

REPORT  
ON  
THE GREAT SLAVE REEF LEAD-ZINC DEPOSITS  
PINE POINT, N.W.T.

FOR

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## 1.0 SUMMARY AND CONCLUSIONS

- This report is written for Tamerlane Ventures Inc. and outlines the exploration potential of the Pine Point Project, south of Great Slave Lake in the Northwest Territories. The project consists of 175 square kilometers of ground once held by Pine Point Limited, a subsidiary of Cominco Ltd. and ground to the west once held by the Westmin-Dupont joint venture.
- The project is located about 800 km north of Edmonton, on the south shore of Great Slave Lake. Access is by 825 km of paved highway north from Edmonton to Hay River and then 90 km of paved highway to the old Pine Point town site. Access to many of the deposits within the project area is via gravel haul roads.
- The Pine Point Project consists of 38 mineral claims, owned 100% by Ross Burns subject to a partnership agreement with Margaret Kent, covering 17,435 hectares plus another 8 claims covering 4,786 hectares staked by Pine Point Mines Inc. Tamerlane can earn a 60% interest in the property by paying \$150,000 and issuing 1,200,000 shares of Tamerlane to the Kent Burns Group and completing a 3 phased cumulative \$1.25 million exploration program by December 31, 2006. If this first option is exercised Tamerlane can acquire the remaining 40% interest in the project, subject to a 3% NSR royalty by paying \$Cdn 1 million to the Kent Burns Group.
- A fur trader first discovered lead-zinc mineralization on the property in 1898. Cominco Ltd. successfully mined the deposits through the subsidiary company Pine Point Mines Ltd. from 1965 to 1986. A total of 64 million tonnes averaging 3.1 % lead and 7.0 % zinc was produced from 50 different ore bodies.
- Exploration at Pine Point was hampered by the westerly dip of the host dolomite reef under glacial overburden and swamps. The flat terrain and numerous deep swamps dictates that all drilling and geophysical exploration be conducted during the winter months. The most successful exploration technique was induced polarization geophysics.
- Lead-zinc sulphide mineralization at Pine Point is hosted by Middle Devonian Givetian sediments, which have been subdivided into 5 main Formational groups. Most deposits have been identified within the Pine Point and Sulphur Point formations that make up the Barrier Complex. The main control on mineralization is the formation of karsts along structurally controlled mineralized trends.
- The exploration potential at Pine Point lies in 34 identified mineralized lead-zinc deposits that were not mined by previous owners and large portions of the Barrier Complex that were under explored. The deposits were left undeveloped due to a combination of haul distance from the existing Pine Point mill, uneconomic depths for conventional open pit extraction and/or predicted high ground water inflow rates. The problems with long haul distances can be addressed by in pit crushers and concentrators. Under water mining techniques, currently used in South Africa, will be evaluated as a solution to ground water problems. Dense media separation will be evaluated to upgrade feed material from the mining operation prior to conventional

milling. A drive-in drive-out camp facility can reduce the high overhead of operating a town site. Finally, the continued weak Canadian dollar will provide added value to base metals sold in US dollars.

- The Pine Point area is a very successful mining camp with the Pine Point Mines Limited operation (1965-1986) being among the most profitable in Canadian mining history. The potential exists to not only confirm the unexploited mineralization delineated by previous owners, but also to discover new mineralization within the camp. An exploration program has been recommended to explore the area and investigate modern exploration, mining and milling strategies. The program is spread over 2 years. The initial program in year 1 would complete a geophysical survey over the claim area to test modern geophysical techniques in locating and identifying Pine Point style mineralization at an estimated cost of \$300,000. Phase 2 would confirm through drilling reported lead-zinc deposits and begin mining and metallurgical studies. The Phase 2 program is estimated to cost \$270,000.

## **2.0 INTRODUCTION**

This report was written at the request of Tamerlane Ventures Inc. (“Tamerlane”) to describe the mineral and exploration potential of the Pine Point Project on Great Slave Lake, Northwest Territories. Tamerlane can acquire, through an option agreement with Kent Burns Group, approximately 175 square kilometers of ground once held by Pine Point Mines Limited, a subsidiary of Cominco Ltd. and ground contiguous to the west of the Pine Point Property which was once held by the joint venture of Westmin Resources and Dupont.

The writers base this report on a study of the literature and personal experience within the area. Gary Giroux completed a lithochemical study and a number of resource estimates for deposits within the Westmin-Dupont joint venture, in the early eighties. Ian McCartney held the position of exploration geologist for Cominco – Pine Point Mines and was based at Pine Point for three years (1985-87). Mr. McCartney oversaw a team responsible for major exploration and ore delineation drilling programs throughout the Pine Point Mines Property and achieved a discovery record at Pine Point. He also researched applicable rock geochemical techniques and presented a paper on the Rock Geochemistry of the N-81 deposit at the Geoscience Forum in Yellowknife in 1986. On May 9, 2004 Mr. McCartney visited the site. At that time the drill core storage area, access routes, current infrastructure, and the restored town site and mill site as well as several old pit areas were examined and documented with digital photos and video clips. The locations of all photos and observations were recorded as GPS waypoints. These photos and records of their locations are available at the Kent Burns Group office.

### **2.1 Disclaimer**

Any reference to resources or reserves within this report are based on historical documents. Without examination of the data the authors have no way of knowing if the procedures used would conform to the C.I.M.M. guidelines for National Instrument 43-101. It is not the intent of this report to imply that resources or reserves exist. This report is intended to suggest that significant drill indicated lead-zinc mineralized deposits were identified by past owners who considered them uneconomic at that time. The purpose of this report is to

outline an exploration program to collect and validate all available data, drill test known mineralization and determine if further work is warranted.

### 3.0 PROPERTY INFORMATION

#### 3.1 Location and Access

The Pine Point Project Area is located on the south side of Great Slave Lake, in the Mackenzie Mining Division of the Northwest Territories, and some 800 km north of Edmonton. The claims cover the geological feature known as the Great Slave Reef (or the Pine Point Barrier Reef) within NTS blocks 85 B-10, 11, 14, 15 and 16 (see Figure 1). The claim area is situated about 10 km south of the lake and about 60 m above lake level.

Between	Longitude	- 114° and 115° 15' West
	Latitude	- 61° 0' and 61° 45' North

The claims may be accessed by 90 km of paved road from Hay River, which lies due west of the claim group. This road runs longitudinally along the length of the current claim group. Hay River, in turn can be reached by 825 km of paved road north from Edmonton, Alberta.

Hay River has all major services including an airport with scheduled jet service from Edmonton and Yellowknife, a rail terminal and a port from which all barge traffic goes down the Mackenzie River. An airstrip suitable for small aircraft is also present 4 km SSE of the former Pine point mill site and the 2 km east of the former Pine Point town site.

The claim area can be accessed using light vehicles, skidoos, Bombardier/Nodwell tractors and other all terrain vehicles via a series of all season haul roads built to service the various open pit mines that were worked by Pine Point. These haul roads remain serviceable, and summer light truck access could be re-established to all of them with some re-culverting work. The haul roads extending west and southeast from the former mill site were found to be in excellent condition and were readily truck accessible during the site visit of May 9. The main North Trend haul road were driven for 8.5 km to the west of the mine where snow and mud was encountered, however the summer vehicle access along this road will extend farther to the west. The Main Trend Haul road is also exceptionally well preserved although snow pack limited truck access to 4 km west of the mill site at the time of the site inspection. Haul roads extending east from the mill site are also accessible and well preserved although mud and snow limited truck access in this direction to 2 km at the time of the visit. The establishment of additional winter light truck access by cat is relatively easy in all areas of the property. Additional Nodwell access exists along a regular grid of geophysical lines extending throughout the property. Inspection of these old cut lines on May 9 indicated them to be in good condition with very sparse recent alder vegetation that would not impeded Nodwell access. No re-cutting would be necessary to conduct ground surveys in most areas.

#### 3.2 Topography, Vegetation and Climate

Low relief, poor drainage, swampy muskeg and shallow, marl-bottomed ponds characterize the topography of the area. In general a blanket of glacial till, gravel, sands and clay produce a low-lying terrain that slopes gently towards the north and Great Slave Lake.

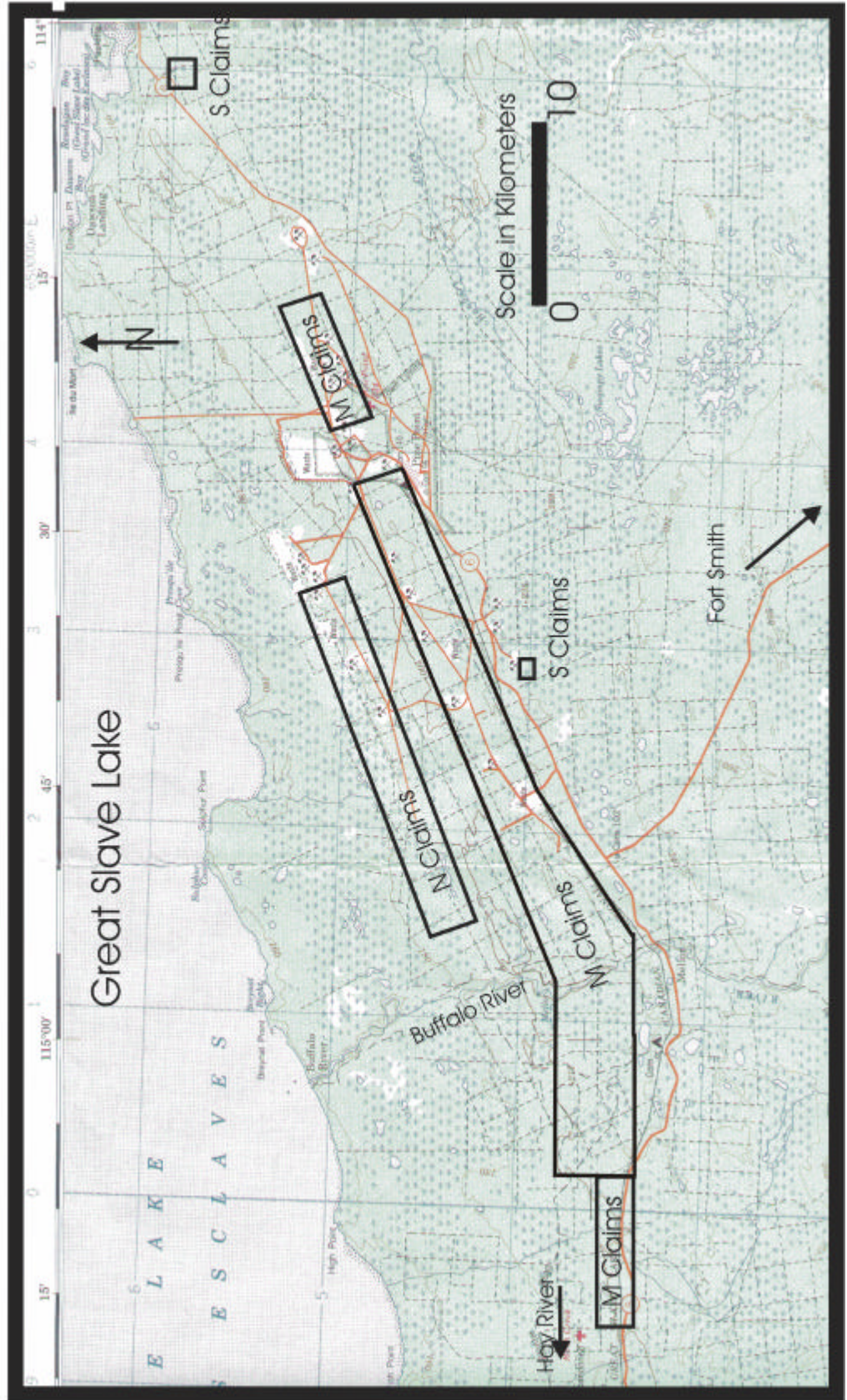


Figure 1: Location Map of Pine Point Showing approximate area of Claims

The main vegetation of scrub jack pine, black spruce and willows are interspersed between large areas of open swamp. Within the claim area, raised beaches afford space suitable for industrial development.

Sub-arctic winter conditions with mean average temperatures of  $-32^{\circ}\text{C}$  ( $-25^{\circ}\text{F}$ ) extend from November to late April. Snowfall is relatively light with maximum snow pack of 1 to 1.5 m. The summers are hot and relatively dry with long daylight periods.

Sparse moose, black bear and deer populations occur in the area. The area is believed to be well south of caribou migration areas and well to the northwest of the main range of wood buffalo. A "NWT Bison Management Area" extends west from the Buffalo River and may cover part of the western extremity of the property. It is administered by the Department of Renewable Resources.

### 3.3 Infrastructure

While the CNR Great Slave Lake Railway was completed in 1964 connecting Hay River to Pine Point, the tracks were removed in the early 1990's when Pine Point ceased shipments of concentrates. At this time only the Hay River Railway Bridge and the rail bed remains. The four concrete pylons for the Buffalo River Railway Bridge also remain although the bridge superstructure was removed at Buffalo River. The railway embankment has been re-contoured and set back from smaller stream crossings such as Twin Creek and Birch Creek.

The town site of Pine Point, built in 1963 was also removed when the mine closed. The former town site is 4.4 km by paved road to the south of the old mill site. All houses and buildings were taken down and the town site restored. All the paved streets were left in place and these remain in good condition and are accessible from two paved access roads leading off the Hay River – Fort Resolution Highway. Paved 2-lane highway runs continuously from Hay River to the former town site and the old Cominco mill site.

