatic and stratigraphic. Such dyke swarms may form a large igneous province and are the roots of a volcanic province.
Mean	Arithmetic average value in a distribution.
Mega-annum	The unit of 10^6 or one million years.
Mesoarchean	Geologic era within the Archean, spanning 3,200 to 2,800 million years ago.
Mesoproterozoic	Geologic era that occurred from 1,600 to 1,000 million years ago. The Mesoproterozoic was the first period of Earth's history of which a respectable geological record survives.
Metasediments	Sedimentary rocks that have been modified by metamorphic processes.

Term	Definition
Migmatite	Rock that is a mixture of metamorphic rock and igneous rock. It is created when a metamorphic rock such as gneiss partially melts, and then that melt recrystallizes into an igneous rock, creating a mixture of the unmelted metamorphic part with the recrystallized igneous part.
Mudstone	Fine grained sedimentary rock whose original constituents were clays or muds. Grain size is up to 0.0625 millimetres (0.0025 inches) with individual grains too small to be distinguished without a microscope. With increased pressure over time the platey clay minerals may become aligned, with the appearance of fissility or parallel layering.
Mylonitization	Rock deformation produced by intense microbrecciation without appreciable chemical alteration of granulated materials.
Neoarchean	Geologic era within the Archaean spanning the period of time from 2,800 to 2,500 million years ago.
Opaque minerals	Mineral that does not transmit plane polarised light due to either absorption and/or dispersion of light. Iron oxides and sulphides are often opaque minerals.
Ordovician	Geologic period and system, the second of six of the Paleozoic Era, and covers the time between 485.4 ± 1.9 to 443.4 ± 1.5 million years ago.
Orogenic belt	The process of mountain formation, especially by a folding and faulting of the Earth's crust.
Orthophoto	An aerial photograph geometrically corrected ("orthorectified") such that the scale is uniform: the photo has the same lack of distortion as a map. Unlike an uncorrected aerial photograph, an orthophotograph can be used to measure true distances, because it is an accurate representation of the Earth's surface, having been adjusted for topographic relief, lens distortion, and camera tilt.
Overburden	Materials of any nature, consolidated or unconsolidated, that overlie a deposit of useful materials. In the present situation, overburden refers to the soil and rock strata that overlie kimberlite deposits.
Palynology	The science that studies contemporary and fossil palynomorphs, including pollen, spores, orbicules, dinocysts, acritarchs, chitinozoans, and scolecodonts, together with particulate organic matter and kerogen found in sedimentary rocks and sediments.
Pegmatite	An exceptionally coarse-grained igneous rock, with interlocking crystals, usually found as irregular dykes, lenses, or veins, especially at the margins of batholiths.
Pelite	Old and currently not widely used field geological term for a clayey fine-grained clastic sediment or sedimentary rock, i.e., mud or a mudstone. It is equivalent to the Latin-derived term lutite.
Petrographic	Of or relating to the origin or formation of rocks.
Phanerozoic	The current geologic eon in the geologic timescale, and the one during which abundant animal life has existed. It covers roughly 542 million years (541.0 ± 1.0) and goes back to the time when diverse hard-shelled animals first appeared.
Plagioclase	Important series of tectosilicate minerals within the feldspar family. Rather than referring to a particular mineral with a specific chemical composition, plagioclase is a solid solution series, more properly known as the plagioclase feldspar series (from the Greek "oblique fracture," in reference to its two cleavage angles).
Psammite	General term for sandstone. It is equivalent to the Latin-derived term arenite. Also, it is commonly used in various publications to describe a metamorphosed sedimentary rock with a dominantly sandstone protolith.
Pyroxene	Group of important rock-forming inosilicate minerals found in many igneous and metamorphic rocks. They share a common structure consisting of single chains of silicatetrahedra and they crystallize in the monoclinic and orthorhombic systems.
Rb-Sr dating	The rubidium-strontium dating method is a radiometric dating techhnique used by scientists to determine the age of rocks and minerals from the quantities they contain of specific isotopes of rubidium (^{87}Rb) and strontium (^{87}Sr, ^{86}Sr)
Quartz	The second most abundant mineral in the Earth's continental crust, after feldspar. It is made up of a continuous framework of SiO_4 silicon–oxygen tetrahedra, with each oxygen being shared between two tetrahedra, giving an overall formula SiO_2.

