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**Ts' ude niline Tu' eyeta
(Ramparts River and Wetlands)
Candidate Protected Area
Phase 1 Non-renewable Resource Assessment - Minerals**

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EXECUTIVE SUMMARY

The Northwest Territories Geoscience Office (NTGO) has completed the Minerals component of the Phase I Non-renewable Resource Assessment (NRA) of the Ts'ude niline Tu'eyeta Candidate Protected Area, which is being advanced under the Northwest Territories Protected Area Strategy (PAS). The NRA has been carried out as part of Step 5 of the PAS process, which also includes ecological and cultural evaluations of the Candidate Protected Area (Northwest Territories Protected Areas Strategy Advisory Committee, 1999). The PAS outlines a phased approach to NRAs, and this report summarizes Phase I work which consisted of selecting a study area, data compilation, gap analysis, and evaluation of all available geoscience information relative to mineral potential. The NRA is undertaken in support of the Government of Canada's Minerals and Metals Policy (1996), and informed land use decision-making.

Ts'ude niline Tu'eyeta covers 15,063 km², or approximately 1.5 million hectares, stretching from the Mackenzie River to the border of the Gwich'in Settlement Area. The settlement of Fort Good Hope is located adjacent to the proposed eastern boundary of Ts'ude niline Tu'eyeta. The study area for this report covers parts of National Topographic System 1:250 000 scale map sheets: 106G, H, I, and J.

The northern and central parts (Peel Plain) of the study area are predominantly flat-lying, with an average elevation of about 100 m above sea level. Peel Plain is underlain by unconsolidated glacial deposits up to 70 m thick, which almost completely obscure bedrock. The southern part of the study area lies in the Mackenzie Mountains. More bedrock is exposed in this upland region, with elevations locally greater than 1900 m above sea level.

Most of Ts'ude niline Tu'eyeta lies within the Interior Platform geological province, an area of generally undeformed Phanerozoic aged sedimentary rock, comprising Cambrian to Cretaceous sandstone, shale, limestone, and dolostone. The bedrock directly underlying Ts'ude niline Tu'eyeta is dominantly Cretaceous shale and sandstone. The Mackenzie Mountains lie in the southern portion of Ts'ude niline Tu'eyeta, where Cretaceous folds and faults have brought rocks as old as Neoproterozoic to the surface.

The bulk of the historical exploration work was conducted at the headwaters of the Gayna and Arctic Red rivers, just outside the southwest corner of the study area, and entailed zinc-lead exploration in carbonate rocks. Zinc-lead sulphide minerals are hosted by shallow water carbonate rocks and associated stromatolitic reefs within the 160 m thick host unit of the Little Dal Group. Sulphide minerals include mainly sphalerite with minor galena and accessory pyrite disseminated within the matrix and/or fragments and as envelopes to fragments within both primary sedimentary and secondary dissolution breccias. An historical resource estimate (not 43-101 compliant) of 50 million tonnes at 5% combined Zn-Pb has been attributed to the Gayna River deposits.

Other mineral deposit types to be considered within the Ts'ude niline Tu'eyeta area include Primary Diamond deposits, Zinc-Lead (Zn-Pb) deposits including both Mississippi Valley Type (MVT) and Sedimentary Exhalative (SEDEX) and their subtypes, Breccia-hosted Iron-Oxide Copper Gold deposits (IOCG), Sediment-Hosted Copper, Nickel-Copper-Platinum Group Elements (Ni-Cu-PGE), Iron-Formation, Coal and Industrial Minerals.

The deposit type considered to have the highest potential within the Ts' ude niline Tu' eyeta area is MVT Zn-Pb, to which is ascribed moderate potential for the southern, Mackenzie Mountains part of the area and low potential for the northern, or wetlands part of Ts' ude niline Tu' eyeta. The entire area is considered to have low potential for Primary Diamond deposits. The SEDEX Zn-Pb deposit type is considered to have low to moderate potential in the Mackenzie Mountains, and low potential in the wetlands part of Ts' ude niline Tu' eyeta. The potential for Ni-Cu-PGE deposits is low to moderate in the Mackenzie Mountains and low in the wetlands of Ts' ude niline Tu' eyeta. There is low to moderate potential for Coal deposits in the wetlands part of Ts' ude niline Tu' eyeta and low potential within the Mackenzie Mountains. The Breccia-Hosted IOCG deposit type has very low potential across the entire Ts' ude niline Tu' eyeta area. The Sediment-Hosted Stratiform Copper and Iron-Formation deposit types are both considered to have low potential in the Ts' ude niline Tu' eyeta area. Some of these rankings might improve if favourable stratigraphy was identified in the study area. The potential for Industrial Minerals should be considered in a separate study, as this report deals strictly with subsurface resources, however sand and gravel are important quarried resources for community infrastructure.

The paucity of geological information and data for the Ts' ude niline Tu' eyeta area poses the greatest problem to conducting a NRA, since very little information exists in the literature. The first phase of the NRA is designed to compile all existing data and it is this compilation upon which a mineral evaluation is based. Because the area has not been intensively explored by the mineral exploration community, this report uses data from adjacent areas or geologically similar areas and infers comparisons with the study area. Specific information gaps identified for the Ts' ude niline Tu' eyeta area include: a lack of regional till, stream sediment, or lake sediment geochemical data coverage; lack of magnetic, electromagnetic or radiometric geophysical survey coverage; and a lack of detailed bedrock mapping coverage suitable for mineral potential estimates. Recommendations for Phase 2 Non-renewable Resource Assessment include a regional stream sediment survey, including the collection of heavy mineral concentrates, stream silt and water samples, and thematic bedrock map data targeting stratigraphic units that may be prospective for sediment-hosted mineral deposits.

POTENTIAL Ranking	CONFIDENCE Ranking			
	Rank 1: Abundant reliable information	Rank 2: Moderate amount of information	Rank 3: Some information	Rank 4: Very little and/or unreliable information
Rank A: Very High: Geologic environment is favourable. Significant deposits are known. Presence of undiscovered deposits is very likely.			X	X
Rank B: High: Geologic environment is favourable. Occurrences are present but significant deposits are not known. Presence of undiscovered deposits is likely.				X
Rank C: Moderate to High: Intermediate between moderate and high potential.				
Rank D: Moderate: Geological environment is favourable. Occurrences may or may not be known. Presence of undiscovered deposits is possible.			MVT Zn-Pb deposits (Mackenzie Mountains)	
Rank E: Low to Moderate: Intermediate between low and moderate.			Coal deposits (wetlands)	Ni-Cu-PGE deposits (Mackenzie Mountains)
Rank F: Low: Some aspects of the geological environment may be favourable but are limited in extent. Few if any occurrences are known. Low probability that undiscovered deposits are present.				Primary diamond deposits Sediment-hosted Cu deposits Iron-Formation deposits SEDEX Zn-Pb deposits (Mackenzie Mountains)
Rank G: Very Low: Geologic environment is unfavourable. No occurrences are known. Very low probability that undiscovered deposits are present.				Breccia-hosted IOCG deposits SEDEX Zn-Pb deposits (wetlands)
Rank H: Not Assessed: Deposit types unknown, overlooked, beyond the scope of the assessment, or not worth mentioning at the time the assessment was done. A higher rating could be assigned during future assessments.	X	X		
<i>Criteria for assessing mineral potential follows the Geological Survey of Canada's Mineral and Energy Resource assessment rating scale (Scoates et al., 1986).</i>				

Table I. Mineral potential summary.

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INTRODUCTION

Background

The following background summary of the Ts' ude niline Tu' eyeta area is distilled from Gal (2007). Parts of the lower Ramparts River and surrounding wetlands (Tuyat'ah) as well as the bluffs along the Mackenzie River upstream from Fort Good Hope (Fee Yee) were first identified by the Sahtu Heritage Places and Sites Joint Working Group in early 2000 as important heritage sites (Sahtu Heritage Places and Sites Joint Working Group, 2000). In August 2001 the NWT Protected Areas Strategy (PAS) Secretariat attended an information workshop in Fort Good Hope to introduce the PAS, and discuss conservation issues pertaining to the Fort Good Hope area.

In a protected area initiative report for Ducks Unlimited Canada, Hunter et al. (2002) proposed to expand the Ts' ude niline Tu' eyeta area to about 4,448 km². A second community workshop in June of 2002 was held to facilitate the community's entry into the PAS process. The Fort Good Hope Renewable Resources Council submitted a request for information (including non-renewable resources) to the PAS Secretariat in October 2002. This request was partly addressed in a brief report in November 2002 (Gal and Lariviere, 2002a).

A third community workshop was held in May 2003 to define boundaries of the area of interest. A fourth community workshop in April 2004 re-examined the previously defined boundaries and expanded them by a factor of three to the current size (15,063 km²). The community passed a resolution defining the interim boundary and accepted the Canadian Wildlife Service as the sponsoring agency. A new request for information was received by the PAS Secretariat in August 2004 and was addressed in October 2004 with an updated Preliminary Economic Information Request on Minerals, Oil & Gas (Gal and Lariviere, 2004a).

In the preliminary draft of the Sahtu Land Use Plan (Sahtu Land Use Planning Board, 2003) Ts' ude niline Tu' eyeta was identified as a Conservation Area, with similar boundaries to the current candidate area. The most recent draft of the Sahtu Land Use Plan (Sahtu Land Use Planning Board, 2005) identifies Ts' ude niline Tu' eyeta as a Special Management Area, surrounding a core Conservation Zone that is similar in shape and size to the original lower Ramparts River and surrounding wetlands (Tuyat'ah) area identified in 2000.

In November 2005, the Yamoga Land Corporation submitted a proposal for the advancement of Ts' ude niline Tu' eyeta through the NWT PAS, and a Notice of Applications (for Land Withdrawal) was filed. The Yamoga Land Corporation and Fort Good Hope Renewable Resources Council are currently developing a proposal for interim land withdrawal (Northwest Territories Protected Areas Strategy, 2005).

Currently, no land withdrawal of Ts' ude niline Tu' eyeta candidate protected area is in place. However, the area has been provisionally excluded from recent Calls for Nomination for Petroleum Exploration Licenses issued by Indian and Northern Affairs Canada (Gal, 2007). Upon withdrawal of the lands, typically for a five-year period, no mineral claims, prospecting permits, or Petroleum Exploration Licenses may be issued. The various required assessments of the candidate protected area (under step 5 of PAS process) generally take place after the interim withdrawal is in place (Northwest Territories Protected Areas Strategy, 2001).