In 1965 an 18 MW hydroelectric plant was built on the Taltson River to supply power to Pine Point, Fort Smith and the mine site. A 274 km long single-circuit 115 kV transmission line connects the hydro plant to the mine site. The capacity of the electrical system was increased in 1976 to allow for an electric powered dragline. At present the power line is routed from the main Hay River road to the N81 pit and from there, along an old haul road to the Pine Point Substation. A site inspection on May 9, 2004 found the power infrastructure was all in place as above described. The power remains live to a large substation located at the old Cominco Mill site (at  $114^{\circ} 25' 30''$  /  $60^{\circ} 52' 00''$ ).

The former town site is equipped with Northwestel telephone services via a 400-foot tall microwave tower. This facility also remains connected to the power grid of the area.



#### 4.0 CLAIM INFORMATION

The Pine Point Project is contained within 38 mineral claims covering 17,435 hectares (43,082 acres) registered to Ross Burns plus another 8 claims covering 4,786.3 hectares (11,827 acres) staked by Pint Point Mines Inc. No legal survey for claims is required in the applicable mining jurisdiction, although Global Positioning Satellite (GPS) surveys of all claim boundaries were conducted during staking. The 38 claim group is 100% owned by Ross Burns subject to a 50-50 partnership agreement with Margaret Kent. Mr. Burns holds the claims for the Kent Burns partnership. The claim information is provided below in Table 1 and claim locations are shown on Figure 2.

Tamerlane Ventures Inc. has an option to acquire 60% interest in the project by paying \$150,000 and issuing 1,200,000 shares of Tamerlane to Kent Burns Group and completing the following:

- a \$400,000 work program by December 31, 2004
- a cumulative \$750,000 work program by December 31, 2005
- and a cumulative \$1,250,000 work program by December 31, 2006.

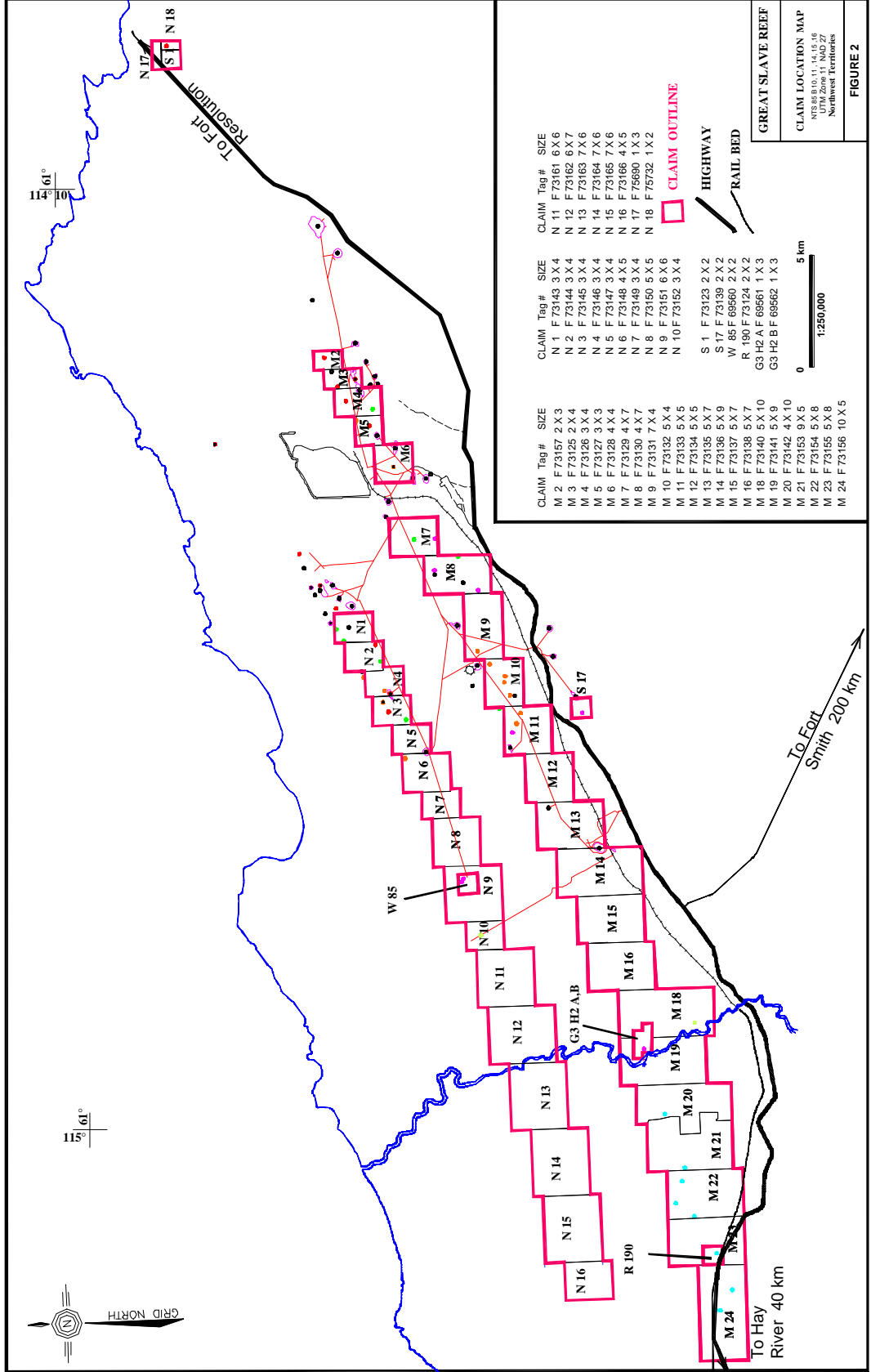
If this part of the option agreement is completed, Tamerlane can acquire the remaining 40% interest in the project by paying \$1,000,000 to the Kent Burns Group, in which case Kent Burns retain a 3% NSR.

The claims are mostly contiguous with the exception of the S claims which are single blocks staked to cover known South Trend deposits. The M claims cover the strike length of the Main Trend mineralization and are contiguous except in the area of the Pine Point mine tailings. A decision was taken not to stake the tailings areas as part of the current property. Cominco previously completed condemnation drilling through the tailings pond area. The N claims are a contiguous group of claims covering the North Trend mineralization. The N claims are not contiguous with either the M or S Claims.

The W85 and G3H2A and B claims were staked in 2000 to cover known prismatic deposits and are now contiguous with the N and M groups of claims respectively. Claim information has been provided by Kent Burns Group and the authors have not checked claim posts.

Table 1: Claim information

Claim #	Name	Acreage (acres)	Record Date
F69560	W85	194.55	07/18/00
F69561	G3H2A	154.95	07/18/00
F69562	G3H2B	154.95	07/18/00
F73123	S1	206.60	09/06/01
F73124	R190	206.60	09/06/01
F73125	M3	413.20	09/06/01
F73126	M4	774.75	09/06/01
F73127	M5	464.85	09/06/01
F73128	M6	826.40	09/06/01
F73129	M7	1,033.00	09/06/01
F73130	M8	1,446.20	09/06/01
F73131	M9	1,446.20	09/06/01
F73132	M10	1,033.00	09/06/01
F73133	M11	1,291.25	09/06/01
F73134	M12	1,291.25	09/06/01
F73135	M13	1,807.75	09/06/01
F73136	M14	2,324.25	09/06/01
F73137	M15	1,807.75	09/06/01
F73138	M16	1,807.75	09/06/01
F73139	S17	206.60	09/06/01
F73140	M18	2,479.20	09/06/01
F73141	M19	2,117.65	09/06/01
F73142	M20	2,014.35	09/06/01
F73143	N1	619.80	09/06/01
F73144	N2	619.80	09/06/01
F73145	N3	619.80	09/06/01
F73146	N4	585.80	09/06/01
F73147	N5	619.80	09/06/01
F73148	N6	1,033.00	09/06/01
F73149	N7	619.80	09/06/01
F73150	N8	1,291.25	09/06/01
F73151	N9	1,652.80	09/06/01
F73152	N10	619.80	09/06/01
F73153	M21	2,479.20	09/06/01
F73154	M22	2,066.00	09/06/01
F73155	M23	1,859.40	09/06/01
F73156	M24	2,582.50	09/06/01
F73157	M2	309.90	09/06/01
F73162	N12	2,169.30	03/24/02
F73163	N13	2,169.30	03/24/02
F73164	N14	2,169.30	03/25/02
F73165	N15	2,169.30	03/27/02
F73166	N16	1,033.00	03/27/02
F73161	N11	1,859.40	03/29/02
F75690	N17	154.95	04/02/02
F75732	N18	103.30	04/02/02
<b>Total</b>	<b>46</b>	<b>54,909.55</b>	



## 5.0 HISTORY

### 5.1 Chronological History of Pine Point

An excellent summary of the chronological history of the Pine Point area is contained within a report written by R. Burns. (Burns, 2001)

*“The following is a summary of the history of the area.*

- 1898 *A fur trader at nearby Fort Resolution staked eight claims. When it was discovered that the ore contained no gold or silver the claims were allowed to lapse.*
- 1899 *The deposits were reported by Dr. Robert Bell, Director of the Geologic Survey of Canada.*
- 1908 *A few claims were staked but allowed to lapse.*
- 1914 *Additional claims were staked by a mining engineer but these were allowed to lapse. Dr. Charles Camsell reported on the deposits to the Geologic Survey of Canada.*
- 1916 *Dr. A.E. Cameron of the Geologic Survey made positive reports on the geology of the area.*
- 1920 *Dr. J. McIntosh Bell, who had been with Dr. Robert Bell in 1899, sent an engineer, D.B. Dawson, to examine the deposits. This enterprise was assisted financially by certain Boston interests. Claims were again staked.*
- 1921 *The work of 1920 was continued and reported favorably. Dr. Bell evidently considered these deposits to be geologically similar to the famous Tri-State lead-zinc deposits of southeastern Missouri.*
- 1926 *W.M. Archibald, Cominco’s Manager of Mines, became interested in the country north of Edmonton and began forming an exploration staff.*
- 1927 *W.L. McDonald and Ted Nagle (son of the original claim staker) of Cominco’s new group visited and reported favorably.*
- 1928 *Again under Dawson, and now joined by the Atlas Exploration Company, a much more extensive program of churn drilling was begun. Shaft sinking was undertaken. Ted Nagle, noting the new activity, secured an option on 16 adjoining claims for Cominco.*
- 1929 *The Boston interests, Atlas Ventures Ltd. and Cominco combined to form the Northern Lead Zinc Company. A 1929 - 1930 work program under Dr. Bell included sinking pits and shafts plus drilling. With surface showings fully explored, the resource estimate was a disappointing half-million tons of 15% Pb-Zn. Widespread surface work failed to find further indications of mineralization. Northern Lead Zinc would not advance more funds, but Dr. Bell’s optimism was shared by Archibald, who obtained Cominco financing to hold the ground. In that period Cominco,*

*through Mr. Archibald, developed a corporate flying organization to explore the north with aircraft.*

- 1930 From this year until 1948, only enough work was carried out to maintain 104 claims. This was undertaken and financed by Cominco.*
- 1940s Cominco's geological staff extended geological theories and concluded that a number of deposits might occur in the vicinity.*
- 1948 Cominco obtained a 500 square mile concession surrounding the area of known mineralization. A second concession was obtained the following year. The ownership and the exploration and development program, which required seven years of work, was shared with Ventures Ltd.*
- 1951 Pine Point Mines Limited was formed to finance the continuing work. Cominco obtained a 78% interest.*
- 1961 It was in 1961 under the "Roads to Resources" program that the agreement of a railway to Great Slave Lake became a reality. The agreement was reached between the Federal Government, Pine Point Mines Limited, and Canadian National Railways whereby the Government undertook to construct the railway and Cominco undertook to bring Pine Point Mines into production. Total investment, including the railroad, mill and hydroelectric plant exceeded \$130,000,000. The Northern Canada Power Commission agreed to build a 25,000 horsepower hydroelectric plant on the Taltson River to supply power to Pine Point and Fort Smith and other future developments. The cost was underwritten by Pine Point Mines Limited.*
- 1962 Railroad construction began, and mining preparations were commenced with Cominco continuing as manager and agent of Pine Point Mines Limited.*
- 1963 A town site was laid out and services installed, in collaboration with the Department of Northern Affairs and National Resources. Modern bunkhouses, a dining room-recreation hall and 53 homes were built. Stripping and construction of a 5,000 ton per day concentrator commenced as part of a \$23,000,000 project.*
- 1964 The railway reached Pine Point late in the year, well ahead of schedule. Construction of the power plant on the Taltson River and construction of the ore concentrator were not due for completion until the end of the following year.*
- 1965 Early transportation, and the availability of high grade ore averaging 50% combined lead-zinc, made possible ore shipments to Cominco's treatment plants in B.C. Ore shipments to treatment plants continued after the concentrator was completed in November. High mining interest in the Pine Point area generated a major staking rush. Late in the year the Pyramid Mining Co. Ltd. found a major deposit to the east of Pine Point's ground.*
- 1966 Pine Point Mines Ltd. acquired Pyramid's mineral claims in the area and expanded the mill to 10,000 tons per day.*

- 1970 *A test program was undertaken to determine the feasibility of mining some of the ore by underground methods.*
- 1975-79 *Western Mines Ltd. commences to stake claims in the Buffalo River—Polar Lake area.*
- 1976-79 *Western Mines Ltd. commences exploratory drilling.*
- 1979 *Pine Point Mines Limited starts an intense exploration program to delineate more reserves*
- 1983 *D. Rhodes et al completes and publishes a paper on the geology of Pine Point.*
- 1985 *In January 1985, Cominco reduced its 69% interest in Pine Point to approximately 51%.*
- 1986 *Pine Point decides to close the mine in an orderly fashion and commences permanent layoffs. An attempt is made to form a grout curtain to eliminate or reduce pumping at the N81 ore body, containing 2.6 million tons at a grade of 7%Pb and 14% Zn. The attempt fails due to technical problems and it is decided to mine the deposit very quickly and stockpile the ore alongside the pit then haul it to the mill as needed. The ore is milled and the concentrate stored and shipped as required over the next few years. The decision was taken to remove the town as well as the mill facilities and this was completed in the early 1990's and the tailings pond was covered with coarse material to prevent windblown tails.*
- 2000 *Cominco allows some claims to lapse.*
- 2001 *All remaining Pine Point mining leases expire and the Westmin (Boliden)-Dupont mining leases expire.”*

## 5.2 Exploration Phase

### 5.21 Cominco

The first recorded discovery of mineralization in the Pine Point area was in 1898 when four small outcrops containing high grade lead-zinc sulphides in dolomite were found within an area about 1.6 x 2.4 km in size. By the end of 1930, exploration within this area consisted of intensive trenching and drilling of the showings and mapping and wide-spaced drilling in the surrounding region. Pits and shafts to a maximum of 30 m (100 ft) tested the various mineralized showings but the mineralization identified was confined to small pockets.