Term	Definition
Permian	Geologic period and system which extends from 298.9 ± 0.2 to 252.2 ± 0.5 million years ago. It is the last period of the Paleozoic Era, following the Carboniferous Period and preceding the Triassic Period of the Mesozoic Era.
Rutile	Mineral composed primarily of titanium dioxide, TiO_2. Rutile is a common accessory mineral in high-temperature and high-pressure metamorphic rocks and in igneous rocks.
Shale	Fine-grained, clastic sedimentary rock composed of mud that is a mix of flakes of clay minerals and tiny fragments (silt-sized particles) of other minerals, especially quartz and calcite.
Silurian	Geologic period and system that extends from the end of the Ordovician Period, approximately 443.4 ± 1.5 million years ago, to the beginning of the Devonian Period, approximately 419.2 ± 3.2 million years ago.
Slave Structural Province	Archean granite-greenstone terrane covering 190,000 km^2 in the Northwest Territories of Canada.
Software	A set of instructions to program a computer or other 'smart' device.
Shaded relief image	A raster image that shows changes in elevation using light and shadows on terrain from a given angle and altitude of the sun.
Stockpile	Pile or storage location for bulk materials, forming part of the bulk material handling process.
Supracrustal	Rocks that were deposited on the existing basement rocks of the crust.
Tectonic	Pertaining to the internal forces involved in deforming the Earth's crust.
Terrane	Shorthand for tectonostratigraphic terrane, which is a fragment of crust.
Till	Till is an unsorted glacial sediment. Glacial drift is a general term for the coarsely graded and extremely heterogeneous sediments of glacial origin. Glacial till is that part of glacial drift which was deposited directly by the glacier. It may vary from clays to mixtures of clay, sand, gravel, and boulders.
Tonalite	Igneous, plutonic (intrusive) rock, of felsic composition, with phaneritic texture. Feldspar is present as plagioclase (typically oligoclase or andesine) with 10% or less alkali feldspar. Quartz is present as more than 20% of the rock. Amphiboles and pyroxenes are common accessory minerals.
Topography	The physical features of a district or region, such as those represented on a map, taken collectively; especially the relief and contours of the land. On most soil maps topography may also mean topography classes that describe slopes according to standard ranges of percent gradient.
Tourmaline	Crystal boron silicate mineral compounded with elements such as aluminium, iron, magnesium, sodium, lithium, or potassium.
Treeline	An area of transition between the tundra and boreal forest to the south.
Tundra	A vast, mostly flat, treeless Arctic region of Europe, Asia, and North America in which the subsoil is permanently frozen. The dominant vegetation is low-growing stunted shrubs, mosses, lichen.
Turbidite	Geologic deposit of a turbidity current, which is a type of sediment gravity flow responsible for distributing vast amounts of clastic sediment into the deep ocean.
U-Pb dating	Uranium–lead (U–Pb) dating is one of the oldest and most refined of the radiometric dating schemes, with a routine age range of approximately 1 million years to over 4.5 billion years, and with routine precisions in the 0.1 to 1 percent range.
Veneer	Unconsolidated materials too thin to mask the minor irregularities of the underlying unit surface. A veneer ranges from 10 cm to 1 m in thickness and possesses no form typical of the materials' genesis.
Volcaniclastic	Clastic rock chiefly composed of volcanic materials.
Waterbody	An area of water such as a river, stream, lake, or sea.
Watercourse	Riverine systems such as creeks, brooks, streams and rivers.
Winter Road	Roads which are built over frozen lakes and tundra. Compacted snow and/or ice is used for embankment construction.

Term	Definition
Xenolith	Rock fragment which becomes enveloped in a larger rock during the latter's development and hardening. In geology, the term xenolith is almost exclusively used to describe inclusions in igneous rock during magma emplacement and eruption. Xenoliths may be engulfed along the margins of a magma chamber, torn loose from the walls of an erupting lava conduit or explosive diatreme or picked up along the base of a flowing lava on Earth's surface.
Zircon	Mineral belonging to the group of nesosilicates. Its chemical name is zirconium silicate and its corresponding chemical formula is $ZrSiO_4$.