Terms of Reference

The Northwest Territories Geoscience Office (NTGO) completed the Petroleum component for a Phase I Non-renewable Resource Assessment (NRA) of Ts'ude niline Tu'eyeta in February 2007 (Gal, 2007). The NRA for a Candidate Protected Area typically includes both the Minerals and Petroleum components (e.g., Gal and Lariviere, 2004b). However, lack of human resources prevented initiation of the Minerals component until suitable personnel were in place. NRAs are intended to be initiated as part of Step 5 of the eight-step PAS process, which also includes ecological and cultural evaluations (Northwest Territories Protected Areas Strategy Advisory Committee, 1999). The NRA conforms to the Canadian Minerals and Metals Policy (Government of Canada, 1996), which requires a thorough understanding of the mineral potential of an area before exclusion of any federal lands from development is granted. The NRA also facilitates informed land use decision-making.

The PAS outlines a phased approach to NRAs, and this report constitutes the Minerals component to a Phase I NRA. This includes selection of a study area, data compilation and evaluation, gap analysis, and recommendations for Phase II work. A study area (Figure 1), hereafter termed 'the study area', larger than the proposed boundaries of Ts'ude niline Tu'eyeta Candidate Protected Area was selected to allow for a broad enough base for assessment, and to allow for extrapolations and potential boundary modifications.

This assessment is an informed evaluation using geological knowledge, expert opinions, and GIS modeling of available information. The mineral resource potential of the area is assessed and ranked qualitatively. An absolute measure of mineral resource potential cannot be provided, as quantitative estimates of mineral resources generally require multiple drill-holes on which to base calculations. Other types of quantitative measures have been used for resource estimates of certain commodities, but these are not appropriate for most mineral deposits and are unreliable in areas with very little data (Sangster, 1983).

Resource assessments are based on the best *currently available* geoscience information. As such, assessments must be revised and updated as new data becomes available, knowledge of mineral and hydrocarbon deposits evolve, and as socio-economic conditions change (especially with respect to commodity prices and infrastructure). Thus the concept of potential is considered dynamic, and limits of an NRA as a planning tool must be recognized.

Mineral Potential Evaluation Ranking System

Table 1 outlines the ranking criteria for mineral potential based on the application of mineral deposit models to the known geologic setting as it is currently understood. The criteria used partly follow those of the Mineral and Energy Resource Assessment (MERA) process used by the Geological Survey of Canada (Scoates et al., 1986). The ranking potential is accompanied by a confidence ranking based on the quantity and quality of information available. This mineral potential ranking scheme is better suited to areas that have been substantively explored. Areas that have undergone very little or no exploration should be treated differently, although no known evaluation scheme is suited for such under-explored terrains.

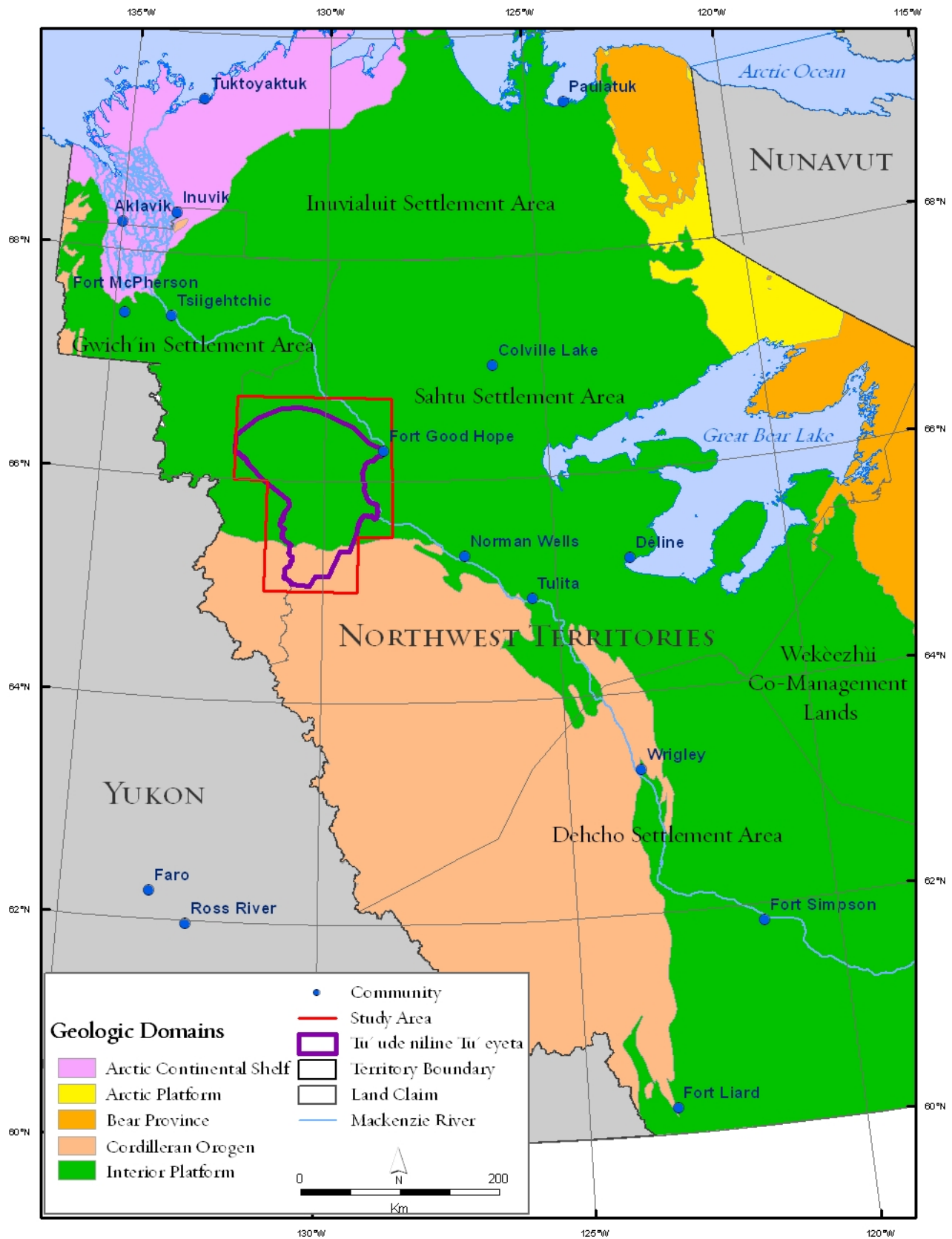


Figure 1. Geological domains and location of Ts'ude niline-Tu'eyeta candidate protected area and study area.

POTENTIAL Ranking	CONFIDENCE Ranking			
	<u>Rank 1:</u> Abundant reliable information	<u>Rank 2:</u> Moderate amount of information	<u>Rank 3:</u> Some information	<u>Rank 4:</u> Very little and/or unreliable information
<u>Rank A: Very High:</u> Geologic environment is favourable. Significant deposits are known. Presence of undiscovered deposits is very likely.			X	X
<u>Rank B: High:</u> Geologic environment is favourable. Occurrences are present but significant deposits are not known. Presence of undiscovered deposits is likely.				X
<u>Rank C: Moderate to High:</u> Intermediate between moderate and high potential.				
<u>Rank D: Moderate:</u> Geological environment is favourable. Occurrences may or may not be known. Presence of undiscovered deposits is possible.				
<u>Rank E: Low to Moderate:</u> Intermediate between low and moderate.				
<u>Rank F: Low:</u> Some aspects of the geological environment may be favourable but are limited in extent. Few if any occurrences are known. Low probability that undiscovered deposits are present.				
<u>Rank G: Very Low:</u> Geologic environment is unfavourable. No occurrences are known. Very low probability that undiscovered deposits are present.				
<u>Rank H: Not Assessed:</u> Deposit types unknown, overlooked, beyond the scope of the assessment, or not worth mentioning at the time the assessment was done. A higher rating could be assigned during future assessments.	X	X		
<i>Criteria for assessing mineral potential follows the Geological Survey of Canada's Mineral and Energy Resource assessment rating scale (Scoates et al., 1986).</i>				

Table 1. Mineral potential evaluation system.

Location, Area and Access

Proposed boundaries of the Ts'ude niline Tu'eyeta Candidate Protected Area lie between 65°03'05" N and 66°40'05" N latitude and 128°41'55" W and 132°00'00" W longitude and cover an area of 15,063 km² (1.5 million hectares). The candidate protected area occupies 1:250 000 scale National Topographic System map sheets 106G, 106H, 106I, and 106J. Parts of these

four map sheets constitute the study area for this report. The study area is roughly bounded by 65° and 66°50'N latitude, and 128°30' and 132°W longitude, and is depicted in Figure 1.

Ts' ude niline Tu' eyeta lies west of the Mackenzie River, and includes parts of the watersheds of the Ramparts, Hume, and Ontonagon rivers. The Mackenzie River itself is a major transportation corridor. Traditional trails are concentrated along the lower Ramparts and Hume rivers (Hunter et al., 2002). Recent trails tend to follow lines cut for seismic surveys of petroleum exploration.

Physiography, Climate and Vegetation

The following description of the Ts' ude niline Tu' eyeta area is summarized from Gal (2007). The study area lies mainly within Great Slave Plain, a physiographic region of generally low relief (average elevation is less than 350 m above sea level). The Mackenzie Mountains in the southern part of the study area comprises rugged upland ranges, with elevations up to 1990 m.

The study area lies within the Taiga Plains and Taiga Cordillera ecozones (Environment Canada, 2005; Gal and Lariviere, 2004a). The part of the study area within Taiga Plains ecozone includes several ecoregions: Fort McPherson Plain, Mackenzie River Plain, and Peel River Plateau. The climate of these regions is characterized by short cool summers and long cold winters, and is classified as high subarctic, ranging to subhumid boreal along the Mackenzie River. Mean annual summer temperatures range from 9.5 to 11.5°C; winter temperatures range from -22.5 to -25°C (Environment Canada, 2005). Mean annual temperatures in the Mackenzie Mountains are similar, though somewhat cooler in summer, with more precipitation (up to 500 mm).

Vegetation in the region is dominated by open, stunted stands of black spruce and tamarack, with secondary white spruce and ground cover of willow, birch, shrubs, cotton grass, lichen, and moss (Environment Canada, 2005). Wetlands constitute a significant portion of the study area (Figure 2), and support sedge, cotton grass and moss. Along the Mackenzie River, taller stands of black spruce and jack pine dominate, with a lower cover of shrubs, moss, and lichen. Higher elevations in the Mackenzie Mountains are covered by alpine tundra vegetation (lichen, dwarf shrubs, sedge), with bare rock and talus. Lower elevations in the mountains support white spruce, willow, and birch.