Mapping by the Geological Service of Canada in the Canadian Shield to the east identified major Precambrian faults that could be projected southwesterly beneath younger rocks into the Pine Point area. During the period 1940 to 1947, Cominco geologists postulated that while these faults may have been dormant in Paleozoic times, they may have been the source of and/or provided structural control to mineralized solutions in some post-Devonian period. It was then surmised that breaks in the dolomite might have been created, producing a linear

array of Pb-Zn ore bodies. A program to drill test this hypothesis was conducted between 1948 and 1955.

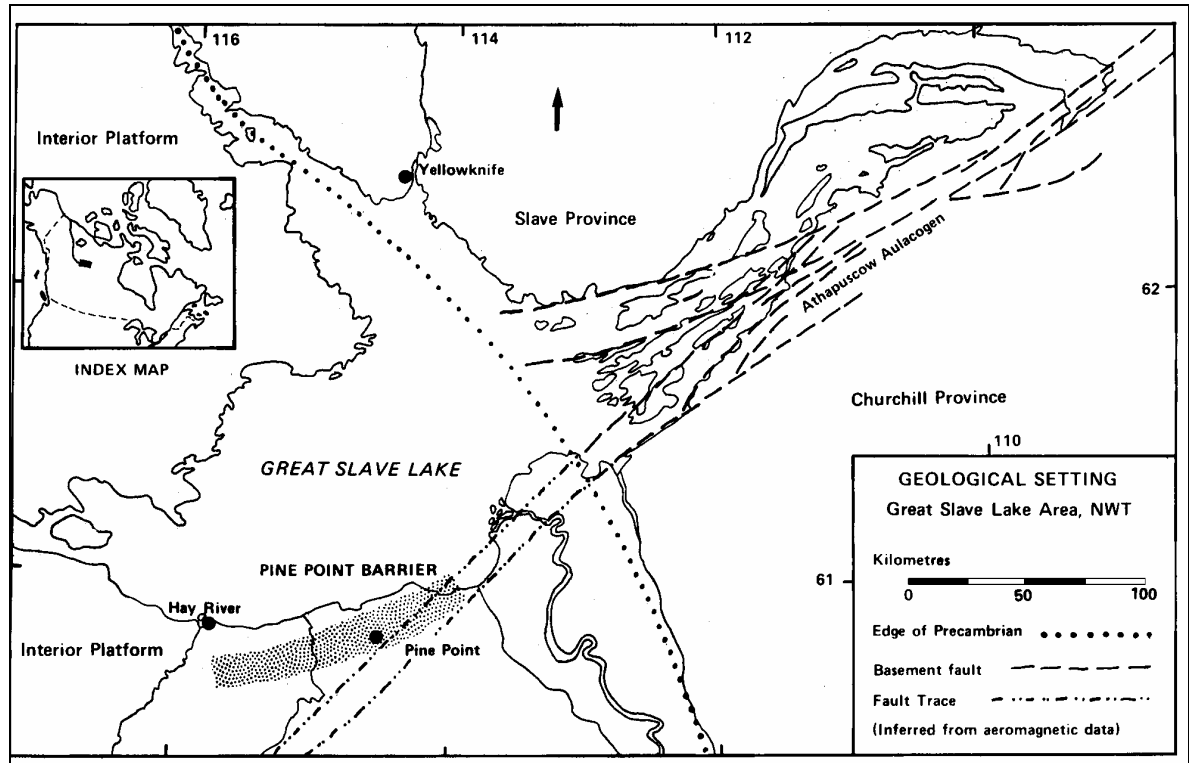


Figure 3: Location and geological setting of Great Slave Lake area illustrating the Relationships between basement faults and the trend of the Pine Point barrier Complex (after Rhodes et al 1984)

Drill results located a number of lead-zinc deposits, all covered by overburden that were located several kilometers from the previous surface discoveries. Mineralization consisting of disseminated sphalerite and galena replacement bodies along with colloform sphalerite and coarse galena cavity fillings occurred mainly at certain stratigraphic horizons within a large, coarsely recrystallized dolomite barrier reef. Fracturing and folding suggested that reef development was influenced by post-Precambrian tectonic movements associated with basement complex faults. Mineral deposits were thought to be created by mineralized solutions moving from a distant source into favorable structural and chemical locations within the dolomite reef.

As pre production drilling was conducted, the expanding geologic information base and applied geophysical techniques resulted in many new discoveries. Full production at a rate of 248,000 tons of concentrate per year, began in 1965. Initial reserves of 21.5 million tons averaging 4% lead and 7.2% zinc were reported.

Cominco completed large annual winter drill programs on the property throughout the 1980's and accumulated a large drill core resource, which was left in wooden cradles at a core storage area extending from 500 to 900 meters west of the old mill site. This core was left in an orderly and well-labeled condition. The core included fences of exploration holes across all areas of the property. The core storage areas were inspected during a site visit on May 9,

2004. The drill core was undisturbed by the site reclamation activities and is well labeled with aluminum tags. Boxes on the top rows of the cradles were left without lids and are deteriorating due to exposure, however over 95% of the core appears to be in recoverable condition. The core is stored in two discrete areas centered at Lat. 60° 52' 00'' / Long. 114° 26' 15''. The eastern core farm covers an area of 125 x 50 meters and the adjacent western core farm covers an area of 250 x 75 meters. A typical cradle holds 13 stacks of BQ core boxes stacked 10 boxes high, and rows of these cradles are set end to end throughout the core farms.

Cominco Pine Point Mines employed a large team of experienced base metal exploration geologists in the mining and development departments and all core logging followed rigorous standard procedures. Preprinted standardized logging cards were used to systematically record run by run recoveries, all assays and geochemical analyses, verbose geological logs, and geology, alteration, karst and mineralization codes (digital). Confidence codes for geological units and contacts were also systematically recorded in hard copy and digital format.

The database for all the Pine Point drilling was compiled in "Geores" format by the Cominco exploration staff (Geores is Cominco's in house geological modeling software). The drill data exists for all holes drilled on the Pine Point Mines Property. In the final years of operations the Pine Point Mines data was systematically updated and coded throughout the property according to the latest geological nomenclature developed from geological research at Pine Point. As such it represents one of the largest and most comprehensive systematic digital mine databases ever assembled for a Canadian base metal camp.

## 5.22 Westmin-Dupont Project

During 1975 Westmin staked a large block of claims immediately west of Cominco's Pine Point project covering the down dip extension of the Pine Point mineralization. Geophysical exploration and drilling resulted in the discoveries of nine lead-zinc deposits from 1976 through the early 1980's. From west to east these deposits were called O555, O556, P449, R190, T799, V48, W19, X25 and Z155 (see Figure 11).

The deposits were presented to Pine Point for possible exploitation, but the distance of up to 50 km between deposits and concentrator combined with the additional depth of the deposits and the corresponding higher stripping ratio and dewatering costs made them unfeasible at that time.

The Westmin mining leases expired in August 2001 and Burns subsequently staked the ground. The Westmin (Boliden) geologic and drill data are presently housed at the C.S. Lord Geological Institute in Yellowknife and available to the public.



Table 2: Pine Point District Production and Reserves from 1964 to 1983  
 Compiled from Pine Point Mines Limited Annual Reports 1964-1983  
 (after Rhodes et al 1984)

	Reserves			Production				
	Tons ore × 10 <sup>6</sup>	Pb%	Zn%	Tons ore	Pb%	Zn%	Tons Pb × 10 <sup>3</sup>	Tons Zn × 10 <sup>3</sup>
1964				14,070	18.6	25.8	2.6	3.6
1965	21.5	4.0	7.2	75,356 364,168 <sup>1</sup>	4.27 22.50	7.63 29.10	3.2 81.9	5.8 106.0
1966	37.8	2.9	6.8	1,457,990 282,309 <sup>1</sup>	4.9 18.8	10.5 26.3	71.4 53.1	153.1 74.2
1967	40.5	2.6	6.8	1,521,000 333,000 <sup>1</sup>	4.7 18.0	9.7 27.9	71.5 59.9	100.4 92.9
1968	39.3	2.6	6.8	2,138,000 353,000 <sup>1</sup>	3.5 19.0	6.6 25.0	74.8 67.1	141.1 88.3
1969	41.8	2.4	6.3	3,605,000	3.2	7.4	115.4	266.8
1970	43.5	2.5	6.0	3,860,000 92,600 <sup>1</sup>	3.0 14.5	7.1 21.5	115.8 13.4	274.1 19.1
1971	41.9	2.4	6.0	3,892,000	2.6	6.5	101.2	253.0
1972	40.9	2.4	6.0	3,810,000	2.7	6.2	102.9	236.2
1973	38.3	2.3	5.7	3,896,000	2.9	6.0	113.0	233.8
1974	39.5	2.2	5.7	4,135,000	2.5	5.3	103.4	219.2
1975	39.2	2.0	5.4	3,905,000	2.4	4.9	93.7	191.3
1976	36.2	2.0	5.4	3,773,000	1.7	5.3	64.1	200.0
1977	37.5	2.1	5.3	3,443,000	2.1	5.3	72.3	182.4
1978	37.3	1.9	5.1	3,290,000	2.6	5.9	85.5	194.1
1979	38.0	1.9	5.0	3,291,000	1.9	5.5	62.5	181.0
1980	41.3	1.9	5.3	3,626,000	1.9	5.5	68.8	199.4
1981	41.3	1.9	5.4	3,636,000	2.0	4.8	72.7	174.5
1982	35.2	2.4	6.1	2,445,000	3.0	7.3	73.4	178.5
1983	25.7	2.7	6.3	985,000	2.7	8.1	26.0	80.1
Total milled				56,785,226	2.5	6.2	1,444.5	3,509.6
Total direct shipping				1,439,634	19.4	26.7	279.4	384.9
Total				58,224,860	3.0	6.7	1,723.9	3,894.6

<sup>1</sup> These figures refer to high-grade ore shipped directly to the Trail smelter and not milled on the property.

*Note : The authors of this report have not examined the data and calculations contained in the above Table to confirm that these reported reserves would conform to National Instrument 43-101. However based on the extensive production history at Pine Point, we have no reason to believe Cominco's estimates are flawed.*

### 5.23 Exploration Techniques

Exploration at Pine Point is challenged by the westerly regional dip of the dolomite reef that hosts deposits and the extensive amount of glacial material and swamps that cover them. Early exploration, focusing on Mississippi Valley type mineralization, depended on prospecting, trenching and shaft sinking. Significant discoveries of buried Pine Point ore bodies did not occur until the development of geophysical techniques and modern diamond drilling.

Normal electromagnetic surveys did not work well with Pine Point mineralization as the amount of marcasite and pyrite in the ore is limited and neither lead or zinc mineralization respond well to this technique. On the other hand, induced polarization (IP) surveys responded well in areas not covered by pyritic shales.

The flat terrain and the numerous and deep swamps necessitated work be completed in the winter season. IP surveys were completed with Nodwell tracked vehicles support on lines cut by bulldozer.

An example IP profile is shown below in Figure 4 as taken from a paper by Seigel et al titled Discovery Case History of the Pyramid Ore Bodies Pine Point, Northwest Territories Canada (Seigel, et al 1968). The profile over a known ore body shows three geophysical techniques and their results.

Drilling IP anomalies discovered the majority of deposits at Pine Point. Drill sites were established in winter using bulldozed winter roads. Diamond drilling using either BQ or NQ rods was completed from skid or Nodwell mounted drills. Water for drilling was supplied by double lined tanker trucks from dewatering wells. Core from the Pine Point drilling was stored on site, west of the old mill site and is still in tact.

During the 1980's the blanket Induced Polarization (IP) coverage of the Pine Point property neared completion and the discovery rate from IP began to drop. During this time a greater emphasis was placed on understanding the geological controls. Regional fence drilling was completed to intersect the E shale, a prominent stratigraphic marker unit at the base of the succession, and a geological and genetic model of the reef facies and it's associated karst, alteration and mineralization features was developed. Greater focus was also placed on the discovery of new shallow high-grade north trend tabular deposits. In particular, grid drilling for tabular zones was undertaken in areas overlain by pyritic shales, which masked the IP response of underlying lead-zinc sulfide mineralization.

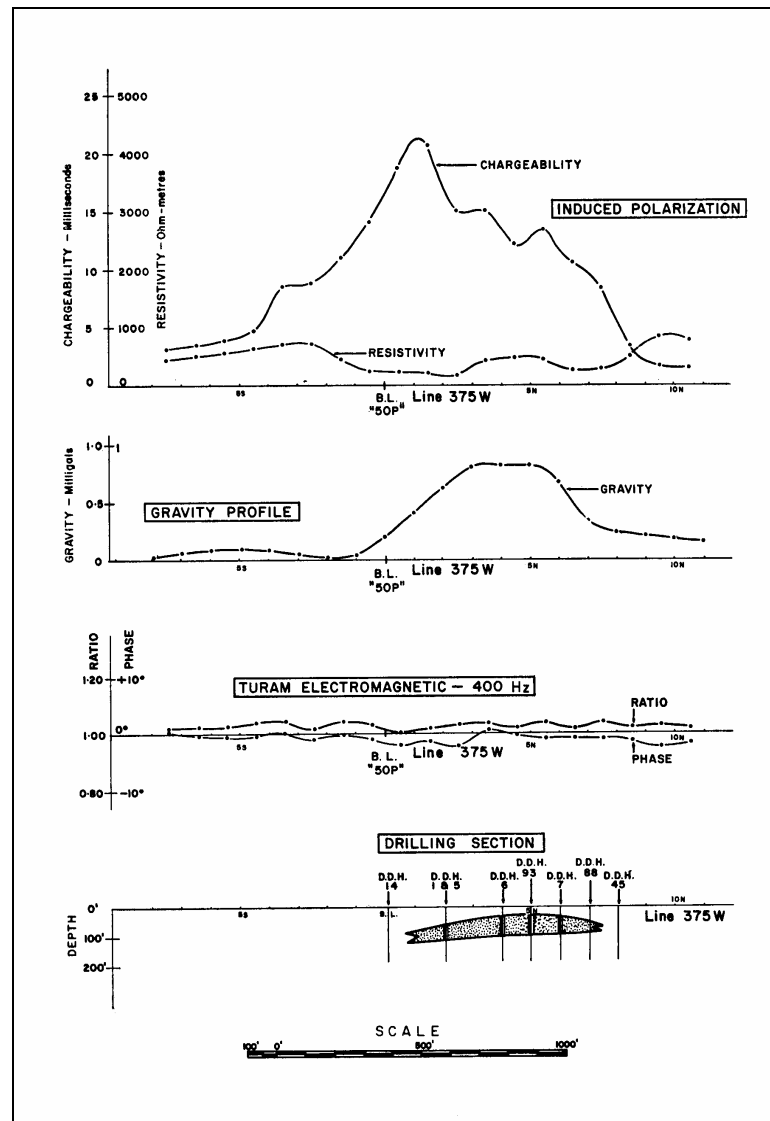


Figure 4: Multi-method geophysical profile, Section 375'W, Pyramid No. One ore body (after Seigel, et al 1968)

Compounding exploration difficulties at Pine Point is the sheer size of the property and number of potential drill targets. Deposits have been found along three trends that parallel the reef complex over a distance of 79 km. Consequently drill tests by previous operators are very widely spaced over much of the property. The majority of the Pine Point property, east of the Buffalo River was drilled by 100 to 300 m vertical core drill holes down to the Keg River Formation-E shale marker on 915 x 915 m (3000 x 3000 ft) or 915 x 1,830 m grids. The mineralized trends on the eastern section of the property were drilled on 300 x 300 m grids and in many instances 150 x 150 m grids. Individual deposits were drill tested on grids varying from 20 to 35 m square.

The majority of the drilling at Pine Point was NQ and BQ core size. Sampling was done in mineralization only (usually for +1% sulfide intervals only) and was by hydraulic and manual core splitting techniques. At Pine Point the drill core assays were done by Pine Point

Mines in a small assay lab within the mine complex. Half cores are preserved in standard wooden core boxes for all the sampled zones.

Pine Point Mines Ltd. mined a total of 50 deposits (see Table 3) and another 25 deposits were identified but not mined due to the prevailing economic conditions. An additional 9 deposits were identified on Westmin ground to the west.

### 5.3 Mining

The mining and processing at Pine Point is described by R. Burns who worked as a mine geologist at Pine Point from 1981 to 1986.

#### 5.31 Open Pit Mining

*“Pine Point ore was mined by open pit methods on a year round basis since Cominco brought the mine into production in late 1964. In November 1964, the first crude ore was shipped from Pine Point to a concentrator at Kimberley, British Columbia for processing. Over the 20-year period from 1964 to the end of 1984, more than 63 million tonnes of ore were mined at average grades of 7.0% zinc and 3.0% lead (see Table 3).*

*Mining was carried out using trucks, which were loaded by either electric shovels or large front-end loaders. The deposits were drilled using B-E 45R electric rotary drills, which drilled large diameter 10 to 12” blast holes to depths of over 30-feet. The ore was blasted using ammonium nitrate prills mixed with diesel fuel in a blasting truck. Bench height varied according to the type of deposit being mined. The prismatic ores, which are very vertically continuous, were mined using 25-foot benches and the tabular ores, which are vertically erratic but laterally continuous, were mined using 12.5 foot benches.*

*A Page 752LR walking dragline with a 320 foot boom and 28 cubic yard bucket was brought into the property to mine the L 27 tabular Main Trend ore near the mill, but this proved unfeasible and the dragline was used mainly for stripping afterwards. The use of the dragline for stripping on the north trend made possible the economic open pit mining of the shallower tabular mineralized zones. The dragline often had to rehandle the overburden to move it far enough from the pits.*

*The ore was hauled to the mill stockpile in trucks that varied in size but at the end of the mine life the fleet included 80 ton 777 Cat trucks, 120 ton Wabco trucks and 150 ton articulated Cat trucks. The haul roads were built 100 feet wide from the waste stripped from the pits and topped with finer gravel. These roads still exist and are in good condition, however some culverts have been removed to meet environmental closure guidelines.*

*The pits were characteristically small compared with most base metal mining operations. Several pits were mined concurrently to achieve economic production rates. Pine Point’s lead-zinc mineralization lies mostly beneath the water table, as the reef that hosts the deposits is an excellent aquifer with abundant void space. Dewatering of the pits was achieved by ringing the pits with water wells, which were pumped by deep well pumps into ring ditches that carried the water away. As the mining proceeded westward the pits became deeper due to the regional dip to the west and dewatering became a major problem. For example, in 1984, 37 new wells were drilled as part of the total dewatering program, which*

cost \$5.5 million. The 55 pumps in service averaged a total pumping rate of 60,000 U.S. gallons a minute. The water levels were observed very closely during power failures and any prolonged failure would require moving the equipment up the ramp. Flooding in the bottom of the pit was especially bad in winter when the water would form thick layers of ice that would have to be mined before regular mining could proceed.

Open pit dewatering posed serious and complex problems to the operation and was one of the main reasons the mine shut down. High dewatering expense and a shortage of power to operate the pumps both contributed to the economic problems prior to closure of the operation. Pumping was the main method of dewatering and at times this was started a year in advance of mining. Grouting techniques were eventually tried but were not successful due to technical problems.

The regional dip of 1.9m/km. to the west resulted in the deposits being found at greater depths as the mining proceeded to the west. The increase in depth of the mineralized bodies to the west caused several problems. The increase in depth naturally increased the stripping ratio and also resulted in an enormous increase in the amount of water that needed to be pumped to keep the pits dry. Transportation of the ore to the mill became a major expense as mining moved further west and haul distances increased.”

### 5.32 Underground Mining

“Since the mid-1970s, when test stoping established that underground mining was technically feasible, material mineable by underground methods was included in Pine Point’s ore reserves. Exploration on the western part of the property, where the mineralized rocks dip to 300 feet below the surface, showed signs of tabular mineralized zones of sufficient thickness, continuity and grade to warrant mining by underground methods. In time, extensive mineralized trends to the west could have been successfully opened up, which could have supported underground mining for many years.

Underground mining was carried out on both the Main Trend and the North Trend at Pine Point. The Main Trend mining was done close to the mill where the mill pumping lowered the water table sufficiently to allow it to be economic. The L30 ore body, that was mined, was a Main Trend tabular ore zone. It was mined using a decline and conventional room and pillar mining with trackless equipment. The ore was drilled and blasted then mucked by an LHD into trucks that took the muck to a surface stockpile. The open pit loaders and trucks then hauled the ore to the mill stockpile where this high-grade material was blended with lower grade open pit material.

**Table 3: Pine Point Mines Ltd. Deposits that have been mined**

PINE POINT OPEN PIT PRISMATIC OREBODIES					
PIT	TONNES	%PB	%ZN	TONNES PB	TONNES ZN
A-55	1,550,830	3.0	7.6	46,525	117,863
A-70	2,289,360	4.5	10.4	103,021	238,093
I-46	389,870	5.1	4.2	19,883	16,375
I-65	194,510	3.8	11.1	7,391	21,591
J-44	1,282,230	5.9	9.8	75,652	125,659
J-69	854,770	1.2	5.2	10,257	44,448
K-53	468,900	3.7	9.3	17,349	43,608

K-57	1,564,540	6.5	5.2	101,695	81,356
K-62	1,001,590	3.6	4.8	36,057	48,076
K-77	511,120	6.4	6.4	32,712	32,712
M-52	455,260	3.5	7.6	15,934	34,600
M-64	178,460	4.9	8.0	8,745	14,277
N-31	505,200	1.6	4.1	8,083	20,713
N-32	1,862,070	3.4	8.4	63,310	156,414
N-38	1,182,110	4.9	7.4	57,923	87,476
N-42	2,959,680	5.3	9.5	156,863	281,170
N-81	2,699,950	7.0	14.1	188,997	380,693
O-28	1,483,870	2.0	3.7	29,677	54,903
O-32	375,970	2.8	6.4	10,527	24,062
O-42	2,742,720	8.8	11.6	241,369	318,156
P-24	496,640	3.5	7.6	17,382	37,745
P-29	476,120	1.6	3.3	7,618	15,712
P-31	604,760	2.2	3.6	13,305	21,771
P-32	694,980	3.2	3.5	22,239	24,324
P-41	196,140	2.1	8.3	4,119	16,280
R-61	1,034,540	1.6	5.2	16,553	53,796
S-65	575,550	1.2	5.7	6,907	32,806
T-58	563,310	4.5	12.6	25,349	70,977
W-17	3,515,400	2.0	6.1	70,308	214,439
X-15	17,474,260	2.0	6.2	349,485	1,083,404
X-17	44,910	1.5	6.3	674	2,829
Y-61	549,040	3.5	9.3	19,216	51,061
<b>TOTAL</b>	<b>50,778,650</b>	<b>3.5</b>	<b>7.4</b>	<b>1,785,117</b>	<b>3,767,368</b>

**PINE POINT OPEN PIT TABULAR OREBODIES**

<b>PIT</b>	<b>TONNES</b>	<b>%PB</b>	<b>%ZN</b>	<b>TONNES PB</b>	<b>TONNES ZN</b>
L-30	262,170	1.1	2.8	2,884	7,341
L-37	3,417,550	1.0	3.4	34,176	116,197
T-37	358,960	2.1	6.3	7,538	22,614
X-51	1,203,980	2.2	6.7	26,488	80,667
X-52	1,104,080	1.6	6.3	17,665	69,557
X-53	1,231,940	2.7	9.2	33,262	113,338
X54/55	216,130	2.1	6.7	4,539	14,481
X56/57	1,319,580	1.6	6.3	21,113	83,134
Y-53	967,710	1.5	5.6	14,516	54,192
Y-54	263,840	1.3	4.0	3,430	10,554
Y-60	512,490	2.1	7.3	10,762	37,412
Z-53	380,520	1.4	5.0	5,327	19,026
Z-57	827,870	1.1	4.2	9,107	34,771
Z-64	913,470	1.4	5.1	12,789	46,587
<b>TOTAL</b>	<b>12,980,280</b>	<b>1.6</b>	<b>5.5</b>	<b>203,595</b>	<b>708,869</b>

**PINE POINT UNDERGROUND TABULAR OREBODIES**

<b>MINE</b>	<b>TONNES</b>	<b>%PB</b>	<b>%ZN</b>	<b>TONNES PB</b>	<b>TONNES ZN</b>
M-40	350,870	2.2	5.5	7,719	19,298
Y-65	149,770	7.0	12.9	10,484	19,320
<b>TOTAL</b>	<b>500,640</b>	<b>3.8</b>	<b>7.7</b>	<b>18,203</b>	<b>38,618</b>
<b>GRAND TOTAL MINED</b>	<b>64,259,570</b>	<b>3.1</b>	<b>7.0</b>	<b>2,006,915</b>	<b>4,515,875</b>