Previous Work

Regional Government Surveys

The geology of the study area is covered by Geological Survey of Canada (GSC) 1:250 000 scale maps for NTS sheets 106G and H (Aitken et al., 1982), 106J (Cook and Aitken, 1975), and 106I (Aitken et al., 1969). This mapping was part of the GSC's Operation Norman in the late 1960s and early 1970s. Less detailed compilation maps covering the area include Yorath and Cook (1981), and more recently Journeay and Williams (1995), and Wheeler et al. (1996).

Surficial geology maps for the north part of the study area have been completed by Rampton and Fulton (1970) and Duk-Rodkin and Hughes (1992a, b), and for the southern half by Hughes (1970), Hanley et al. (1973), Monroe (1973), and Duk-Rodkin and Hughes (1993a, b).

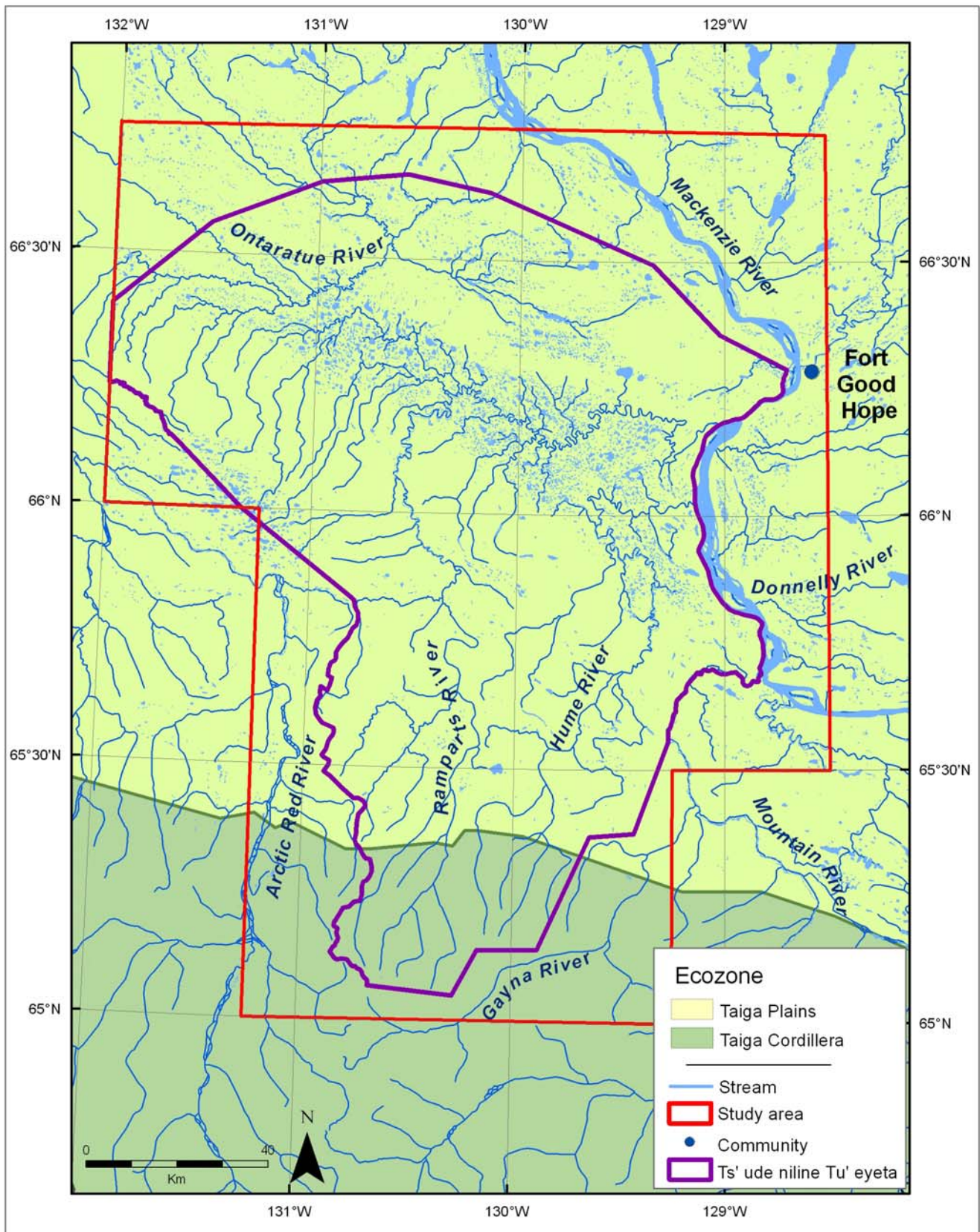


Figure 2. Ecozones, topography, and geographic names and locations mentioned in the text.

Gravity maps covering the study area have been produced at 1:1 000 000 scale (Seemann et al., 1988). Aeromagnetic maps at 1:100 000 scale are available for NTS map sheet 106H (Dumont, 2000a-d), part of 106G (Dumont et al., 2000), 106I (Dumont et al., 2001a, b), and 106J (Dumont et al., 2001c, d). Older vintage aeromagnetic surveys (GSC G-series maps at 1:250 000 scale) cover the remainder of the study area.

No government geochemical surveys have been completed in the study area.

Mineral Exploration History

The study area has seen very limited mineral exploration activity. Existing company reports are summarized in Table 2. The bulk of the historical exploration work was conducted at the headwaters of the Gayna and Arctic Red rivers, just outside the southwest corner of the study area (Figure 3) and entailed Zn-Pb exploration in carbonate rocks.

Welcome North Mines Ltd. conducted exploration in 1974 on 12 claims (known as the HAB Mineral Claim Group) on behalf of the Arctic Red Joint Venture (Brock and Guild, 1975). Several Zn-Pb occurrences (Figure 3) were discovered in carbonates believed to be Devonian in age. The mineralized material was primarily vuggy quartz-carbonate veins with lesser barite that locally cements the brecciated and silicified carbonate wall rock. All occurrences were talus or float, and no mineralization was found *in-situ*. Grab samples were taken and analytical results for Zn and Pb are presented in the report. None of the areas described were sufficiently exposed to allow proper assessment of economic potential; the company recommended a small trenching program to reveal the source of the mineralization. It is not known if the trenching was ever completed, as the company did not file any further reports.

Rio Tinto Canadian Exploration Limited conducted large exploration programs over the RT claim group area, also known as Gayna River, from 1974-1976 (Sanguinetti et al., 1975; Hewton, 1976). Zinc sulphide occurrences were discovered between the Gayna and Arctic Red rivers in 1974, and the company staked essentially the entire length of exposed mineralized Little Dal Group rocks. Field work included drilling, mapping, prospecting, sampling and geophysics. Seventeen drill holes totaling 7010 feet (2336 m) were drilled near the A showing in 1975 (UTM coordinates: 419350 E, 7203300 N, Zone 9, NAD 1927). A total of 30,131 feet (10,043 m) were drilled in 68 holes in 1976. Of the holes drilled in 1976, seven contained “ore”, defined as 40 ft % (13 m%) with a minimum of >8 feet (2.6 m) having >2% Zn or 60 ft % with no minimum grade; six holes were deemed “indicative”, containing 16-40 ft (5-12 m) % with >8 feet (>2.6 m) having >2% Zn. The best drill results are 40 feet (13 m) at 6.65% Zn including 20 feet (6.6 m) at 11.25% Zn. A total of 17 “showings” and >100 “occurrences” were reportedly located by the company. Although undefined in the assessment report, each of the “showings” is a surface exposure with anomalous Zn, whereas an “occurrence” is a geochemical anomaly that may occur in talus or soil. A vast soil sampling program was undertaken, with the collection of 2833 soil samples and these were used to determine background values and to produce contoured maps showing areas of anomalous Zn values. Geophysical surveys entailed 12 line-miles of IP (Induced Polarization) and magnetics. The magnetic results were flat except for one anomaly caused by a diabase dyke. Five definite and four probable anomalies were outlined by IP. In 1977, the company concentrated efforts on the eastern portion of the property, but only filed results for new claims staked west of the original claim group. This work involved the collection

REF_TYPE	DATE PUBLISH	AUTHOR	TITLE	AREA	ASSESSMENT WORK	COMMODITY	OWNER	WORK_PERFORMED
Prospectors Report 015370	31/12/1974	Catchilly, 1974	Prospecting Report; under NWT Prospectors Assistance Program	Lac a Jacques	Prospecting	unknown		Handwritten report with hand-drawn maps; no analytical results.
Assessment Report 060569	30/05/1961	Brady, 1961	A Stratigraphic Reconnaissance of the Western Part of the Mackenzie District, Nahanni Area.	Mackenzie Valley corridor; Wrigley to Fort Good Hope	Stratigraphy and biostratigraphy	unknown	Union Oil Company of California	Stratigraphic correlation on Keller Lake permits, focusing on the depositional history of Middle Devonian strata; includes biostratigraphic correlation of Middle Devonian strata; 27,300 metres of stratigraphic section were measured for this study.
Assessment Report 062082	01/10/1974	Anonymous, 1974	Geology Map, Arctic Red River Joint Venture	Arctic Red River	Geological mapping	Unknown (Zn?)	Welcome North Mines Ltd	No report; geological map showing locations of “mineral occurrences” only; southern 106G overlapping 106B.
Assessment Report 080389	14/05/1975	Brock and Guild, 1975	Geological Report on the BAH claim Group	Arctic Red River JV (106G/4)	Geological mapping and sampling	Zn-Pb	Welcome North Mines Ltd	Prospecting and sampling; up to 25% Zn from Zone A; up to 10% Pb from boulders at Zone C; >9% Zn from angular boulder at Zone D.
Assessment Report 080567	04/10/1976	Hewton, 1976	Gayna River Project – Geology, Geochemistry and Diamond Drilling – 1976, RT Claims	RT Claims	Mapping, prospecting, soil sampling, and drilling.	Zn-Pb	Rio Tinto Canadian Exploration Ltd	2833 soil samples collected – used to produce contoured maps; ~10 000 metres drilled in 68 holes – 7 holes contained “ore”; prospecting outlined 17 showings and >100 occurrences.
Assessment Report 080568	07/11/1975	Sanguinetti et al., 1975	Summary Report on the RT Claim Group	Heads of Gayna and Arctic Red rivers	Mapping, prospecting, soil sampling, geophysics and drilling.	Zn-Pb	Rio Tinto Canadian Exploration Ltd	17 drill holes; 12 line miles (19.2 line km) of IP resistivity and magnetics resulting in identification of 5 definite and 4 probable anomalies; geological mapping over entire property at scale 1” = ½ mile.
Assessment Report 080724	12/09/1977	Hewton and Wilson, 1977	Gayna River Assessment Report, 1977	Heads of Gayna and Arctic Red rivers	Mapping, soil and silt sampling, prospecting, drilling	Zn-Pb	Rio Tinto Canadian Exploration Ltd	716 soil and silt samples collected; mapping at scale 1” = 400’; 2 drill holes; work was done on newly staked claims west of the original RT claim block.
Assessment Report 084557	04/02/2003	Bauer, 2003	Prospecting and Sample Analysis	Norman Wells, Imperial River	Prospecting and sampling	unknown	Bauer R	The Rainbow claim investigated by local prospector; 31 samples assayed, no significant results. Looked at gabbro, 12 samples had >100 ppm nickel (but <200 ppm).