*On the north trend, an attempt was made by underground methods to mine high-grade tabular deposits because they were too deep for open pit mining. A 1,050-foot decline was placed in the north wall of the Z64 pit and a Roadheader continuous miner was used to establish the workings. Ground conditions proved to be satisfactory, and the decline reached the mineralization in the first quarter of 1985. The continuous miner worked well in the soft rocks and ore.*

*A novel approach was used to establish a ventilation raise through the muskeg and overburden in this swampy area. A pad was established on surface then drill holes were set up to freeze the ground before a raise borer was used to establish the raise. This kept the water away until the shaft could be lined and sealed against the overlying water.*

*In 1985, the underground test mining operation experienced lower productivity than expected, but achieved higher than forecast grades. A small addition of high-grade underground ore supplemented ore mined from six operating pits. In the fourth quarter of 1985, underground mining ceased. In part, the decision reflected a need to free electrical power to help satisfy increasing demand for pumping water at the N-81 pit.”*

#### 5.4 Processing

*“Mine production commenced in early 1965 with high grade ore (50% combined lead-zinc) being shipped directly to Cominco’s operations in British Columbia. The Pine Point concentrator came on stream in November 1965 operating at a design capacity of 5,000 tons per day (tpd) with an ore grade of 2.4% lead and 6.0% zinc.*

*The acquisition of the Pyramid Mining Company’s claims in 1966, which contained a sizeable ore body to the east of Pine Point’s ore body, necessitated the addition of a 3,000 tpd expansion to the concentrator, which started up in December, 1968. This expansion (the Sphinx circuit) was constructed with its grinding and primary flotation circuits independent of the two original Pine Point circuits.*

*In 1973, the daily capacity of the plant was further expanded to 11,000 tpd through modifications in the crushing plant and additions to the flotation circuit.*

*The basic concentrator flow sheet consisted of primary and secondary crushing, grinding in rod mills and ball mills, separate lead and zinc flotation circuits, dewatering, tailings disposal and production of lead and zinc concentrates.*

*Stockpiles containing over 100,000 tonnes of ore were constructed at the concentrator adjacent to the primary crusher to provide control of feed grades for periods of 10 to 12 days. This also permitted ores with adverse milling characteristics to be blended with more amenable ore to dilute their effect on the flotation circuit.*

*Primary crushing was carried out in a 42 x 65 gyratory crusher, which reduced the size of the ore to minus 5. The ore was then crushed to minus ¾ in an open -circuit secondary crushing system consisting of two 7 shorthead cone crushers. At various points in the crushing circuit heating was provided to reduce the risk of material freezing in the winter.*

*The two Pine Point grinding circuits each consisted of two conventional open-circuit rod mills followed by grinding in two closed-circuit ball mill – cyclone classifier combination arrangements. The Sphinx grinding circuit was configured similarly except that there was only one circuit instead of two.*

*Lead concentrates were produced by flotation in roughing, middling and cleaning cells followed by dewatering. Overflow from the lead cleaning cells was treated in zinc roughing, middling and cleaning flotation cells followed by dewatering to produce zinc concentrate. Lead and zinc concentrates containing 5 to 6% moisture were shipped to smelters.*

*Concentrates from the Pine Point operation were railed to Trail, B.C. or to the port to be shipped by boat to Japan. Throughout the life of the operation, the lead concentrate was sold to the Mitsubishi Cominco Smelter in Japan and the zinc concentrate was sold to the Cominco Trail Smelter. Both lead and zinc concentrate products contained minimum amounts of impurities, which resulted in minimum penalty charges.”*

## **6.0 GEOLOGY**

The Pine Point camp belongs to the class of carbonate hosted lead-zinc sulfide deposits commonly referred to as Mississippi Valley Type (MVT) deposits, and is probably the most famous and best known Canadian example of this type of deposit. Nanisivik (in production) and Polaris (in production) are other Canadian examples of the same geological class. MVT deposits are among the most important sources of lead and zinc metal in the world, with moderate to high grade, simple metallurgy, and easy processing and beneficiation characteristics. They occur in carbonate (limestone and dolomite) host rocks and are typically associated with the ingress of mineralizing brines into structurally prepared cavities associated with dissolution of the carbonate rocks by karst processes. In the case of Pine Point this dissolution and mineralization process occurred on an extensive scale and was controlled by the distribution of a major carbonate barrier reef complex of Devonian age.

D. Rhodes of Cominco Ltd., E.A. Lantos and J.A. Lantos of Pine Point Operations, R.J. Webb of Geology Department University of Waterloo and D.C. Owens of Polaris Mine have compiled a very detailed study of the geology for the Cominco Pine Point Property, in a 1984 paper in *Economic Geology* Vol. 79 (Rhodes et al, 1984). The Rhodes et al paper built on early pioneering work by H. Scall of Cominco who first described the Pine Point Reef complex in modern geological terms (Scall, 1975).

### **6.1 Regional Geology**

The Pine Point Project area lies within the northwestern part of the interior platform, an area consisting of gently west-dipping sedimentary strata between the Precambrian Shield to the east and the Foothills belt of the Cordilleran orogen to the west. At Pine Point an estimated 350 to 600 m of Ordovician to Devonian sediments cover a basement made up of Archean crystalline rocks and Proterozoic sediments.

Middle Devonian Givetian sediments host the mineralization at Pine Point. Within these sediments a barrier reef complex about 10 km wide and 200 m in thickness was formed by a linear buildup of carbonate facies (see Figure 5). This barrier complex separates two



depositional basins; the Mackenzie basin made up of shales and shaley limestones to the north and the Elk Point basin made up of evaporites and lesser carbonates to the south. This Givetian barrier complex outcrops on the eastern half of the project area and dips very shallowly to the west at about 1.9 m per km.

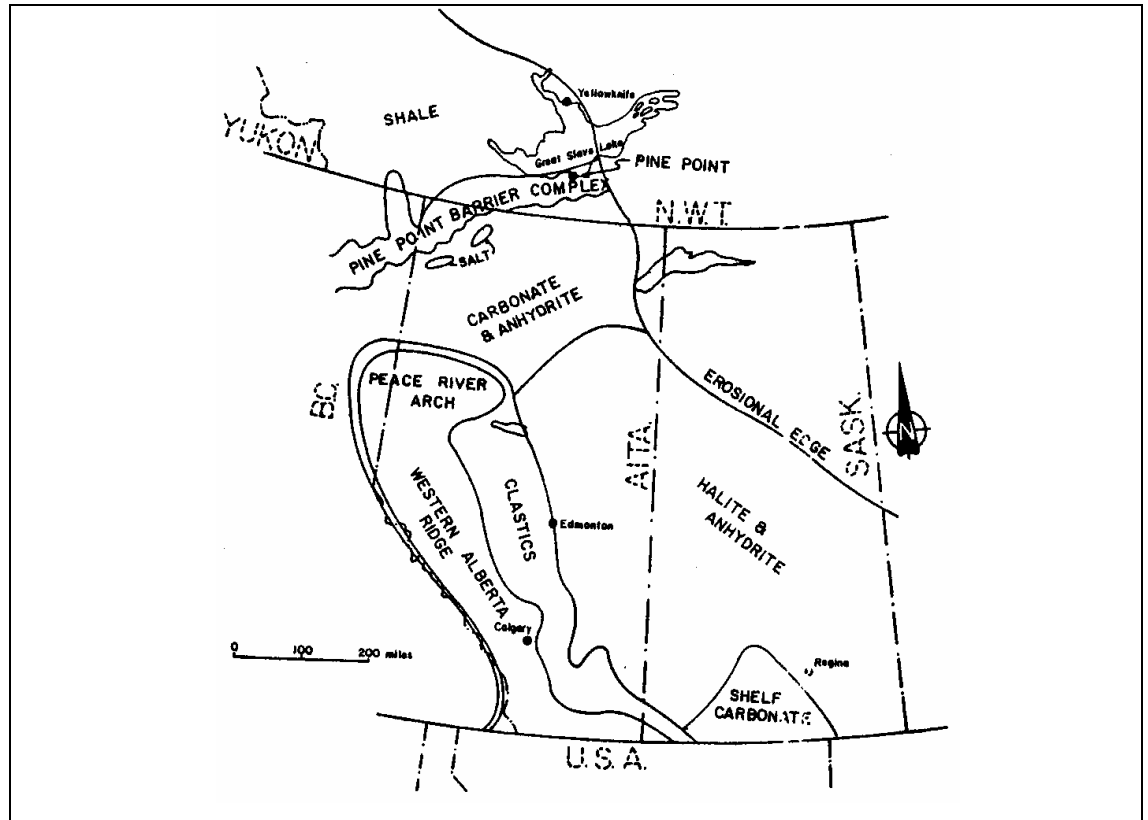


Figure 5: Middle Devonian regional Facies (after Rhodes et al, 1984, Bebout and Maiklem, 1973 and Grayson et al, 1964)

## 6.2 Stratigraphy

The understanding and knowledge of the stratigraphy at Pine Point has evolved over the years of exploration and production. Figure 6 shows the changes in nomenclature from Law in 1955 to Rhodes in 1984 brought about by extensive diamond drilling, detailed core logging and comparative studies by geologists. The Givetian stratigraphy, that hosts the Pine Point mineralization, has been subdivided by Rhodes and others into 5 main Formation Groups as follows from oldest to youngest: Keg River Formation, Barrier Complex, Pine Point-Muskeg Formations, Buffalo River-Windy Point Formations and the Watt Mountain-Slave Point Formations. Figure 7 provides a subcrop geologic plan within the old Pine Point Mines Ltd. claim area east of the Buffalo River. Figure 8 shows a typical cross section (X-X') through the stratigraphy.

### 6.21 Keg River Formation (code A)

The Keg River Formation consists of a marine platform carbonate unit that overlies sulfate evaporates of the Chinchaga Formation. The Keg River Fm. is composed of gray-brown dolomite and maintains a constant thickness of  $65 \pm 10$  m in the Pine Point area.

An important marker unit, the E shale (Code ESH), consistently occurs from 3 to 6 m below the top of the Keg River Formation. These shale to shaley dolomite beds, range from a few centimeters to 1 m thick and are widely distributed throughout the project area. Historic drilling has used the E-shale unit as a marker to terminate drill holes.

## 6.22 Barrier Complex

The Barrier complex is composed of the Pine Point Formation (Code PP) at the base and the Sulphur Point Formation (Code SP) on top. These two Formations are the principle hosts of lead-zinc mineralization in the Pine Point Camp.

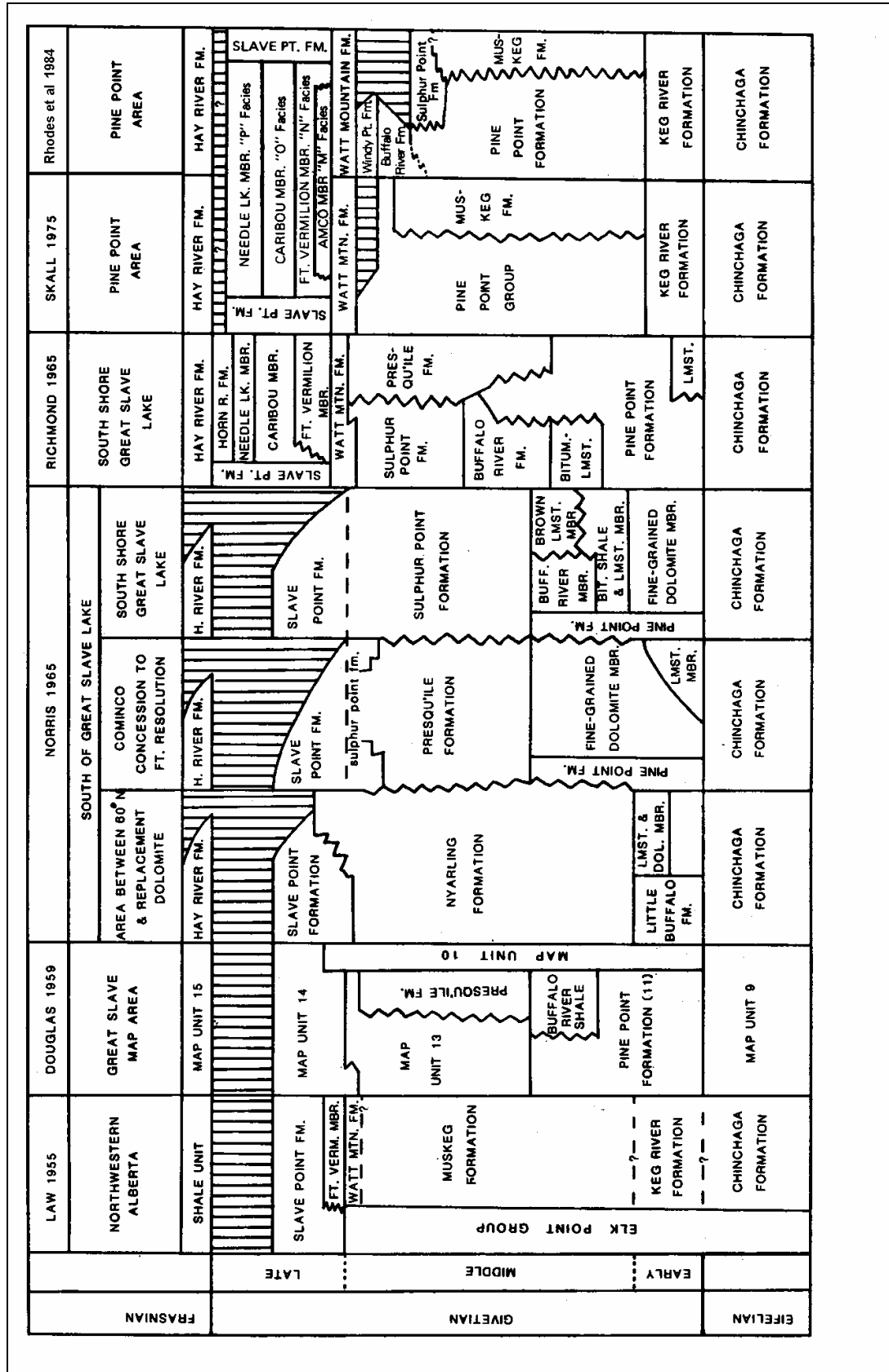
The Pine Point Formation, the oldest member of the Barrier Complex, lies conformably on the Keg River Formation. It is composed of a wide variety of carbonate lithofacies with no skeletal debris, reaches maximum thickness of 175 m at the axis of the barrier and thins to both north and south (see Figure 7). The various lithofacies show significant north-south and vertical variability but maintain remarkable consistency along the east-west strike of the complex. The various facies identified within the Pine Point Formation are shown in Figure 8 as they might have developed over time.

Cominco-Pine Point Mines Ltd. divided the Pine Point Formation into the following principle facies:

E	E-facies: clean calcarenite, >20 % corals
EFOS	E Fossiliferous: similar to above but less corals
ESH	E shoal
D1	D1 facies (bioclastic): the main reef unit of Pine Point Fm.
E-B and B-E	transitional B to E
BMD	B marine dolomite: argillaceous / bituminous with brachiopods and crinoids
BML	B marine limestone: as above, limestone
BDE	BDE fossil horizon (north trend): clean, densely fossiliferous coquina
BRS	B Reef substrate: pancake stromatolite-brachiopod fauna
EBL	E blotchy: bioturbated micrite with brachiopod fauna
BSP	B spongy: micrite with fossil moldic vuggy porosity
B-F	transition B to F Facies
F	F facies: brown-black lime mudstone with tentaculites

The Sulphur Point Formation is composed of a succession of light cream to white limestones and their coarsely dolomitized equivalents and reaches a maximum thickness of 65 m over the central part of the barrier. The Sulphur Point limestone, which is cream to white with virtually no impurities, can be readily distinguished from the underlying Pine Point limestones, which are light buff due to organic residue. In the south part of the complex the Sulphur Point overlies the Muskeg Formation with a transitional and partial coeval basal contact.

Figure 6: Summary of Stratigraphic Nomenclature (after Rhodes et al 1984)



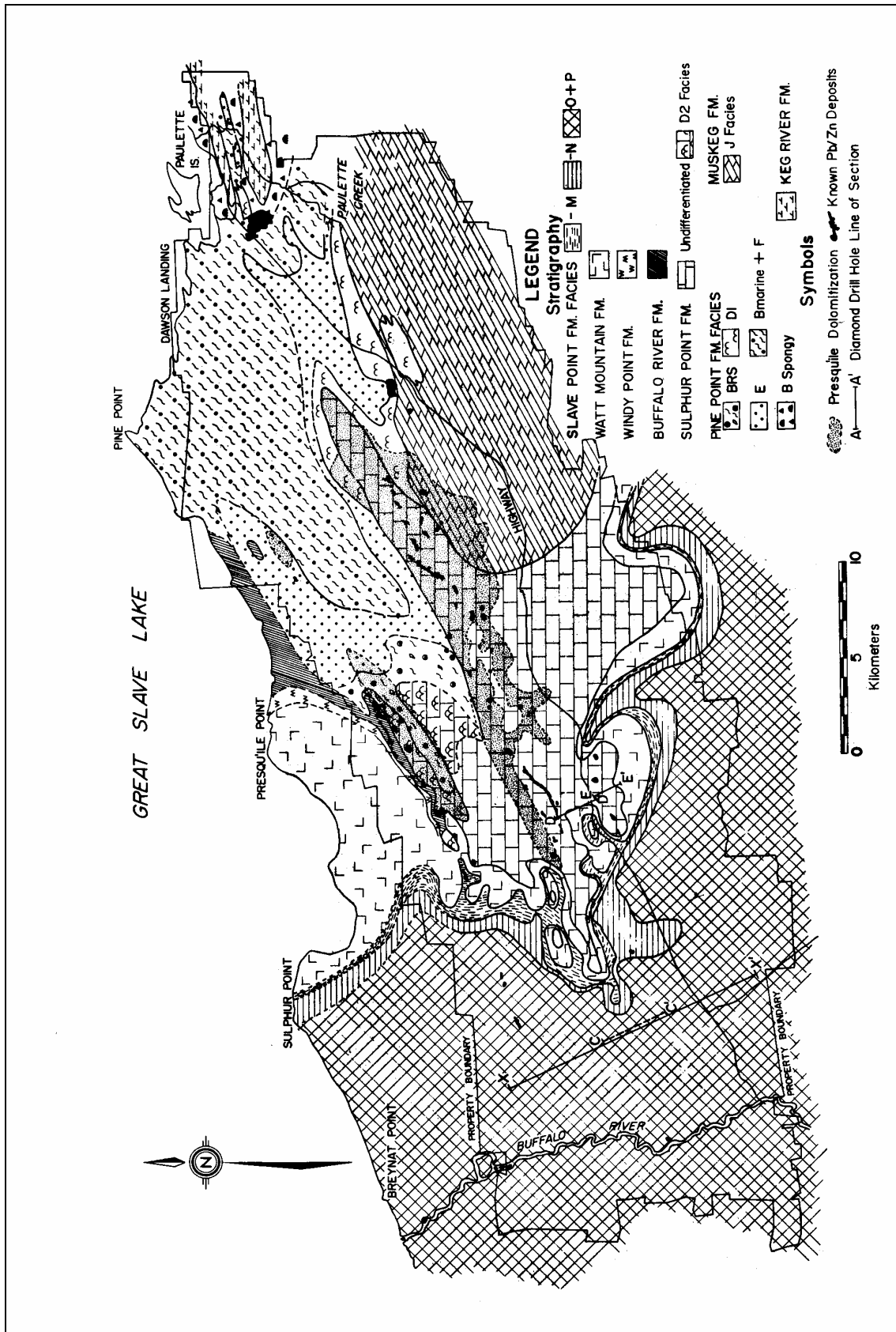


Figure 7: Subcrop Geology map of the Pine Point Area (after Rhodes et al, 1984)  
 Note: Property boundary shown is not the current property boundary but that of Pine Point Mines Ltd. in 1984

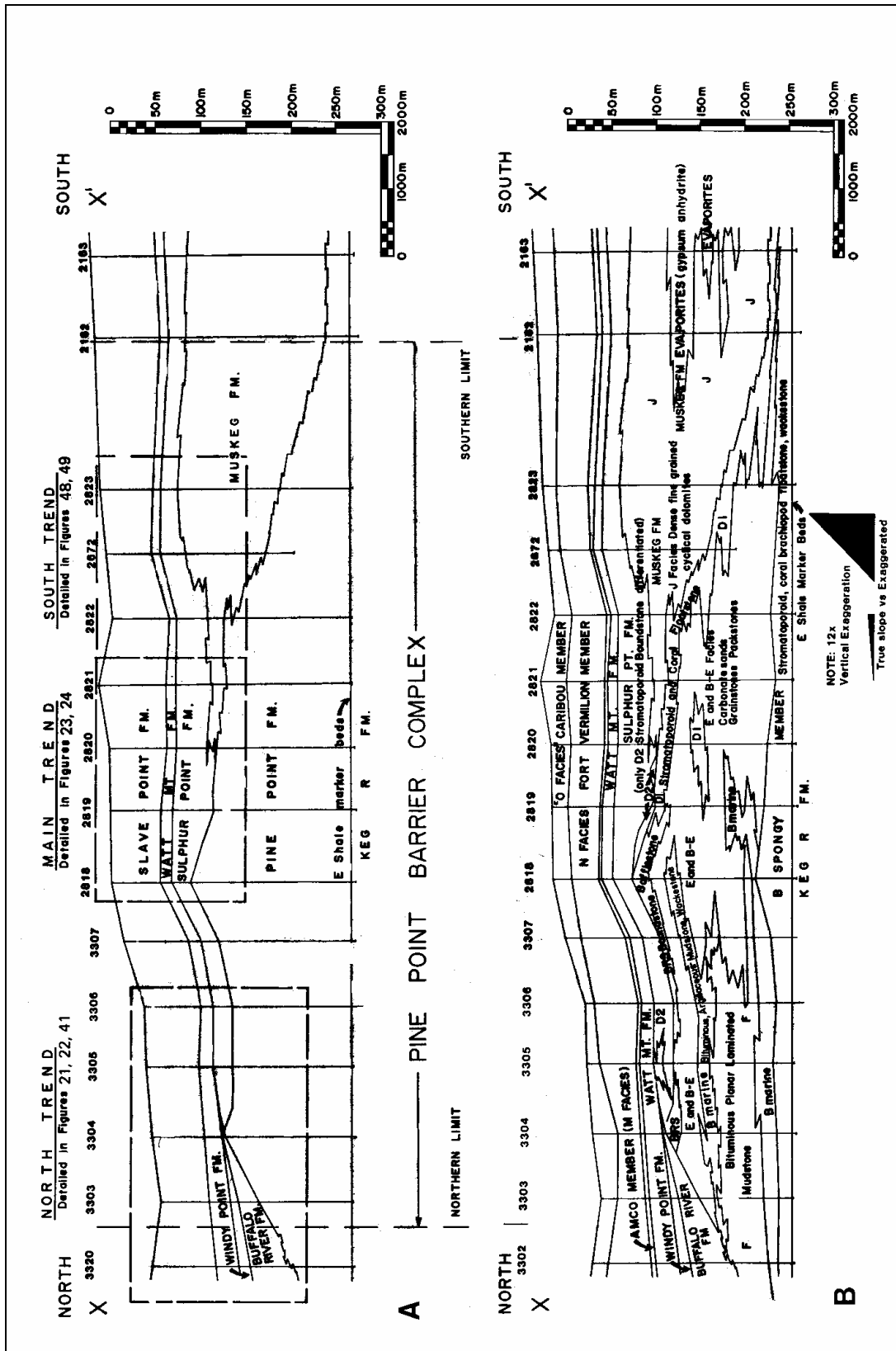


Figure 8: Geologic cross section along line X-X' A) Stratigraphic Formations B) Simplified lithofacies and members of Formations (After Rhodes et al 1984)

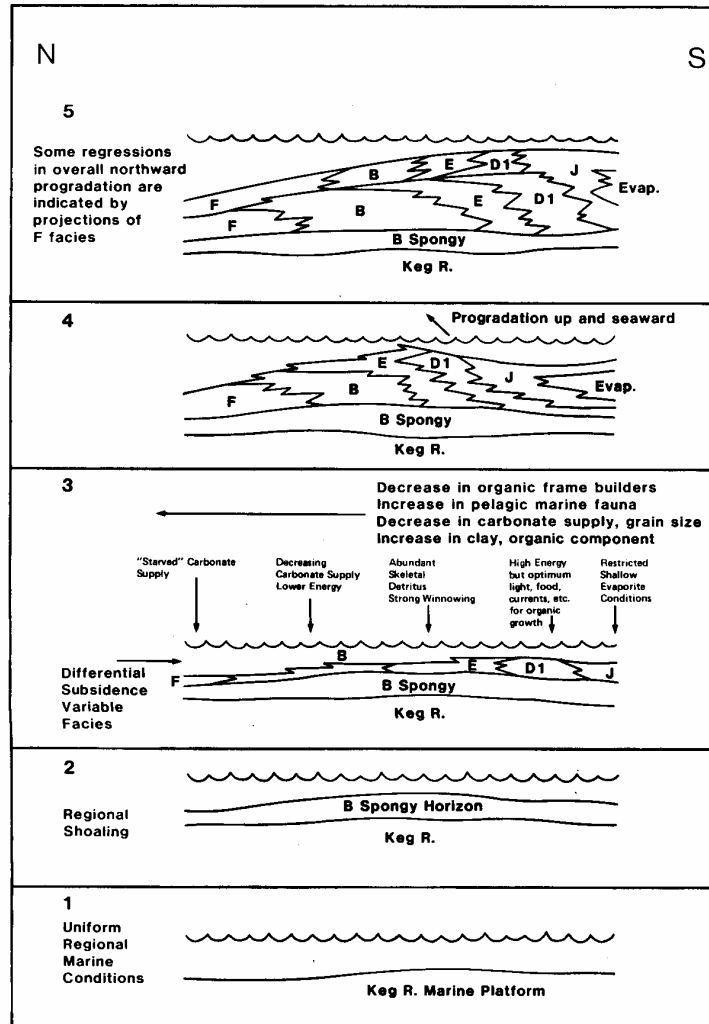


Figure 9: Pine Point Lithofacies development through time (after Rhodes et al 1984)

Cominco-Pine Point Mines Ltd. divided the Sulphur Point Formation into the following principle facies:

BR	Bioclastic Rudstone
BF	Bioclastic Floatstone
BWK	Bioclastic Wackestone
C	C facies / Grainstone, clean fine bioclastic unit, usually presquile altered
D2	Stromatoporoid Reef Facies, clean light colored, usually presquile altered
LAM	laminated carbonate intervals, stylolitic, algal
CH	C-Horizon markers are J-like beds <20 feet thick
(J)	J like – transitional to Muskeg Fm., evaporate textures

In the 1980's Cominco - Pine Point Mines Ltd. adopted the nomenclature of Embry and Klovan (1971) to describe some of the facies in the reef complex. This classification utilizes the terms mudstone, wackestone, packstone, grainstone, floatstone, rudstone and boundstone and is ideally suited for the description of clastic carbonate deposits such as those associated

with reef buildups. However other long established carbonate terminologies such as calcarenite and micrite also remained in general use at Pine Point to the close of operations.