Table 2. Summary of assessment reports in study area.

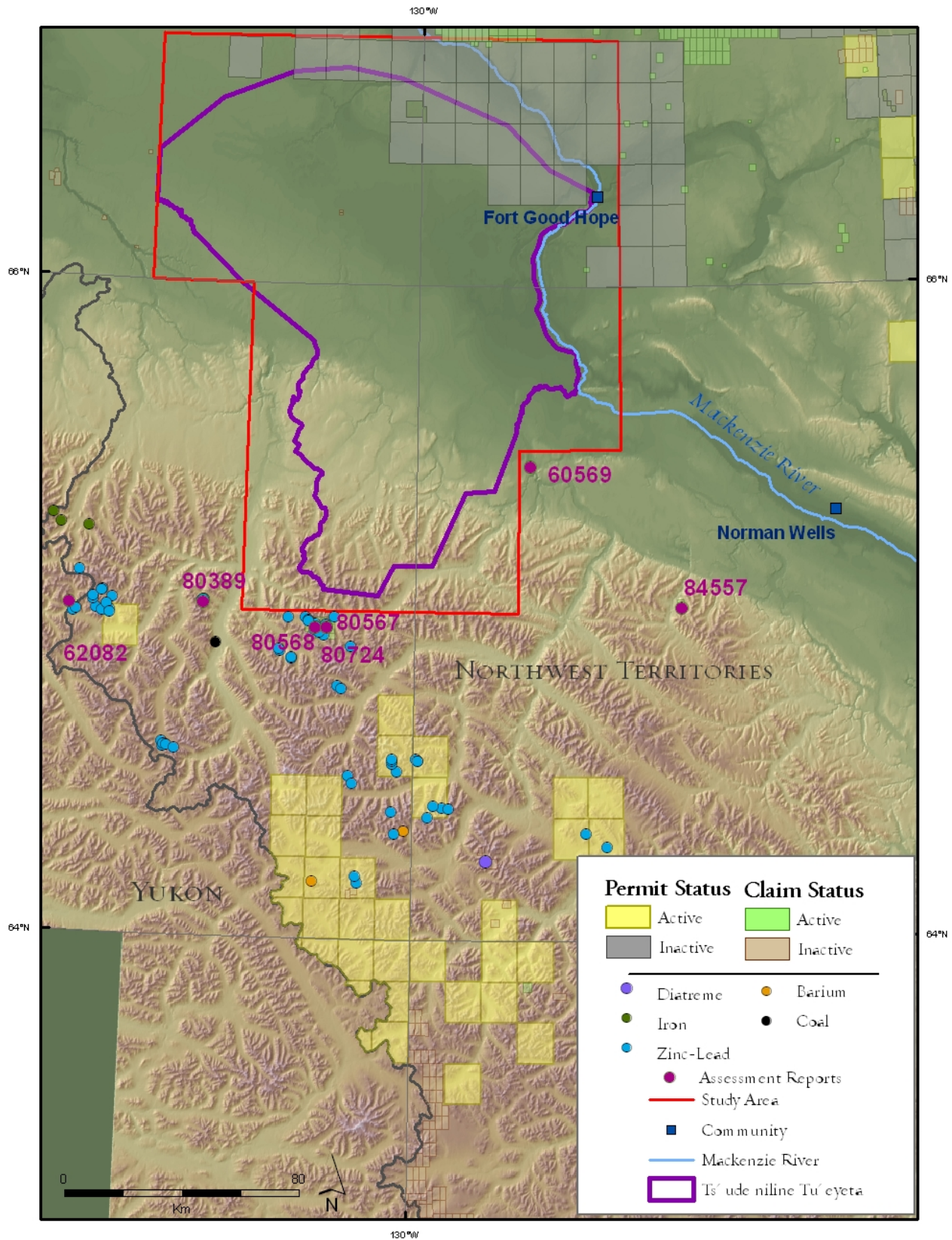


Figure 3. Location of historical exploration work (showings, active and lapsed mineral claims and prospecting permits, approximate locations of Assessment Reports) in the Ts'ude niline Tu'eyeta area.

of 716 soil and silt samples, geological mapping at a scale of 1" = 400', and 2 drill holes (Hewton and Wilson, 1977). A large geochemical anomaly (Zn and Pb) and mineralized talus were identified and interpreted to indicate that the area is prospective for Zn and Pb. Rio Tinto last worked the property in 1978.

The Gayna River property remained dormant for over 20 years until it was staked by Eagle Plains Resources Limited in March of 2005. The company also acquired Rio Tinto's maps and sample pulps for over 5700 stream sediment samples in June of 2006. A non-43-101 compliant, historical resource estimate of over 50 000 000 tons (or 45.36 million metric tonnes) grading 4.7% Zn from numerous individual ore bodies was suggested by Rio Tinto, making it possibly one of Canada's largest undeveloped Zn deposits. In addition, Eagle Plains has re-analyzed some of the mineralized carbonate samples from Gayna River and found significant gallium values (the rocks and soil samples were not analyzed for elements such as gallium in the 1970s). The company also assembled a group of carbonate-hosted Zn-Pb deposit experts to assess the economic potential of the Zn belt. Based on the type and degree of alteration, they suggest that it may be contemporaneous with the alteration system present at the Pine Point Zn-Pb mining camp in southwestern NWT (Eagle Plains Resources Ltd., 2005).

There is no record of any diamond exploration in the area. However, much of the area to the north and east has been staked (Figure 3). Farther east, Diamondex Resources has been exploring the Lena West area since 2002. The company reports excellent KIM chemistry and has recovered 14 diamonds from till and stream sediment samples to date, the largest of which measures 3.0 mm in its longest dimension. If a primary diamond source is located within the Mackenzie Valley, the diamond potential for the Ts' ude niline Tu' eyeta area will need to be considered. In addition, the diamond potential of the Edehzhie Candidate area, located approximately 600 km to the south-southeast, was ranked as moderate to high based on KIM chemistry and the recovery of a diamond from a stream sediment sample collected for Non-renewable Resource Assessment purposes (Mills, in prep.). It should be noted that sometimes the exploration industry may be "ahead" of science and often their findings may create controversy and stimulate new studies to further our understanding of existing deposit models.

REGIONAL GEOLOGY

General Tectonic and Geological History of the Study Area

A brief summary of the regional geology is presented here. For a comprehensive and thorough description of the regional geology, including lithological descriptions, as well as tectonic and depositional histories, see Pyle et al. (2006) and Gal (2007).

Ts' ude niline Tu' eyeta lies mainly within the Interior Platform geological province, a vast basin of Phanerozoic sedimentary rocks lying between the Canadian Shield to the east and the Cordillera to the west and south (Figure 1). Sedimentary rocks of the Interior Platform are generally flat lying, and form a west-southwestward thickening wedge which overlies Proterozoic basement (Figure 4). The Mackenzie Mountains are located in the southern part of Ts' ude niline Tu' eyeta, and expose uplifted and deformed Phanerozoic rocks correlative to those in the Interior Platform, as well as older Proterozoic rocks. These Proterozoic sedimentary rocks were deposited in an ocean-margin basin at the edge of the ancestral North American continent, with early rifting followed by later quiescent platform conditions. Several kilometers

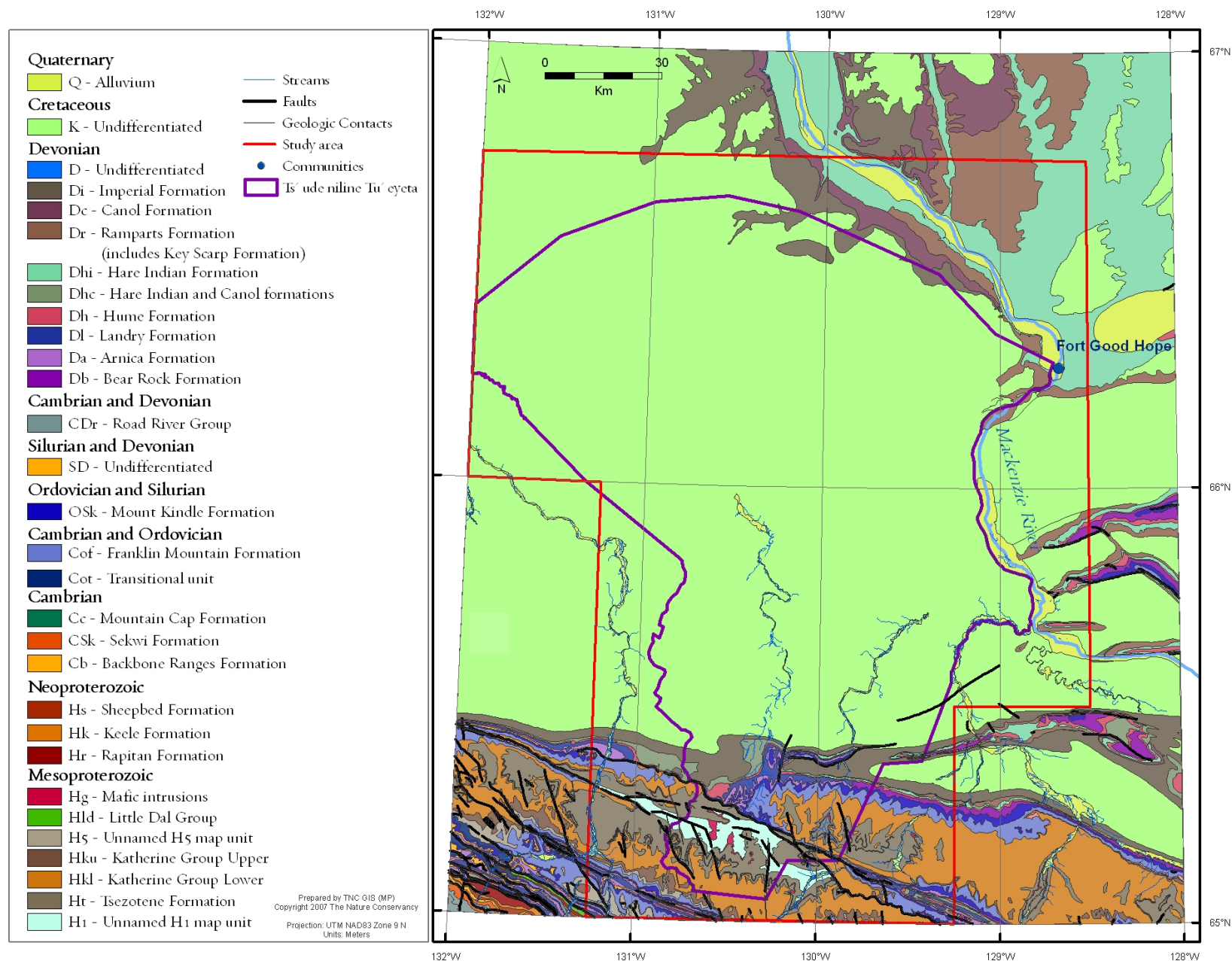


Figure 4. Bedrock geology of the Ts'ude niline Tu'eyeta area. Geology is compiled from Aitken et al., 1969; Aitken et al., 1982; and Cook and Aitken, 1975; stratigraphic nomenclature is consistent with Aitken, 1993.

of dominantly marine siliciclastic and carbonate sedimentary rocks were deposited. Periodic episodes of uplift, tilting, deformation, and erosion affected these rocks. Ancient glaciation is recorded by the Proterozoic lithofacies (e.g., Aitken, 1993).

Marine deposition of sedimentary rocks continued through the Phanerozoic. Tectonic quiescence through the Cambrian to Middle Devonian was succeeded by Ellesmerian orogenesis beginning in the Late Devonian. In the study area, the Ellesmerian orogeny is expressed by shallow marine siliciclastic deposition on a rising foreland, and this continued into the Carboniferous. A period of non-deposition and erosion lasted through Permian to Jurassic times (Poulton et al., 1993). The Columbian and Laramide orogenies produced the modern Mackenzie Mountains during the Cretaceous.

LOCAL GEOLOGY

Geology and mineral occurrences of the Gayna River area

Gal (2007) provided a rigorous synthesis of the geology of the Ts'ude niline Tu'eyeta study area, including descriptions of known bedrock exposures within the study area. The Gayna River area in the southwestern-most part of the study area has experienced the most exploration, and is underlain by the most structurally complex and lithologically varied rocks of the area. The geology of this area and styles of mineralization are therefore summarized below.

The area at the headwaters of the Gayna River was explored by Rio Tinto Canadian Exploration Limited during the mid to late 1970s and a small portion of this ground is currently being investigated by Eagle Plains Resources Limited. A number of Zn showings and deposits were outlined. An historical resource estimate in excess of 50 000 000 tons grading 4.7% Zn, has been suggested by Rio Tinto (Hewton, 1982). Thus Gayna River may be one of Canada's largest undeveloped Zn camps.

Zn sulphide concentrations are hosted by carbonate rocks of the Mesoproterozoic H5 unit that overlies coarse grained quartzarenite of the Katherine Group, and is overlain by the Little Dal Group (limestone, dolostone, anhydrite, gypsum, mudstone and sandstone) (Hewton, 1976; Aitken, 1981, 1993, Aitken et al., 1982). The mineralized H5 unit (named Basinal formation of the Little Dal Group by Aitken, 1981) grades upward from deep water shale and carbonate through shallow marine carbonate to lagoonal rocks. Large pinnacle reef stromatolitic structures within the Basinal formation constitute a north-south chain and record deep to shallow water carbonate environments. The reefs are conformably overlain by shallow platformal marine carbonate rocks - oolitic and stromatolitic tabular units of the Grainstone formation. These in turn are overlain by the variably thick Gypsum formation (bedded deep to shallow water gypsum evaporite) and the laterally continuous stromatolitic carbonate rocks of the Upper Carbonate formation (formerly Upper Little Dal Formation). The Basinal, Grainstone and Gypsum formations of the Little Dal Group are only locally exposed over the Gayna River area, as these units have been partially eroded beneath an Upper Cambrian unconformity.

Basinal limestone and dolostone constitute the Upper and Lower Host units of Hewton (1982), and are separated by about 10 m of argillite, all part of the Basinal formation of Aitken (1981). Several forms of carbonate alteration are common to both the Upper and Lower hosts. Sphalerite, pyrite and galena are the main sulphide minerals. Sphalerite is most commonly intergrown with

calcite and dolomite in primary (syn-sedimentary) breccias, and in recrystallized zones of bedded carbonate rocks where it ranges from massive to disseminated. Sphalerite ranges from pale yellow to colourless in primary breccias and is bright yellow, orange, red or green in secondary breccias. Concentrations of massive sphalerite with associated fine disseminations may represent migration of mineralizing fluids along bedding planes away from fluid conduits such as fractures or faults. Massive sphalerite ranges from dull red, olive green, yellowish green to bright yellow. Pyrobitumen, dodecahedrons of pyrite, euhedral quartz crystals, dolomite crystals, barite and rare fluorite are also located in vugs within the Lower and Upper Host units (Hewton, 1976).

MINERAL RESOURCE ASSESSMENT

The mineral potential of the Ts'ude niline Tu'eyeta area has never before been assessed, as it has received little exploration attention. This likely stems from the lack of geologic information available for the area, in part due to poor outcrop exposure. Areas with better bedrock exposure have naturally seen more mineral exploration activity in the past.

From known and extrapolated geologic information, a number of mineral deposit-types may possibly occur within the study area. These include Primary Diamond deposits, Zn-Pb deposits (including MVT, SEDEX and their subtypes), Breccia-hosted IOCG deposits, Sedimentary-Hosted Cu, Ni-Cu-PGE deposits, Stratiform Iron, coal and Industrial Minerals.

The mineral deposit-types considered in this assessment were selected based upon conceptual models of deposit types and comparison of these models to the geology of the area being assessed (Sangster, 1983). This method is based upon the best currently available scientific knowledge. The existence of deposit types not listed here can not be ruled out. The mineral deposit-types considered are based on descriptions provided in *Geology of Canadian Mineral Deposit Types* (Eckstrand et al., 1996).

The various assessment criteria outlined in the literature (e.g., Rogers et al., 1995; Eckstrand et al., 1996) have been applied to the mineral deposit-types determined to have the best potential (Table 3) within the study area. The assessment criteria are summarized in Table 4. More complete synopses of the mineral deposit-types considered are available in Eckstrand et al. (1996).

Primary Diamonds

Kimberlite, the principal host-rock for diamonds, is a volcanic rock that was sourced in the Earth's mantle, deep beneath the crust. Kimberlite pipes and dykes penetrated crystalline rocks and erupted as explosive volcanoes through overlying cover rocks (e.g., Buffalo Head Hills in northern Alberta, Fort la Corne kimberlites in northern Saskatchewan, James Bay kimberlites in Ontario). Kimberlites are not restricted to a period of geologic time or to specific host-rock types. Lamproites are porphyritic, peralkaline, volatile rich, ultrapotassic rocks that also have potential to host diamonds (e.g., Argyle, Australia; Prairie Creek, USA; Ellendale, Australia; Kapamba, Zambia).

The nature of the basement and lithospheric mantle must be considered in the evaluation of diamond potential for a particular area. Traditionally, kimberlites have been sought in areas known to be underlain by thick, relatively cool Archean crust. However, the Argyle diamond

deposit in Western Australia is hosted by lamproite that intrudes Paleoproterozoic rocks of the Lamboo complex. Similarly, the Buffalo Hills kimberlites of northern Alberta appear to be underlain by Paleoproterozoic crust (ca. 2.1 – 2.4 Ga) (Aulbach et al., 2004), although they have not yet been proven to be economic diamond sources. Ts'ude niline Tu'eyeta is underlain predominantly by the Fort Simpson terrane, for which limited geochronology has yielded an age of 1845 Ma with T_{DM} ages ranging from 2.1 to 2.4 Ga (Villeneuve et al., 1991). The Fort Simpson terrane has been interpreted as a 1.85-1.84 Ga plutonic complex (Aspler et al., 2003 and references therein). The 'Nahanni terrane' underlies the southernmost part of Ts'ude niline Tu'eyeta, and has been interpreted as either an accreted microcontinent (Hoffman, 1989) or as a sedimentary basin that formed on attenuated crust of the Fort Simpson terrane (Cook et al., 1999). The lithospheric mantle beneath the Wopmay orogen, including the Fort Smith terrane, Hottah terrane and Great Bear magmatic zone, may be as thick as 180 km (Cook and Erdmer, 2005). It is therefore possible that a deep-seated Precambrian lithospheric mantle root, necessary for preservation of diamonds, is present beneath this part of North America.

Mineral Deposit Type	Examples with emphasis on Canada & Northwest Territories
<i>Potential Mineral Deposit Types Occurring In Phanerozoic Cover Rocks</i>	
Diamonds	Ekati Diamond Mine, Lac de Gras, NWT Diavik Diamond Mine, Lac de Gras, NWT DeBeer's Snap Lake Mine, NWT Kennady Lake, Jericho, NWT Buffalo Head Hills, Alberta Fort a la Corne, Saskatchewan
Mississippi Valley Type Zn-Pb	Pine Point, NWT Wrigley, NWT Nanisivik, Nunavut Polaris, Nunavut Gayna River, NWT
Sedimentary Exhalative (Sedex) Zn-Pb-Cu	Red Dog, Alaska Anvil Range (Faro, Dy, Grum, Swim, Vangorda), Yukon Tom, Jason, NWT-Yukon Border Howards Pass, NWT Sullivan Mine, B.C.
Sedimentary-Hosted Cu	Redstone (Coates Lake), NWT Hottah Lake occurrences, NWT
Coal	Coal Mine Lake, NWT Douglas Bay, Great Bear Lake Perry Creek and Brule Mine, northeast B.C.
Banded Iron Formation (BIF)	Crest BIF, NWT Mary River BIF, NU
Breccia-hosted IOCGs	Wernecke Breccia, YT Ernest Henry, Australia Olympic Dam, South Australia Sue-Dianne, NWT
Ni-Cu-PGEs (Nick-type, sediment-hosted, or mafic to ultramafic magmatic-hosted)	Nick deposit, YT Ferguson Lake, NU Noril'sk, Siberia
Industrial Minerals (Potash, Gypsum, Aggregate)	Esterhazy, Saskatchewan

Table 3. *Potential Mineral Deposit Types in the Ts'ude niline Tu'eyeta area.*

Deposit Type Criteria	Kimberlite-hosted diamond deposits (Kjarsgaard, 1996)	Mississippi Valley-Type (MVT) Zn-Pb (Sangster, 1996)	Sedimentary Exhalative (SEDEX) Zn-Pb (Lydon, 1996)	Sediment-hosted Cu (Kirkham, 1996)	Stratiform Iron (Gross, 1996)	Breccia-hosted IOCG deposits (Hunt et al., 2005)	Ni-Cu-PGE deposits (Eckstrand and Barrie, 1996)	Coal and Industrial Minerals
Geological Criteria present in the study area	<ul style="list-style-type: none"> ▪ Possibility of kimberlite pipes intruding basement and cover sequence. ▪ Deep-seated regional lineaments for pipe emplacement. ▪ Possible Precambrian cratonic basement (Aspler et al., 2003). ▪ Diamonds and abundant KIMs recovered from till samples taken from other areas thought to be underlain by Precambrian Nahanni/Fort Smith basement. ▪ No known kimberlite or lamproite occurrences. 	<ul style="list-style-type: none"> ▪ Proterozoic to Paleozoic age range; thick marine platform sequence. ▪ Regional faults identified, associated reef complexes, presence of chemical breccias, unconformities; all have potential to focus hydrothermal fluids. ▪ Regional proximity to Pine Point, Great Slave Reef and Wrigley deposits. 	<ul style="list-style-type: none"> ▪ Earn Group equivalents including the Hare Indian, Canol, and Imperial formations represent favourable host rocks with respect to age range. ▪ Road River Group is favourable rift sequence, host to Howard's Pass deposits in Yukon, though platform not basinal facies in NWT. ▪ Presence of evaporite deposits (gypsum; Aitken, 1982). ▪ Known occurrences of MVT deposits (commonly associated with SEDEX deposits). 	<ul style="list-style-type: none"> ▪ Favourable age range: Paleoproterozoic to Cretaceous. ▪ Favourable tectonic/depositional setting: passive continental margin, thick sedimentary sequence. ▪ Known evaporates represent favourable lithology association. ▪ No known redbeds or basaltic flows. 	<ul style="list-style-type: none"> ▪ Favourable age range. ▪ Proximity of known deposits (Crest). ▪ Favourable rift-related sedimentary rocks. ▪ Known Rapitan Group rocks (host of Crest IF) in southwest corner of study area. 	<ul style="list-style-type: none"> ▪ Regional-scale faults known: could function as conduits for hydrothermal fluids. ▪ No known plutonic rocks in the area. ▪ No known Wernecke Supergroup rocks in the area. 	<ul style="list-style-type: none"> ▪ Gabbro sills occur in Tsezotene Formation; potential for magmatic Ni-Cu-PGEs. ▪ Earn Group-age equivalents may have potential for Nick-type Ni-Cu-PGEs. 	<ul style="list-style-type: none"> ▪ Coal potential is considered to be high in the Mesozoic to Cenozoic stratigraphy of the Mackenzie and Great Bear Plains (Dixon, 1999). ▪ Gypsum occurs in the unnamed map unit H5 beneath the Little Dal Formation (Aitken et al., 1982).
Geochemical Criteria	Insufficient data.	Insufficient data.	Insufficient data.	Insufficient data.	Insufficient data.	Insufficient data.	Insufficient data.	Insufficient data.
Geophysical Criteria	Insufficient data.	Insufficient data.	Insufficient data.	Insufficient data.	Insufficient data.	Insufficient data.	Insufficient data.	Insufficient data.

Table 4. Mineral deposit-type assessment criteria.

The nature of the basement and lithospheric mantle must be considered in the evaluation of diamond potential for a particular area. Traditionally, kimberlites have been sought in areas known to be underlain by thick, relatively cool Archean crust. However, the Argyle diamond deposit in Western Australia is hosted by lamproite that intrudes Paleoproterozoic rocks of the Lamboo complex. Similarly, the Buffalo Hills kimberlites of northern Alberta appear to be underlain by Paleoproterozoic crust (ca. 2.1 – 2.4 Ga) (Aulbach et al., 2004), although they have not yet been proven to be economic diamond sources. Ts' ude niline Tu' eyeta is underlain predominantly by the Fort Simpson terrane, for which limited geochronology has yielded an age of 1845 Ma with T_{DM} ages ranging from 2.1 to 2.4 Ga (Villeneuve et al., 1991). The Fort Simpson terrane has been interpreted as a 1.85-1.84 Ga plutonic complex (Aspler et al., 2003 and references therein). The 'Nahanni terrane' underlies the southernmost part of Ts' ude niline Tu' eyeta, and has been interpreted as either an accreted microcontinent (Hoffman, 1989) or as a sedimentary basin that formed on attenuated crust of the Fort Simpson terrane (Cook et al., 1999). The lithospheric mantle beneath the Wopmay orogen, including the Fort Smith terrane, Hottah terrane and Great Bear magmatic zone, may be as thick as 180 km (Cook and Erdmer, 2005). It is therefore possible that a deep-seated Precambrian lithospheric mantle root, necessary for preservation of diamonds, is present beneath this part of North America.

No kimberlites have been discovered in either the Ts' ude niline Tu' eyeta area, or in the Northwest Territories portion of the Interior Platform. However, exploration for diamond-bearing kimberlite within the Interior Platform rocks in the Northwest Territories is currently being conducted by several companies (Stornoway Diamond Corporation, Sanatana Diamonds Inc., Patrician Diamonds Inc.; see *Previous Work*). Kimberlite indicator minerals (KIMs) have been discovered in various parts of the Interior Platform. For instance, KIMs have been found in abundance at Blackwater Lake and the chemistry and morphology of the indicator grains points to a local source for these indicator minerals (Davies, 2003). The Lena West Property, held by Diamondex Resources Limited and located about 200 km north of Fort Good Hope, remains a highly prospective area, due to the abundance of KIMs, their favourable chemistry, and the recovery of at least fourteen diamonds from stream sediment samples collected on the Lena West property (Turner, 2006). In addition, Sanatana Diamonds Inc. recently reported that the newly discovered Dharma kimberlite, located north of Great Bear Lake, is diamondiferous, with 180 diamonds greater than 0.106 mm recovered from the first 339.18 kg of kimberlite (Sanatana Diamonds Inc., 2007).

Prevailing wisdom following the discovery of economic diamond bearing kimberlites in the Lac de Gras area was that the KIMs found in the Interior Platform were likely glacially transported from the Slave Province to the west. With the large amount of glacial debris derived from the Canadian Shield scattered throughout the Interior Platform (e.g., large foliated granitic boulders etc.) it is highly probable that some, and perhaps many, of the very resistant KIMs have been glacially transported. However, the morphology of KIM grains (angular vs. rounded), their geochemistry (kimberlite fields have characteristic geochemical signatures), and KIM dispersion patterns of some Interior Platform regions suggests the presence of locally emplaced kimberlites in some areas, such as Edézhíé (Davies, 2003; Gal and Larivière, 2004b).

Based on the lack of kimberlite indicator mineral data for the area, the potential for primary diamonds is considered low. Due to the lack of data and general geologic information pertaining to the area, the confidence rank is very low (Rank 4). The possible presence of thick Precambrian

lithosphere beneath Ts' ude niline Tu' eyeta could provide a tectonic environment favourable for diamondiferous kimberlites, but this has not been thoroughly investigated.

Mississippi Valley-Type Zn-Pb

There are no known carbonate-hosted Zn-Pb showings within the Ts' ude niline Tu' eyeta area. However, several showings occur just west and south of the area, and the Gayna Zn deposits occur between 2 and 10 km south of the southern boundary of the study area. The Gayna River Zn deposits were discovered in 1974 and occur within platformal carbonate rocks of the Neoproterozoic Little Dal Group that is exposed along a tributary to the Gayna River in the Mackenzie Mountains. The deposit contains an historical estimated reserve of 50 million tons grading 4.7% Zn and 0.3%Pb, and may be one of Canada's largest undeveloped Zn deposits (Hewton, 1982). Other known occurrences of Zn-Pb in the NWT include the very significant past producing Pine Point orebodies and the Wrigley deposit (Figure 3).

The Pine Point and Wrigley deposits are considered Mississippi Valley-Type Zn-Pb (MVT) based on their shared characteristics with the classic MVT districts within the carbonate rocks of the drainage basin of the Mississippi River in the central United States. Some of these criteria include a carbonate platformal setting, presence of sphalerite and galena, mineralization concentrated in dolostone and associated vugs. The main control on mineralization at Pine Point is the formation of karst along structurally controlled mineralized trends (Rhodes et al., 1984; Pană, 2006) and the deposit is hosted within Middle Devonian dolomitized limestone sedimentary rocks.

In evaluating the mineral potential for MVT deposits in the study area, the following criteria need to be considered: presence of platformal carbonate rocks, especially where adjacent to sedimentary basins; the presence of geological features that permit fluid migration (reef complexes, breccias, paleokarsts, faults, basement highs, and depositional margins, unconformities, shale cap); extensive hydrothermal dolomitization of precursor carbonate rocks; carbonate host rocks that range in age from Proterozoic to Carboniferous. The Mackenzie Mountains part of the study area is underlain by Proterozoic to Devonian sedimentary rocks that exhibit many of the criteria outlined above. The presence of carbonate rocks, the local occurrence of associated reef complexes, presence of dissolution breccias, faults, unconformities and shale units at Gayna River and within the surrounding Cordilleran rocks are favourable indicators for MVT deposits in the southern part of the Ts' ude niline Tu' eyeta area.

The northern part of the study area is underlain by Cretaceous clastic sedimentary rocks that are not considered prospective for MVT mineralization. Existing knowledge of the subsurface comes from geological cross sections (e.g., Aitken and Cook, 1974; Cook and MacLean, 2004) and petroleum exploration well data (Hogue and Gal, 2008). Geophysical surveys could potentially detect basement highs and faults underneath the Cretaceous cover; however, any deposits in the Proterozoic to Devonian rocks that underlie the Cretaceous cover would occur at depths ranging up to >2180 m (Hogue and Gal, 2008; see also Figure 8 in Gal, 2007). Therefore, the potential for MVT deposits is considered low in the northern, Cretaceous-covered part of the Ts' ude niline Tu' eyeta area.

The potential for these carbonate-hosted deposit types is considered to be low in the northern part of Ts' ude niline Tu' eyeta within the wetlands proper, but moderate in the southern, Mackenzie Mountains part of Ts' ude niline Tu' eyeta (Figure 3). The confidence rank is low (Rank 3) due to the limited amount of exploration conducted across the area and, consequently, the limited information available.

SEDEX Zn-Pb

SEDEX deposits are generally hosted within basinal marine, reduced facies, fine-grained sedimentary rocks composed of carbonaceous chert and shale. In some deposits, low energy sedimentary deposits are interbedded with turbiditic siltstone and sandstone beds. SEDEX deposits form where metal-rich hydrothermal fluids are emitted from vents into deep water basins under reducing conditions. Sulphide minerals are precipitated either as beds on the sea floor, or within the hydrothermal vent system (Goodfellow and Lydon, 2007). SEDEX deposits are most common in Proterozoic and Paleozoic rocks. The bulk of Paleozoic SEDEX resources in the Yukon Territory and Northwest Territories are located in the Cambrian to Silurian Road River Group of the Selwyn Basin, and the Devonian to Carboniferous Earn Group of northwestern Canada and Alaska (Lydon, 1996).

The proximity of the Gayna River MVT deposit is a positive indicator for SEDEX potential. Mineral deposit characteristics commonly form a continuum between MVT and SEDEX deposits (Lydon, 1996; Sangster, 1996), with MVT deposits occurring in platformal carbonate sequences that are the shallow water facies equivalents to basinal, typically fine-grained sediments that host SEDEX deposits. The two deposit types are commonly spatially and temporally related. The important point here is that where one deposit type occurs, there is potential to find the other as well.

Thick shale sequences of the Devonian Hare Indian, Canol, and Imperial formations (Gal, 2007; Figure 4) are age-equivalents to the Earn Group rocks which host the MacMillan Pass Zn-Pb deposits (western Yukon Territory). There are also known faults in the area (Aitken and Cook, 1974) that have the potential to act as conduits for hydrothermal fluids. Although no SEDEX showings are known in the Ts' ude niline Tu' eyeta area, Earn Group equivalents including the Hare Indian, Canol, and Imperial formations could be considered for SEDEX potential. The lack of known showings may be a function of under-exploration. On the other hand key syn-sedimentary criteria for SEDEX deposits, such as carbonaceous units (representing non-circulating anoxic deep marine conditions), silicious shale (representing radiolarian blooms related to hydrothermal vents), or conglomerate or other facies changes (representing syn-sedimentary faults) are not documented in the Hare Indian, Canol and Imperial formations.

The potential for SEDEX deposits is considered low in the Mackenzie Mountains portion of Ts' ude niline Tu' eyeta area and very low in the northern, or wetlands area. The confidence rank is very low (Rank 4) due to the lack of exploration and geochemical data for the entire study area.

Sediment-hosted Cu

Sediment-hosted Cu stratiform deposits (Kupferschiefer / Redbed-Cu) are commonly found near oxidation-reduction boundaries within continental redbed sequences (Kirkham, 1996).

Kupferschiefer-type deposits are known within the Redstone Copper Belt at Coates Lake in the Mackenzie Mountains (Redstone River Formation of the Coates Lake Group; Jefferson and Ruelle, 1986), approximately 200 km south of the study area. The most important Cu deposits are located where basalts, the thickest redbeds and evaporites comprise the stratigraphy. There is also potential for sandstone-hosted Cu or U (Bell, 1996) (mineable by in-situ leach) in Cretaceous strata, if present.

There are no known Cu occurrences in the study area. The best potential for this type of deposit is within Proterozoic redbed sequences that have not been identified in the study area.

The potential for sediment-hosted stratiform Cu deposits is considered low, with a very low rank of confidence (Rank 4). The potential for stratiform-Cu would increase if amenable stratigraphy was discovered in the area. Improvement upon existing maps, generated at 1:250 000 scale and heavily reliant upon air photo interpretation, by targeted or thematic mapping at 1:50 000 could result in the identification of stratigraphic sequences favourable to this style of mineralization.

Stratiform Iron Formation

Banded Iron-Formation (BIF) is part of the Neoproterozoic Rapitan Group and outcrops in both the Northwest Territories and the Yukon Territory. The Crest-IF deposit comprises three main occurrences in the NWT, these are situated approximately 60 km west of the study area. Crest is considered the third largest iron resource in North America and contains an historical resource estimate of about 18 billion tons of ore grading 47% Fe (Stuart, 1963). It remains uneconomic due to lack of infrastructure and high phosphate content.

Iron-Formation belongs to Gross' (1996) stratifer group, which includes lithological facies formed by chemical, biogenic, and hydrothermal effusive or exhalative processes. The Crest-IF occurs in Paleoproterozoic rocks of both the Sayunei and overlying Shezal formations of the Rapitan Group. Iron is concentrated within a 150 m thick zone comprising up to ten subzones (Yeo, 1986). The iron-formation is interpreted as a primary chemical sediment that formed either during glaciation as a distal hydrothermal deposit (Yeo, 1986) or during interglacial times (Klein and Beukes, 1993).

Although no iron deposits are known within the boundaries of Ts'ude niline Tu'eyeta, a belt of Rapitan Group sedimentary rocks transects the southwest corner of the Ts'ude niline Tu'eyeta Area; however, the Rapitan Group does not everywhere include iron-formation.

The potential for BIF in the study area is rated as low because neither iron-formation nor the host Rapitan Group are known to occur within the study area. Due to the lack of available geoscience information from the study area, the confidence rank is very low (Rank 4). However, as for other deposit types, targeted mapping could increase the confidence rank of iron potential in the study area, especially if the favourable units within the Rapitan Group are identified.

Breccia-hosted Iron Oxide Copper-Gold (IOCG) deposits

IOCG (\pm Ag \pm Nb \pm P \pm REE \pm U) deposits include a large spectrum of sulphide-deficient, mono- to polymetallic breccias, veins, disseminations and massive lenses with more than 20% magnetite and /or hematite (Corriveau, 2007). Lithologic hosts and host-rock ages vary to the

point of being non-diagnostic. Associated alteration, however, tends to be quite diagnostic, with calcic-sodic alteration superimposed upon by potassic and iron oxide alterations (Corriveau, 2007). Although the main economic IOCG deposits (e.g., Olympic Dam, Australia; NICO and Sue-Dianne in NWT) are associated with regional-scale granitic suites (Corriveau, 2007), no such relationship is evident for the Wernecke Breccia located in the north-central Yukon Territory (Hunt et al., 2005). The Wernecke Breccia, and associated occurrences interpreted as IOCG type, are located at intersections of regional-scale faults and appear to have exploited pre-existing crustal weaknesses at all scales including the faulted cores of folds, high strain zones, joints and fractures and permeable sedimentary layers (Hunt et al., 2005). U-Pb dating of hydrothermal titanite from a sample of breccia matrix yielded an age of ca. 1600 Ma, interpreted as the age of one component of the polyphase Wernecke Breccia (Thorkelson, 2000).

Although no Wernecke Group equivalents are known to occur in the study area, regional-scale faults do occur and could function as conduits for hydrothermal fluids. However, as the oldest rocks of the Mackenzie Mountains are ca. 1000 Ma in age (Thorkelson et al., 2005), they cannot have been affected by the ca. 1600 Ma event that created the Wernecke Breccia. Some geochronological evidence has been interpreted to indicate the presence of ca. 1100-1175 Ma granite of unknown extent beneath the Mackenzie Mountains Supergroup (Thorkelson et al., 2005; Jefferson and Parrish, 1989), although no associated hydrothermal activity has been documented to date.

The potential for IOCG deposits in the study area is very low, with a very low level of confidence (Rank 4).

Nickel-Copper-Platinum Group Elements (Ni-Cu-PGE)

Two styles of Ni-Cu-PGE mineralization should be considered for the area. The first is mafic to ultramafic magmatic-hosted Ni-Cu-PGE, such as the Noril'sk deposit of northern Siberia. The second style is Nick-type, sedimentary-hosted Ni-Cu-PGE. This latter mineralization style is considered a relatively distinct deposit type, and has been reported in Devonian shale of the eastern Yukon Territory where it has been interpreted as hydrothermal exhalative (Hulbert et al., 1992) or related to a meteorite impact during the Fammenian (Goodfellow, 2002).

At Noril'sk, Ni-Cu-PGE mineralization is hosted by Triassic sill-like intrusions within Paleozoic sedimentary rocks overlying Proterozoic crystalline rocks (Eckstrand and Barrie, 1996). Gabbro sills up to 60 m thick occur in the southernmost part of the study area (northern Mackenzie Mountains) where they intrude all pre-Rapitan formations, including the Tsezotene Formation and Katherine Group (Aitken et al., 1982). These sills are part of the ca. 780 Ma Gunbarrel mafic event, which intruded the western margin of the Neoproterozoic Laurentian craton possibly during breakup of Rodinia (Harlan et al., 2003). Although Cu-Ni-PGE mineralization has not been documented within the study area, the relatively high volume of mafic magmatism warrants investigation.

Nick-type, thinly stratiform, sediment-hosted Ni-PGE concentrations are hosted in Devonian Earn Group rocks within a narrow zone (2-7 cm) of the Phosphatic Chert Member, stratigraphically above the Limestone Ball Member, in Yukon Territory. These occurrences have been interpreted as a type of SEDEX deposit (Hulbert et al., 1992) or a local result of a major

meteorite impact event (Goodfellow, 2002). The Earn Group is not recognized in the study area, but Devonian equivalents include the Hare Indian, Canol and Imperial formations. At Nick, mineralization is associated with limestone concretions of the distinctive Limestone Ball Member, and identification of this association or other aspects suggesting a meteorite impact event should be one of the aims of a targeted thematic mapping project.

Depending on the interpreted origin of Nick-type sediment-hosted Ni-PGE deposit type, potential for it may be low (SEDEX) or moderate (meteorite impact) in the Mackenzie Mountains and similarly low or moderate in the wetlands part of Ts' ude niline Tu' eyeta. Despite the absence of Earn Group rocks, Earn Group-age equivalents such as Hare Indian, Canol and Imperial formations occur in the area and represent prospective stratigraphy for this deposit type. The confidence is very low (Rank 4) due to the lack of available geologic information. The potential for magmatic-hosted Ni-Cu-PGEs is also considered low to moderate in the Mackenzie Mountains and low within the wetlands, with a low confidence rank (Rank 3). Gabbro sills are known in the area but their potential remains to be evaluated.

Coal

Although no coal showings have been documented for the Ts' ude niline Tu' eyeta area, coal potential is considered to be high in the Mesozoic to Cenozoic stratigraphy of the Mackenzie and Great Bear plains (Dixon, 1999). In particular, coal seams are interbedded with conglomerate of the Summit Creek Formation in the Brackett Basin area, near Norman Wells. Individual seams reportedly reach thicknesses of up to 12.1 m, and the grade is generally low-rank, varying from lignite to high volatile C bituminous (Sweet et al., 1989; Dixon, 1999). The bituminous shale units described in the Ramparts area (Cook and Aitken, 1975) are considered to better reflect the area's potential for hydrocarbons (as a source rock or as oil shale) rather than for coal.

The potential for coal is low to moderate for the northern, or wetlands part of the Ts' ude niline Tu' eyeta area, and low in the Mackenzie Mountains. The confidence rank is low (Rank 3).

Industrial Minerals

An assessment of surficial materials is beyond the scope of this NRA, which is aimed at subsurface resources. Industrial minerals are defined in the American Geological Institute Dictionary of Geological Terms as: "Any rock, mineral, or other naturally occurring substance of economic value, exclusive of metallic ores, mineral fuels, and gemstones" (Bates and Jackson, 1984). Industrial minerals are essential resources for modern society and their applications range from construction of roads, bridges, and buildings, to operations such as drilling for oil and gas, to military applications and major constituents of consumer products. Their unit value is usually relatively low compared to most metallic minerals. For this reason, they are not likely to be exploited in remote areas unless they are present in sufficient abundance to meet a surging demand. Construction of a pipeline through the Mackenzie Valley could create a sudden increase in the need for certain industrial minerals such as gravel for road construction. Similarly, discovery of oil and gas in the area would also create a surge in the demand for such materials. A full evaluation of industrial minerals should be considered by a separate study and include Quaternary geological mapping.

CONCLUSIONS

The available geologic information related to mineral resources for the Ts'ude niline Tu'eyeta area is sparse, as very little exploration for minerals has been conducted in the area. Most of the available geological information is in oil and gas exploration reports and regional mapping reports by the Geological Survey of Canada in the 1960s and 1970s.

The remoteness of the area and lack of favourable geology in existing regional-scale maps have dissuaded exploration in the area. Diamond exploration in the Interior Platform is still in its infancy and results from the efforts of exploration companies currently active in nearby regions (e.g., Stornoway Diamond Corporation, Sanatana Diamonds Inc., Patrician Diamonds Inc.) may eventually shed more light on diamond prospectivity within the northern Interior Platform. The presence of thick carbonate sequences, reef complexes, regional faults, chemical breccias and unconformities in the area, the regional similarity of the study area to the Pine Point and Wrigley areas and the presence of known showings at Gayna River are all positive indicators for MVT Zn-Pb potential. The presence of Road River Group rocks, Earn Group age equivalent rocks, evaporites and known MVT occurrences are positive indicators for SEDEX potential. Although rocks of the Coates Lake Group, Rapitan Group and Wernecke Supergroup are not known within the study area, the possible presence of these, or age-equivalent units in the study area cannot be ruled out. Potential for stratiform-Cu, iron-formation, and Nick-type Ni-PGE deposits depends primarily on identification of favourable stratigraphic and structural attributes. The geology of Ts'ude niline Tu'eyeta is not considered conducive to IOGC deposits but the presence of regional-scale faults may be significant if hydrothermal fluids were mobile in the area. In addition, the gabbro sills in the southern part of Ts'ude niline Tu'eyeta should be evaluated in terms of Ni-Cu-PGE potential.

Table 5 summarizes the mineral potential for each of the mineral deposit types considered for the area. The deposit type considered to have the highest potential in Ts'ude niline Tu'eyeta is MVT Zn-Pb deposits, with moderate potential in the southernmost part of the area, in the Mackenzie Mountains; MVT potential is low for the northern part of the area, in the wetlands area proper. The potential for SEDEX, Nick-type Ni-Cu-PGE, and magmatic Ni-Cu-PGE is considered low to moderate for the Mackenzie Mountains part of Ts'ude niline Tu'eyeta, and low for the northern wetlands. The potential for coal is low to moderate in the northern wetlands and low in the Mackenzie Mountains. Primary diamonds, stratiform-Cu and iron-formation are all considered to have low potential across Ts'ude niline Tu'eyeta. The potential for IOGC deposits is considered very low.

POTENTIAL Ranking	CONFIDENCE Ranking			
	Rank 1: Abundant reliable information	Rank 2: Moderate amount of information	Rank 3: Some information	Rank 4: Very little and/or unreliable information
Rank A: Very High: Geologic environment is favourable. Significant deposits are known. Presence of undiscovered deposits is very likely.			X	X
Rank B: High: Geologic environment is favourable. Occurrences are present but significant deposits are not known. Presence of undiscovered deposits is likely.				X
Rank C: Moderate to High: Intermediate between moderate and high potential.				
Rank D: Moderate: Geological environment is favourable. Occurrences may or may not be known. Presence of undiscovered deposits is possible.			MVT Zn-Pb deposits (Mackenzie Mountains)	
Rank E: Low to Moderate: Intermediate between low and moderate.			Coal deposits (wetlands)	Ni-Cu-PGE deposits (Mackenzie Mountains)
Rank F: Low: Some aspects of the geological environment may be favourable but are limited in extent. Few if any occurrences are known. Low probability that undiscovered deposits are present.				Primary diamond deposits Sediment-hosted Cu deposits Iron-Formation deposits SEDEX Zn-Pb deposits (Mackenzie Mountains)
Rank G: Very Low: Geologic environment is unfavourable. No occurrences are known. Very low probability that undiscovered deposits are present.				Breccia-hosted IOCG deposits SEDEX Zn-Pb deposits (wetlands)
Rank H: Not Assessed: Deposit types unknown, overlooked, beyond the scope of the assessment, or not worth mentioning at the time the assessment was done. A higher rating could be assigned during future assessments.	X	X		
<i>Criteria for assessing mineral potential follows the Geological Survey of Canada's Mineral and Energy Resource assessment rating scale (Scoates et al., 1986).</i>				

Table 5. Mineral potential summary.

INFORMATION GAPS

This mineral resource assessment is based upon currently available information. The most critical knowledge gaps are outlined below. Suggestions are made for collecting additional new data to improve the confidence and accuracy of mineral resource assessment. The paucity of geologic information available for the Ts' ude niline Tu' eyeta limits the ability of a mineral resource assessment to accurately depict the probability of specific deposit types to occur in the defined area. Only by collecting new geoscience information will it be possible to better understand the geologic environment and its prospectivity.

Geochemistry

There are no public-domain regional till, stream sediment or lake sediment geochemical data for the study area. Geochemical data alone would greatly enhance confidence in and quality of mineral potential estimates. Specialized geochemical surveys (similar to mobile metal ion leaching) may be useful in the northern part of the study area, where indications of bedrock, even from glacial till deposits, may be sparse. The presence and level of permafrost in the area may hamper the effectiveness of partial leach methods. Various types of media should be tested and examined to determine the most effective assessment tools.

Geophysics

No electromagnetic or radiometric survey coverage exists. New regional surveys would greatly enhance the confidence and quality of mineral potential estimates.

Considerable seismic survey data, of recent vintage, are available in the southeastern quadrant of the study area (Gal, 2007). The remaining survey lines are mostly in the northwest and northeast quadrants, but are generally of poor quality and of limited use for subsurface geological interpretation. New seismic surveys would aid in evaluating subtle structures and stratigraphic anomalies that might be expected through the northern half of the study area.

Geology

Existing bedrock geology maps were published at 1:250 000 scale and are essentially reconnaissance in nature. Much of the mapping in the mountains was done using air photo and binocular reconnaissance interpretation, with only sparse foot traverses. The fieldwork dates from the late 1960s and 1970s. Since that time stratigraphic, structural and sedimentological science has evolved. The northern part of the study area, in the Interior Platform, suffers from poor and widely spaced bedrock exposures. Little can be done to improve bedrock exposure, which underscores the need for other survey methods (geophysical, geochemical).

RECOMMENDATIONS FOR PHASE II

Recommendations are presented in order of relative priority and cost-effectiveness, to address some of the information gaps and increase the level of confidence of the Phase II study. Some gaps are not expected to be easily remedied due to their high cost, hence are given low priority.

1. Stream sediment sampling is highly recommended. It is a highly effective tool for determining areas of anomalous chemistries that may reflect bedrock mineralization. Particular attention must be paid to the northern Wetlands part of Ts'ude niline Tu'eyeta, as the lack of relief may hamper the use of stream sediment sampling as a regional assessment tool. The surficial qualities of the northern area (availability of materials that can supply information pertinent to the underlying bedrock) must be evaluated in order to adapt geochemical techniques to properly assess that area.
2. Heavy Mineral Concentrate (HMC) sampling is an effective tool for mineral evaluation and is invaluable to the proper assessment of diamond potential by detecting KIMs. Gold grains, Platinum Group Minerals, and metamorphosed or magmatic massive sulphide indicator minerals (MMSIMs) should also be counted and examined.
3. Examination of known outcrop areas by prospecting, structural analysis, stratigraphic and paleontological studies, and lithogeochemical sampling to increase knowledge of the area, and may reveal new sites which may require follow up work.
4. Targeted thematic bedrock mapping of parts of the Mackenzie Mountains area is an invaluable tool for discrimination of prospective areas. Proterozoic stratigraphy should be mapped in greater detail with a focus on locating undiscovered iron-formation and red beds. Earn Group equivalents should also be examined with particular attention to SEDEX Zn-Pb and Nick Ni-PGE potential. Search for evaporate beds and stromatolitic bioherms should also be considered in terms of the SEDEX Zn-Pb deposit model.

The Northwest Territories Geoscience Office is currently leading a multi-year, multi-disciplinary, and multi-agency regional geoscience study on the Peel Plain and Plateau, focusing on petroleum potential (Pyle et al., 2006). The Peel Plateau and Plain includes much of the current study area. New results and interpretations from this project will increase the knowledge base of the region, thereby contributing to future non-renewable resource assessments.

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