### 6.23 Muskeg Formation (Code J)

The Muskeg Formation is composed of fine-grained dolomites that are considered to be coeval with the Pine Point Formation extending south into the Elk Point Basin. The principal unit, the J facies, comprises complexly intercalated gypsum and anhydrite beds and extends two to three km south of the barrier. The J facies progrades northward, overlapping, with sharp and definable contacts, slightly older Pine Point Formation strata. The Muskeg Formation is subdivided into the J-bituminous, J1, J2, J3, J4 and J fossiliferous sub-facies. It can be an important host for mineralization on the South Trend.

### 6.24 Buffalo River – Windy Point Formations

The Buffalo River Formation (Code G) is a wedge of gray-green shales and lesser carbonates that flank the northern side of the barrier complex and thicken northwards. It lies conformably on the F and B facies of the Pine Point Formation (see Figure 8) on the north side of the barrier and disconformably on the E and BRS facies of the Pine Point Formation and D2 and C facies of the Sulphur Point Formation on the barrier.

The Windy Point Formation refers to a thin wedge of carbonates that overlie the Buffalo River Formation flanking the north side of the Barrier Complex.

### 6.25 Watt Mountain – Slave Point Formation

The Watt Mountain Formation (Code L) overlies conformably the Windy Point and unconformably the Sulfur Point Formation. The lower shale member is a waxy blue green limy and dolomitic shale with clean intraclastic micrite beds and to the north, earthy cryptocrystalline dolomites often associated with gypsum and anhydrite while the remaining members are interbedded shallow water dolomite, limestone and shale.

The Slave Point Formation (Code SLPT) overlies the Watt Mountain Formation conformably. It can be subdivided into four facies, the M1-3, N, O, and P. The M1 or Amco unit is a 3.1 m thick, blue-gray argillaceous limestone, which is sandwiched between two 0.1 to 2 m thick brown sandy micrites (upper M2 and lower M3 lithofacies) and has been used as a stratigraphic marker unit by Pine Point geologists.

## 6.3 Structure and Tectonism

The original Cominco interest in Pine Point was built around the premise that major Precambrian faults in the East Arm of Great Slave Lake may have provided structural control and the source for mineralized solutions in the post Devonian Period (see Figure 3). Drill fences across the projected trends of these faults resulted in many discoveries.

## 6.4 Alteration (Dolomitization)

The main style of alteration at Pine Point is dolomitization. Dolomites at Pine Point are subdivided into two main types on the basis of grain size with a third subordinate type called white vein dolosparite.

A finely crystalline dolomite with crystal size in the range of 0.01 to 1 mm forms much of the Pine Point Formation and J facies of the Muskeg Formation.

A coarser grained destructive rhombic dolomite replacement is referred to in the literature as Presqu'ile dolomite. This more intense alteration has affected 60 to 70 % of the Sulphur Point Formation on the barrier.

Coarsely crystalline white dolomite occurs in association with in filled solution cavities and mineralization and is termed vein dolomite.

### 6.5 Karstification

According to Rhodes, karstification of the barrier, which has created caves and cavities as well as associated and overlying collapse breccia zones, is the major control of lead-zinc mineral deposition at Pine Point. Karsts and mineralized deposits are aligned along three trends that roughly parallel the N 065° E strike of the Barrier Complex. The north, main and south trends of mineral deposits are shown on Figure 11. Karstification also occurs as four distinct styles: tabular, prismatic, abnormal prismatic and B spongy type (see examples of each in Figure 10).

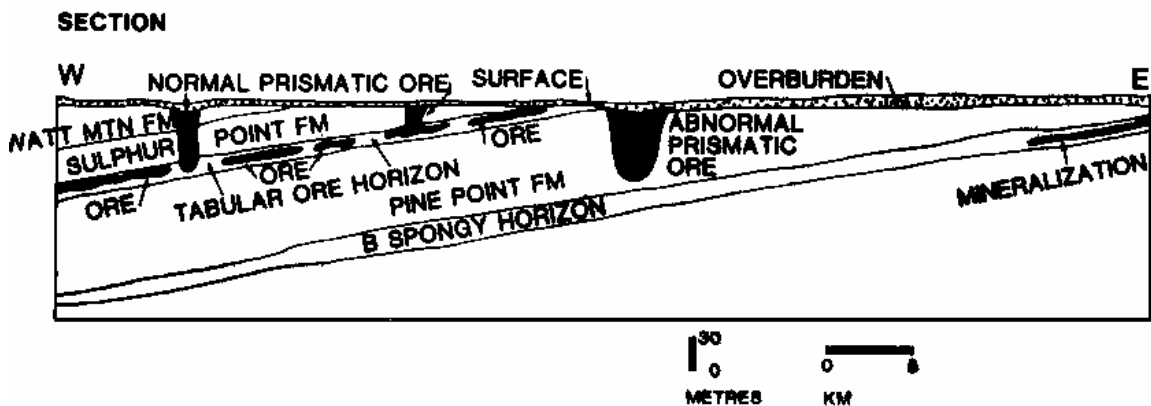


Figure 10: Examples of 4 Karst types (after Rhodes et al, 1984)

Tabular karst is the most wide spread and common type at Pine Point, occurring in a strata-bound horizon coincident with the base of the Presqu'ile dolomite at or near the Sulphur Point-Pine Point contact. Prismatic karsts form in areas of extreme karstification, perhaps in zones of structural weakness where increased jointing and fracturing have increased porosity and permeability. Prismatic karsts are marked by zones of collapse breccia development, often with basal internal sediment accumulations and overlying zones of mosaic and crackle breccia development, and downward warping of markers in the overlying stratigraphy often occurs above the collapse centers. They are believed to form by upward stoping solution activity rooted in basal tabular karsts. Abnormal or unconsolidated prismatic karsts are collapse structures not unlike modern sinkholes. The B spongy type of karst occurs in the B Spongy Member of the Pine Point Formation where leaching out of skeletal fragments has led to a pervasive vuggy porosity.



## 6.6 Mineralization

The lead-zinc mineralization at Pine Point is contained within the karst openings of the Pine Point and Sulphur Point formations and mineralized bodies follow the trends established by prior or contemporaneous karst development. Mineralization (galena, sphalerite, marcasite, and pyrite) occurs within the karst networks as replacement of karst-filling internal sediments and breccias, open-space filling, and peripheral mineralization in vuggy, wall rock porosity. The lead-zinc mineralization is rarely coarsely crystalline. A colloform texture is often seen in high-grade zinc areas and although small galena crystals are often observed, large well-developed crystals are rare. The galena-sphalerite is often accompanied by white sparry dolomite and calcite. When lead-zinc mineralization occurs as large open space fillings, it is often very pure, finely crystalline and very dense. Collapse breccia, from the upward stoping of the roof of the karst cavern, is seen as a dilutant in many of the prismatic deposits and distinct horizons within the stratigraphy can often be traced as distinct zones of rubble within the mineralization. It is also not unusual to find mineralized zones having two or more collapse zones within the deposit. Mineralization is occasionally incorporated as fragments into later stages of collapse breccias. Since these multiple collapses represented very large caverns, usually of prismatic type, the largest deposits were often of this type.

There is ample evidence that the karst openings were host to oil and gas deposits prior to the formation, or during the formation, of the mineralization. Soft tarry bitumen and brittle pyro-bitumen occur within the upper portions, especially in areas capped by shale, such as the north trend tabular deposits. In other areas, bitumen can be found in vugs and sometimes filling fractures in the collapse breccias. All the mineralized cores at Pine Point contained non-toxic volatile hydrocarbon compounds.

The grade of the mineralization varied widely, with the highest grade zones being in open space fill deposits where the mineralization formed without dilution by the host rock. As the grade falls, the host rock plays a bigger role either as:

- a breccia, which either fell into the forming mineralization or was cemented by the mineralization.
- or
- a spongy or fossil moldic host rock, in which the mineralization formed. Host rocks having the greatest interconnected porosity are likely to be the highest grade. Dolospar is often seen lining the vugs or openings and frequently bitumen is found coating the dolospar.

Mining of prismatic bodies was relatively straightforward with respect to grade control and they were very continuous. Bench height and over-digging on a bench did not dilute the ore going to the mill. Tabular bodies were very laterally continuous and thin so bench positioning, height and over-digging had dramatic impacts on the grade of the ore sent to the mill. Shovels could not be used in tabular deposits, as they were not selective enough to follow the sometimes very narrow channels containing the mineralization.

## 7.0 EXPLORATION POTENTIAL

There is still tremendous untapped potential within the Pine Point area for applying new exploration, mining and processing techniques to the known mineral deposits and for identifying new deposits and development potential.

No less than 34 drill defined, un-mined lead-zinc deposits exist on the ground previously held by Pine Point Mines and Westmin-Dupont. From east to west these deposits include N-204, N-31, N-32, K-32, K-35, L-35, L-36, L-37, K-60, M-62, M-63, M-67, X-61, X-62, Y-61, Y-62, X-65, X-68, X-71, Y-72, YBM, W-85, V-90, R-67, GO3HO2, Z-155, X-25, W-19, V-48, T-799, R-190, P-449, O-556 and O-555. The locations of the deposits are shown in Figure 11. The deposits formerly owned by Westmin start with Z-155, which is located very close to the western boundary of Pine Point Mines Limited and proceed westward to O-556.

Large areas within the current claim blocks have been unexplored or under explored by drilling and potential exists for new discoveries of the known types of Pine Point deposits or possibly of new types of lead zinc deposits.

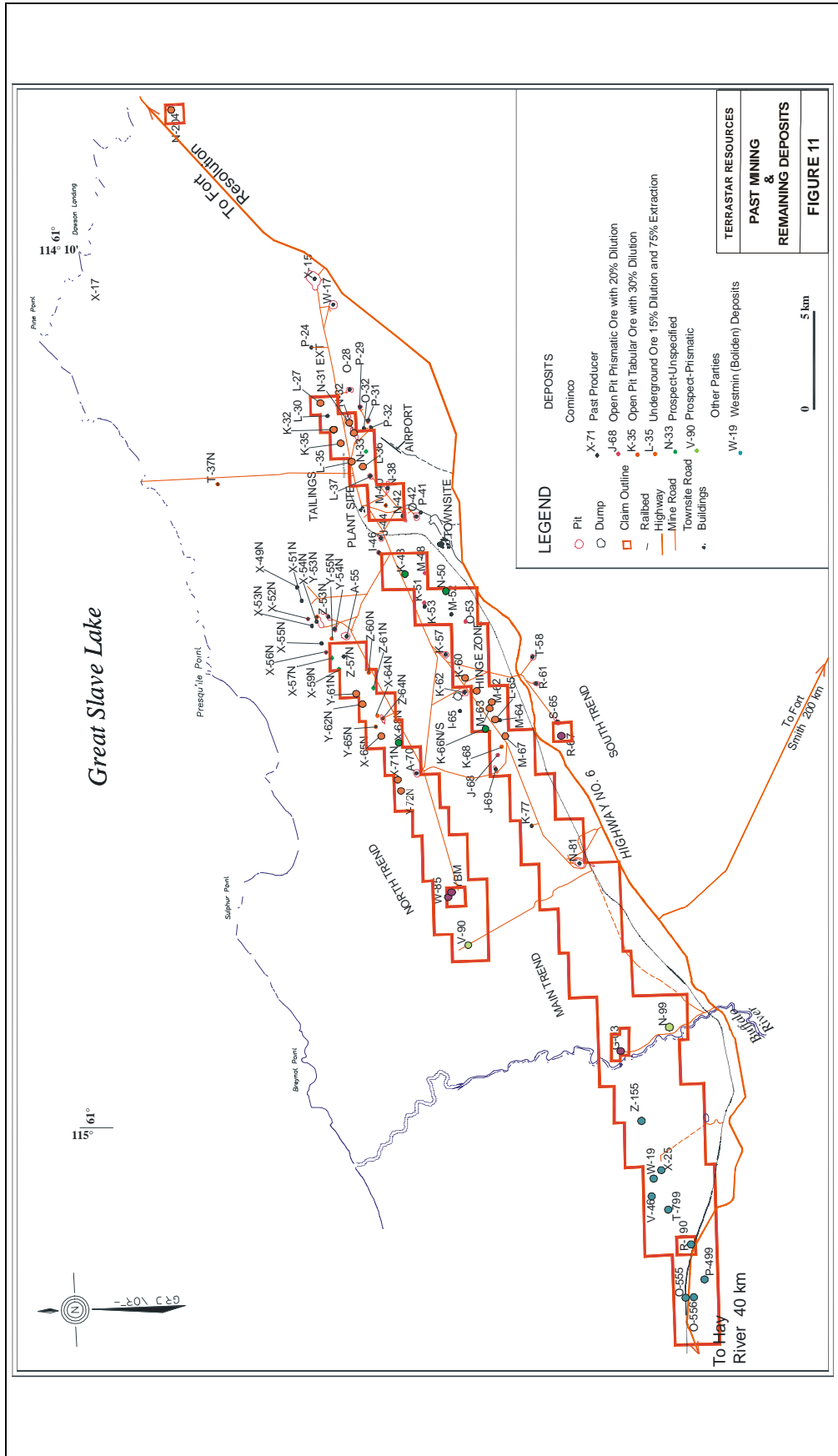
The 34 known, un-mined deposits were not developed by Pine Point Mines Ltd. due to a variety of reasons. Once the mill and town site were established many of these deposits were too far away for economic transportation to the processing facilities. Some were too deep to allow for economic open pit extraction. In other deposits, that were amenable to open pit mining, the expected ground water inflows were too costly to deal with in a conventional pit operation.

Current ownership has proposed new procedures to deal with these difficulties.

### 7.1 Exploration

Due to the large number of know deposits, exploration at Pine Point would be considerably different from a grass roots program. Retrieving existing data from Cominco and Westmin-Dupont records would form the first step in the exploration program. Drill logs and assay sheets, while available on old reel tapes and hard copy, may require re-entry into a computer database. All drill cores are available on site, with metal tags on boxes still in good condition and re-logging and re-sampling of core is possible. Existing deposits will require confirmation drilling both for grade-tonnage and metallurgical information.

Improvements in geophysical techniques in the last twenty years will aid in re-evaluating the Pine Point belt. For example significant advances have been made in the expanded use of computer analysis of the data with 3D seismic and 3D IP both now possible. Significant advancements have been made in gravity survey techniques that also might prove useful at Pine Point. The field of remote sensing has also advanced considerably since the mine closure and new techniques in Landsat TM image processing and Radarsat imagery were not applied during previous exploration at Pine Point. These techniques could prove valuable in defining subtle structural features related to karst and mineralized trends. A combination of the Geological Survey of Canada, Alberta Geologic Survey and the C.S. Lord Institute are currently looking at the spectral properties of the Pine Point area and have Radarstat, Landstat images of the area. They are also studying the seismic and gravity transects of the area. This information will be made public as it is completed.



While soil geochemistry was used in previous exploration, the extensive muskeg and swamp cover produced limited results. Overburden drilling into the first 3 m of rock would produce lithochemical samples that might indicate leakage of mineralized solutions from buried mineralization. In addition, a lithochemical study completed on Westmin-Dupont drill holes (Sinclair and Giroux, 1982) showed good correlation between lead-zinc-strontium anomalies with iron halos and known mineralization. A rock geochemical study around the N-81 prismatic ore body showed that detectable lead-zinc anomalies extend up to 500 ft (152 m) laterally from prismatic ore zones, and form more extensive plumes in the rocks above such deposits (McCartney, 1986). By combining the Pine Point and Westmin databases, new refinements in the rock geochemical model could be achieved and used to guide new exploration drilling.

Significant advances in overburden geochemical techniques have also been made since the Pine Mines closure. For example enzyme leach extraction techniques have provided breakthroughs in the exploration for base metal deposits covered by thick overburden or cap rock deposits and the technique has been found to be effective in many diverse geological settings. The effectiveness of enzyme leach geochemistry has been demonstrated in the similar tri-state lead-zinc mineralized district in the central US. This technique was not tried at Pine Point during the Cominco operations and its possible application should be investigated. Given the number of identified deposits, new techniques can be evaluated over known mineralization (such as at W-85) and then used to explore untested areas.

## 7.2 Mining and Processing

Realization of the economic potential of the Pine Point project requires the application of new mining and processing methods, which were not previously available, on deposits within the belt. The large (79 km) extent of the belt, necessitated long haulage of mine run material to the central mill facility, rendered many deposits uneconomic. The second major problem concerned the ingress of ground water and subsequent pit flooding. Conventional open pit mining, re-locatable near pit crushers and small-scale pit dewatering are proposed to handle deposits that are dry or mostly dry such as N-204.

For deposits with high water inflows an underwater mining approach might be applicable. A system of open pit, sub-aqueous, continuous mining is proposed for roughly vertical prismatic deposits with good depth potential. A remote control, barge supported, continuous miner with crawler, cutter-head, ore retrieval system and reclaim pumps is proposed. Reclaimed ore would be pumped to surface to remote dense media separation ("DMS") processing facilities. Underwater mining techniques have been used in South Africa, for off shore diamond recovery and would have to be evaluated in this setting. High capital cost equipment would need to be balanced by reduced stripping ratios and the high cost of dewatering.

The dense media separation approach is used in many lead-zinc deposits to reduce the amount of mill feed, increase the head grade and thereby minimize the required mill capacity. The process involves sizing the ore on wet screens with the oversize reporting to the DMS drum and the undersize to DMS cyclone circuits. Both streams are re-pulped with a dense media, composed of ferrosilicon and water. Float and sink streams are resized to recover the dense media. The heavies, from the sink stream, would represent the raw concentrate, which is then trucked to the central mill processing facility for conventional

milling and floatation. Final concentrate would be dried and shipped to Hay River for rail transportation to smelters.

The operation is proposed to operate as a drive-in and drive-out camp, much like the Brewery Creek operation in the Yukon, as opposed to the Pine Point experience of operating a town site with associated high infrastructure costs. It is also anticipated that the proposed improvements in mining and milling technologies will allow for reduced manpower. For example, a 10,000 tonne per day operation at Colomac using a SAG mill required a labor force of 250, as compared to the 10,000 tonne per day operation at Pine Point Mines using a number of rod mills that required 480 employees.

These anticipated reductions in overhead, when combined with processing less material and a continuation of the weak Canadian dollar, would create significantly lower operating costs compared with those experienced by Pine Point Mines. Existing infrastructure, that would lower capital cost requirements, includes an 18 MV hydroelectric power plant, paved road, rail access at Hay River and gravel haul roads to access most parts of the eastern claim area.

### 7.3 2002-2003 Work Program

During 2002 and 2003 533,000 dollars of work was completed and \$442,000 of this work was filed and accepted by the NWT mining recorder as being applicable tenure work (Kent Burns Group, 2003). This work entailed procuring all available drill data in computerized form where available and in hard paper data where not. Geologic interpretations were checked, cross sections produced through each identified deposit and a preliminary internal scoping study completed to examine the mineability and economics of some of the know deposits. Approximately 18,200 drill holes from both the Cominco and the Westmin properties were entered into a Gemcom database. The data included survey, geology, alteration, assays and geochemistry from the portion of the property that was formerly owned by Westmin and survey data from the portion of the property formerly held by Pine Point Mines Ltd.

### 7.4 Environmental Considerations

The Great Slave Reef property encompasses most of the mining properties formerly owned by Westmin and Pine Point Mines Ltd.; however it does not include the tailings area from the former Pine Point operation. Westmin and Pine Point Mines Ltd. both held land under mining leases and claims and any area in which mining was done was held under a mining lease. In order to be released from the mining leases the Minister of Mines for the NWT was required to sign off on their responsibilities under the leases. As a result of Pine Point Mines Ltd. (or successor companies) is being required to monitor and treat effluent from the tailings area. There was no environmental monitoring required on the Westmin properties as no mining was done on their lease.

In 2001 the property was optioned to Pine Point Mines Inc. and a permit to work on the ground was acquired by Pine Point Mines Inc., which required a bonding of \$60,000 to cover any possible reclamation derived from its activities. This permit is valid until 2007 and can be transferred to Tamerlane Ventures Inc. In order for the permit to be transferred Tamerlane Ventures Inc. must register in the NWT as an extraterritorial corporation, obtain a Prospectors License and post a bond of \$60,000.

## 8.0 RECOMMENDATIONS

The work performed to date plus the tenure considerations of the property have resulted in the following programs being recommended for 2004 and 2005.

### Phase 1 (2004)

As a result of the 2002 and 2003 review it was determined that 20 years had past since any geophysics work had been completed on the property or in the area. Geophysics technology has progressed considerably over this period of time and now airborne gravity surveying is possible that will provide information that is competitive with ground gravity surveying. Since the Pine Point ore bodies have been shown to respond to ground gravity surveying it is recommended that airborne surveying of the property be undertaken in conjunction with an airborne magnetic survey. Testing of the airborne gravity over known ore bodies will provide a test of the gravity system while a magnetic survey of the property will provide details of the basement geology, which may have an influence on the overlying Paleozoic rocks which contain the ore hosting stratigraphy.

The cost of this program is estimated to be \$300,000.

### Phase 2 (2005)

Confirmation drilling should be undertaken on the existing known deposits. This drilling should be concentrated in the R-190 deposit and on the G-O3 deposit. Samples will be analyzed for the basic lead, zinc, iron, and strontium and in addition an appropriate ICP multi-element package should be tested to determine if there are other pathfinder elements that would be useful in identifying buried mineralization. Drill core should also be obtained for preliminary metallurgical tests. A small bulk sample should be obtained from the dump material in order to run hardness tests, for design of the underwater mining machine cutter heads. Environmental studies should commence on the property, to obtain base line information for possible mining.

The cost of this program is estimated to be \$270,000.

## 9.0 COST ESTIMATE

### PHASE 1

#### Description

Gravity and Magnetic Airborne Survey	
Mobilization- Demobilization	\$20,000
Gravity Surveying 400 line km @ 250/km	\$100,000
Magnetic Surveying 1,200 line km. @ 150/km	<u>\$180,000</u>
<b>Total Phase 1</b>	<b>\$300,000</b>

**PHASE 2****Description**

## Drilling

20 NQ Drill Holes for a total of 4,000 meters of drilling @ \$50/m	\$200,000
Assays 800@\$20/ sample	\$16,000
Geologist (3 months @ \$6,000)	\$18,000
Data Entry and Reserve Recalculation	\$10,000
Technician( 2 months @ \$3,000)	\$6,000

## Test Sample

Select and ship test rock	\$10,000
Complete Laboratory testing for cutter head	\$10,000

**Total Phase 2****\$270,000**

## 10.0 BIBLIOGRAPHY

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## 11.0 CERTIFICATES

I, G.H. Giroux, of 982 Broadview Drive, North Vancouver, British Columbia, do hereby certify that:

- 1) I am a consulting geological engineer with an office at #513 - 675 West Hastings Street, Vancouver, British Columbia.
- 2) I am a graduate of the University of British Columbia in 1970 with a B.A. Sc. and in 1984 with a M.A. Sc., both in Geological Engineering.
- 3) I am a member in good standing of the Association of Professional Engineers and Geoscientists of the Province of British Columbia.
- 4) I have practiced my profession continuously since 1970.
- 5) I have read the definition of a qualified person set out in National Instrument 43-101 and certify that by reason of education, experience, independence and affiliation with a professional association, I meet the requirements of an Independent Qualified Person as defined in draft National Policy 43-101.
- 6) This report is based on a study of the data and literature provided by Kent Burns Group. The work was completed in Vancouver during November 2001. While a site visit, was not made, extensive work on regional lithogeochemistry, and several resource estimates were completed in the early 1980's for Westmin Mines Ltd. on Pine Point deposits.
- 7) I am not aware of any material fact or material change with respect to the subject matter of the technical report that is not reflected in the Technical Report.
- 8) I am independent of the issuer applying all of the tests in section 1.5 of National Instrument 43-101.
- 9) I have read National Instrument 43-101 and Form 43-101F1, and the Technical Report has been prepared in compliance with that instrument and form.
- 10) I consent to the filing of the Technical Report with any stock exchange and other regulatory authority and any publication by them, including electronic publication in the public files on their websites accessible by the public.

Dated this 13 day of May, 2004

**AG.H. Giroux@**

G. H. Giroux, P.Eng., MASc.

I, Ian D. McCartney, of 2242 Spruce Street, Vancouver, British Columbia, do hereby certify that:

1. I am a consulting geologist with an office at 1283 West 10'th Avenue, Vancouver, British Columbia.
2. I am a graduate of the Faculty of Applied Science at Queens University, Kingston, Ontario in 1976 with a B.A. Sc. in Geological Engineering and a specialty in the disciplines of Mineral Exploration and Economic Geology.
3. I have practiced my profession continuously since 1976.
4. I am a member in good standing of the Association of Professional Engineers and Geoscientists of the Province of British Columbia.
5. This report is based in part on a study of the data and literature provided by Tamerlane Ventures Inc.. The work was completed during November 2001. I spent approximately three years based on the Pine Point Mines Property (1985-87) as an employee of Cominco Ltd., during which time I was in charge of a significant portion of the exploration and ore definition drilling programs conducted by Cominco-Pine Pint Mines Ltd. I last visited the subject property May 2004.
6. I have no interest, either direct or indirect, in the properties or securities of Tamerlane Ventures Inc. or associated issuers nor do I expect to receive any such interest.
7. I am not aware of any material fact or material change with respect to the subject matter of this report which is not reflected in the report
8. I consent to the use of this report by Tamerlane Ventures Inc. in submissions to the British Columbia Securities Commission and to distribute all or parts of the report to shareholders or other parties, provided that the meaning is not altered by partial quotes.
9. By reason of education, experience, independence, and membership in a qualified professional association I meet the requirements of securities regulators and stock exchanges in Canada for an Independent Qualified Person.

Dated this 13 day of May, 2004

“Ian D. McCartney”

Ian D. McCartney, P. Eng.

Per: