

Northwest Territories Leading in Canadian Exploration



The Lupin mine proves that mining and the environment can successfully co-exist. Musk-Oxen are regular visitors

The Northwest Territories (NWT) has a rich mining history, with both its economy and infrastructure being based primarily on the minerals industry. NWT has seen extensive exploration activity by companies looking for gold and base metals, as well as one of the world's most concentrated exploration efforts for diamonds. A secure investment climate, with support for mining from both government and aboriginal peoples, very attractive tax rates, an eager and available workforce, and highly favourable geology, indicates the future is bright for mining in the NWT. Having experienced such a tremendous upsurge in exploration and development, the NWT Chamber of Mines has commissioned this Supplement, prepared by *Mining Journal Research Services*, to provide up-to-date information on the region's minerals industry.

The NWT is one of two territories in Canada from which new provinces have been carved. Despite this the territory still covers 3,426,000 km², over one-third of Canada's land area. This makes it considerably larger than any African nation or the combined member states of the EC. But, with only 65,000 residents, it is far less populated.

The NWT extends from 60°N to the northern limits of Canada; it is flanked to the west by the Yukon Territory and to the east by Greenland. The NWT also includes the Arctic islands and the islands of Hudson and Ungava Bays. The geography varies from mountains and timbered foothills in the west, to the treeless hills of the Arctic islands. The climate is subject to large fluctuations in seasonal temperatures.

COUNTRY SUPPLEMENT

An Evolving Economy

Mining is key

Compared to other Canadian provinces, the economy of the NWT is in a developing phase. Achieving increased economic self-reliance has become a key objective of both the territorial and federal governments. Economic stimulus is becoming increasingly urgent under the weight of such factors as: a birth rate twice the Canadian average; an unacceptably high level of unemployment; and government *per-capita* expenditure that is two and a half times the national average.

Given the territory's huge size, sparse population, rugged climate and geography, economic opportunities are limited. Non-renewable resources are the key to achieving improved economic self-reliance.

Mining, in particular, holds great promise to improve the economy in the north. Already, the combined value of mineral exploration and production has exceeded \$C1,000 million (1989), with



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The Hearne Province, a newly classified Archaean subdivision of the Churchill Province, also hosts Archaean-type VMS base metals, gold bearing shear-zones and banded iron-formations, and ultramafic-hosted nickel. Diamonds were also recently discovered in a minette dyke.

The greater thickness of glacial overburden in this Province makes the search for economic deposits challenging, although several promising gold discoveries indicate the presence of an economic deposit.

Proterozoic Provinces

The Rae Province is another newly classified Archaean subdivision of the Churchill Province. It has a wide range of lithologies including Precambrian granites and gneisses; basic and ultrabasic intrusions; volcanics and sedimentary rocks.

The Rae Province has a high mineral potential, with known deposits of uranium, iron, lead, zinc and nickel. The large Thelon Basin, is believed to be analogous to the uranium-rich Athabasca Basin in northern Saskatchewan. Thelon is also known to host uranium deposits in unconformity-related conglomerates and sandstones.

The Bear Province, which borders the Slave Province on three sides, is dominated by sediments, with volcanic rocks

and Precambrian granites and gneisses. It is best known for its uranium and silver deposits, including NWT's first mine, Eldorado. Radium, uranium and silver were all produced here at different times from the 1930s to early 1980s.

The resurgence of exploration interest in this province has been driven by the new application of models to areas of interest such as:

- Victoria Island, where Noril'sk type nickel deposits are being sought;
- at Paulatuk on the Arctic Coast, where the largest single gravity anomaly in North America is being explored for Sudbury-type nickel deposits; and
- in southern Bear, the Australian Olympic Dam model is being used in the search for copper-gold-uranium deposits.

Palaeozoic and younger Provinces

The Cordilleran Province, east of the Mackenzie River in western NWT, is a mountainous area comprising crustal slices of sedimentary rocks with volcanics and gabbro sills of late Precambrian to Mesozoic age.

Deformation and metamorphism varies through-out the province. Exploration has revealed placer gold, copper, tungsten, silver, lead and zinc mineralisation, as well as oil and gas deposits.

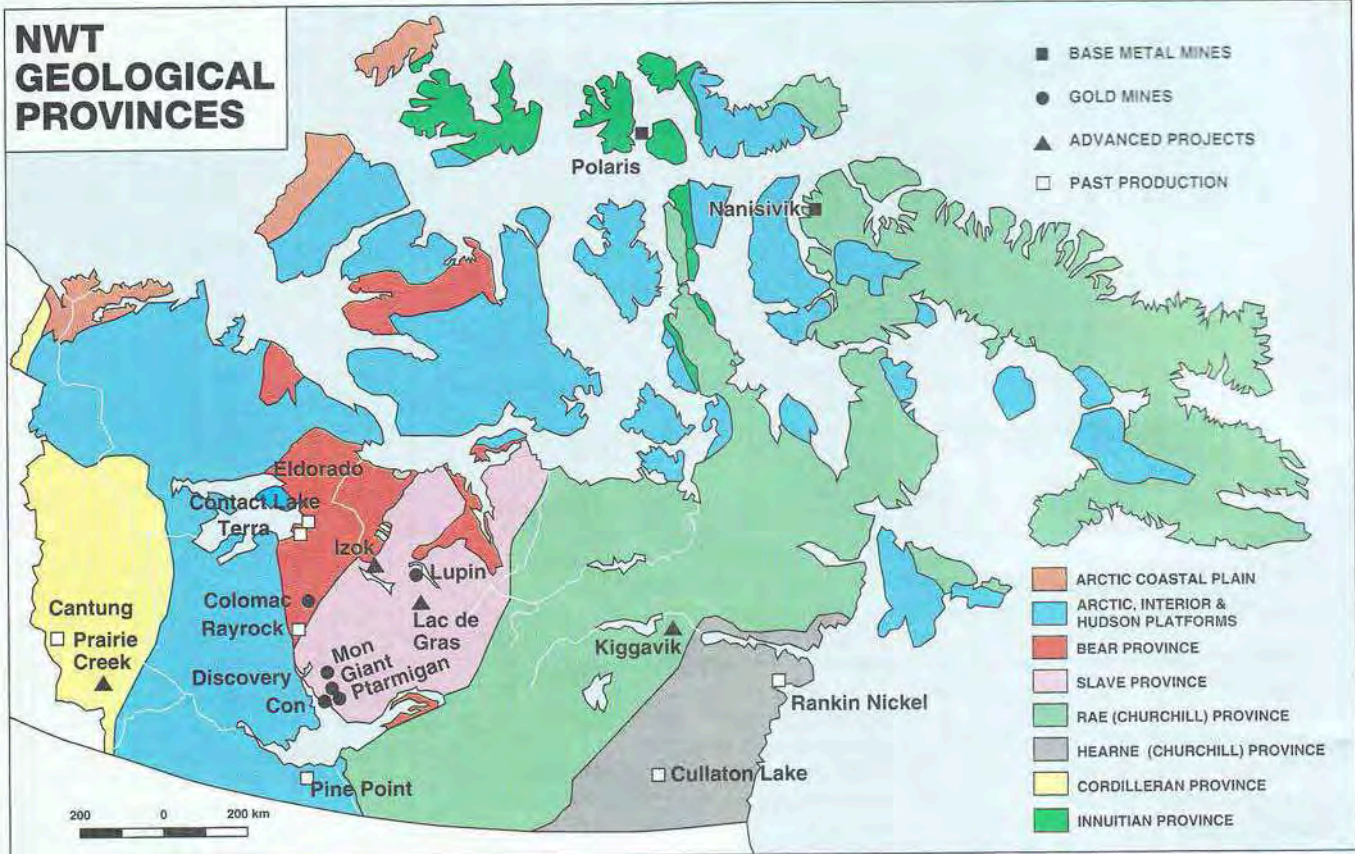
While commercial production has been limited to the Pointed Mountain gas field

in the south, the Norman Wells oil field in the north and the Cantung tungsten mine near the Yukon border, the Province is known to host one of the world's largest undeveloped tungsten resources, the Mactung deposit, as well as the huge Howard's Pass zinc-lead deposit.

The Arctic, Interior and Hudson Platforms comprise relatively undisturbed younger sedimentary rocks, volcanics and gabbroic sills of mainly Ordovician, Devonian and Cretaceous age, with minor Precambrian and Tertiary rocks. The Platforms are best known for the Mississippi Valley Type (MVT) Nanisivik and Pine Point lead-zinc mines.

The Innuitian Province covers most of the high Arctic islands. It comprises lower Palaeozoic sediments and volcanics, as well as Jurassic to Quaternary sediments. Mineralisation in this Province includes MVT base metal deposits, such as at the Polaris mine, as well as extensive oil and gas deposits, such as the oil-producing Bent Horn field.

The Arctic Coastal Plain comprises sediments of Tertiary and Quaternary age and are only exposed in coastal areas. Some coal deposits are known and the province has been actively explored for oil and gas. Substantial resources of all of these three minerals have been found underlying the province.



More Remote Does Not Mean Less Economic

A solid mining presence

Despite the NWT's huge size and location, more remote does not necessarily mean less economic. The territory has eight operating hard-rock mines and over 20 other deposits, that have been mined over the past 60 years. The production from these mines makes the NWT the second largest zinc producer, the largest lead producer and the third largest gold producer in Canada.

GOLD PRODUCERS

NWT ranks about 17th in the world for gold production, Canada as a whole ranks 5th amongst gold producing countries. The main mines are:

Con mine

The Con mine, located in Yellowknife, has produced more than 161 t (5.2 Moz) of gold since operations began in 1938. Miramar Mining Corp. took over the mine in 1993 and has invested \$C17 million in capital programmes. As a result, in 1994 a record 3,558 t of gold was produced at an operating cost of \$US282/oz, a considerable improvement from \$US349/oz in 1993. Overall gold production is expected to reach record levels again in 1995. At the end of 1994, reported proven and probable reserves were 3.6 Mt grading 10.6 g/t gold.

The mine operates throughout the year with about 400 employees. A new three-year collective agreement with the United Steelworkers of America is now in place.

Whenever possible, long-hole and shrinkage stoping mining methods are now used instead of conventional and mechanised cut-and-fill methods. Mill capacity has been increased from 1,000 to 1,300 t/d and the processing of free milling and refractory ores has been split into two circuits. Free milling ore, amenable to direct recovery of gold, will continue to be processed through the existing circuit while refractory ore will be processed utilising a separate recovery circuit that feeds the gold concentrate into Miramar's autoclave to liberate the gold for later recovery. This autoclave is one of only two such high temperature and pressure vessels in Canada. The expansion of the company's hydroelectric power station from 3.5 to 7.5 MW will also generate significant cost savings for the mine.

SELECTED MINES, MINERAL DEPOSITS AND PROJECTS

GEOLOGICAL PROVINCE (AGE)	MINERAL DEPOSIT TYPE	MINES/PROJECTS/DEPOSITS	
SLAVE (Archaean)	Archaean Lode Gold	Con mine	
		Giant mine	
	Iron Formation-Hosted Gold	Discovery mine	
		Boston project	
		Lupin mine	
		Damoti Lake projects	
	Intrusive-Hosted Gold	Colomac mine	
		Nicholas Lake deposit	
		Izok Lake deposit	
		Hackett River deposit	
High Lake deposit			
Gondor deposit			
Volcanogenic Massive Sulphide (VMS) Base Metal	Hood River deposit	Musk deposit	
		Yava deposit	
	Sunrise deposit	BHP/Dia Met deposits	
		Kennecott/Aber deposits	
		De Beers/Gerle project	
	Ashton Cross Lake project	Thor Lake deposit	
		Musk-ox Intrusion project	
	HEARNE (Archaean)	Iron Formation-Hosted Gold	Meliadine deposit
			Meadowbank deposit
		Mafic/Ultramafic-Hosted Cu-Ni-PGM	Rankin Nickel mine
Heninga Lake deposit			
VMS Base Metal		Kiggavik deposit	
		Mary River deposit	
		Borealis East & West deposits	
		Eg Bay deposit	
Unconformity Uranium		Thye Lake deposit	
		Superior Type Iron Formation	
BEAR (Proterozoic)	Mafic/Ultramafic-Hosted Cu-Ni-PGM	Eldorado mine	
		Terra mine	
	Arsenide Vein Silver, Uranium (Erzgebirge-type)	Contact Lake mine	
		Rayrock mine	
	Vein Uranium	Sue-Diane deposit	
		Olympic Dam Polymetallic	
	Noril'sk Cu-Ni-PGM	Victoria Island project	
		Sedimentary Uranium	
	Volcanogenic Cu-Zn (Pb)	Mountain Lake deposit	
		Coppermine deposits	
INTERIOR PLATFORM (Palaeozoic)	MVT Base Metal	Nanisivik mine	
		Pine Point mine	
	Sedimentary Coal	Paulatuk	
		Kimberlite Diamonds	
	CORDILLERAN (Precambrian to Present)	Skarn Tungsten	Cantung mine
			Mactung deposit
		Sediment-Hosted Stratiform Pb-Zn	XY deposit
			Vulcan deposit
		Stratiform & Vein Base Metal	Prairie Creek deposit
			Sediment-Hosted Stratiform
Copper (Red Bed / Kupferschiefer Type)		Coates Lake deposit	
		MVT Base Metal	
INNUITIAN		Coal	Gayna River deposit
			Prairie Creek deposit
	MVT Base Metal	Bear-Twit deposit	
		Fort Norman	
	Coal	Polaris mine	
		Various Deposits in Arctic Islands	

(Note: Mines have or are still producing; Deposits have calculated reserves; Projects may yield reserve mines).

Lupin mine

Lupin is the world's most northerly gold mine outside Russia, located 88 km south of the Arctic Circle and 400 km north of Yellowknife. Despite its remote location, it is the fifth largest gold producer in Canada. In 1994 it produced 3.4 t of gold, 71.5 t since startup. Ore reserves contain more than 22 t gold, with a limited prospect of significantly adding to them.

Ore is crushed near the bottom of the mine shaft at a depth of 1,130 m, then hoisted to a mill on the surface. Gold is extracted by conventional milling and recovery processes, 365 days a year.

Lupin has made a number of changes in mining techniques to overcome the challenges of mining at depth, including a new mining method; sublevel retreat under consolidated fill. Further improvements are expected, including the use of a cement paste backfill, in a continuing effort to limit the increase in mining costs with depth.

For most of the year access to the mine is by the company-owned Boeing 727 aircraft. During ten weeks each winter, supplies can be trucked 560 km to the mine over an ice road ploughed across frozen lakes from Yellowknife. Up to 1,000 round trips are undertaken each year.

Giant mine

Royal Oak Mines Inc. started underground production at Giant mine in the late 1940s. The refractory, arsenic-bearing sulphide ore is treated by roasting, cyanidation and zinc precipitation. Current production, down to the 1800 level, is largely cut and fill with some long-hole stoping and smaller amounts of shrinkage stoping. Mill capacity is 1,100 t/d achieving 88% recovery. Carbon is added to the leach circuit to treat tailings before release.

Giant operated close to forecast in 1994, producing 3.2 t of gold, an increase of 9% over 1993. Gold recovery was enhanced with the installation of new cleaner flotation cells and improved metallurgical con-



Winter roads are commonly used to access mine and exploration sites

trol. This higher production reduced cash costs by 12% to \$US289/oz. Operating costs were also 3% lower than in 1993. Underground development has reached the Supercrest orebody, 3 km north of the C shaft, and mining will begin on this deposit in November.

Forecast production for 1995 is 3.3 t. This increase is largely due Supercrest's higher grade ore of 10.5 g/t, which is expected to increase mill head grade to 8.5 g/t and recovery to 88%. Reserves at the end of 1994 were 23.7 t from mineable ore, and 64.4 t in total mineral inventory.

Colomac mine

In April 1993, Royal Oak purchased the Colomac gold mine, located 208 km north-northwest of Yellowknife. The mine had originally opened in May 1990 and produced 4.1 of gold before operations were suspended in mid-1991.

Gold production in 1994 was 46% below forecast at 1.26 t, which was largely attributable to a fire which damaged mill equipment and delayed mill start-up. The mill processed 894,000 t of ore at an average head grade of 1.6 g/t and achieved an average recovery of 87%. Reserves estimated at end-1994 were 1.25 t in mineable ore. The company has acquired satellite deposits in the immediate vicinity and plans to build an all-weather road to access them.

Gold production is forecast at 4.2 t in 1995, increasing to 5.3 t in 1996 when the mill is expected to be operating at full capacity. The mill head grade is 1.8 g/t with recovery approaching 93%. Cash costs of \$300/oz are anticipated in 1995 decreasing to under \$275/oz in 1996.

The mine employs 260 workers who work 12-hour shifts on a 2-week in and 2-week out rotation by air to the northern communities of Yellowknife and Hay River. Many of the management functions are shared with Royal Oak's Giant mine in Yellowknife to save costs.

Ptarmigan/Tom mine

Treminco Resources' joint Ptarmigan and Tom mines are relatively small operations. The Ptarmigan deposit was mined briefly during the Second World War, while Tom is a new deposit.

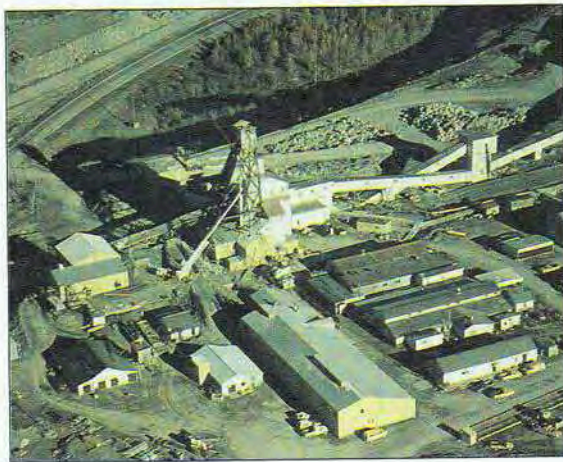
A third ore source, located between the two existing orebodies has since been accessed and production from all three is treated at the company's 230 t/d mill.

Mining is by shrinkage stoping on vertical gold-bearing quartz veins. Production in 1994 totalled 215 kg gold from 26,176 t of ore. The gravity mill recovers 96% of the gold. The mine has a staff of only 28, production costs of \$320/oz, and reserves (mid-1994) of 30,000 t at 8.2 g/t gold.

Mon mine

The smallest operation in the NWT, the Mon, is a seasonal operation, with nine staff winning gold from quartz veins in Archaean sedimentary rocks. Using a new winterised camp and mill facilities, and increased fuel storage, operator Ger-Mac Contracting extended the mine's operating period from four to six months in 1994.

Total production last year was estimated at 21 t gold from 1,452 t of ore. The gravity mill circuit has a 91 t/d capacity with 87% recovery. A tailings pond with a 18,000 t (dry) capacity was completed in 1994.



Left: Nainisivik mine, Canada's first Arctic mine, overlooks the Arctic ocean



Right: Royal Oak's Giant mine, Yellowknife, has been producing since 1940's

BASE METAL PRODUCERS

With its Polaris and Nanisivik mines, NWT ranks ninth amongst world zinc producers. Although both mines are located in the high Arctic, they are among the lowest cost zinc producers in the world.

Polaris Mine

Polaris, on Little Cornwallis Island, is the world's most northerly base metal mine. The joint venture company includes exploration properties and is owned by Cominco (77.5%), which is also the operator, and Teck Corp. (22.5%).

In 1994, 1.0 Mt of sulphide ore was milled, yielding 207,600 t of zinc concentrate and 40,260 t of lead concentrate. Extraction is by mechanised, longhole and sub-level open stoping. Production from mining pillars accounted for nearly three quarters of the total production in 1994, equalling the record level set the previous year, but falling short of the forecast level. Difficult ground conditions persisted and increased levels of ground support were implemented. Operating costs at Polaris fell almost 8% and productivity rose a record 18%. Ten shipments of zinc and lead concentrates, totalling 246,200 t, were made to Europe in the July to October shipping season.

Nanisivik mine

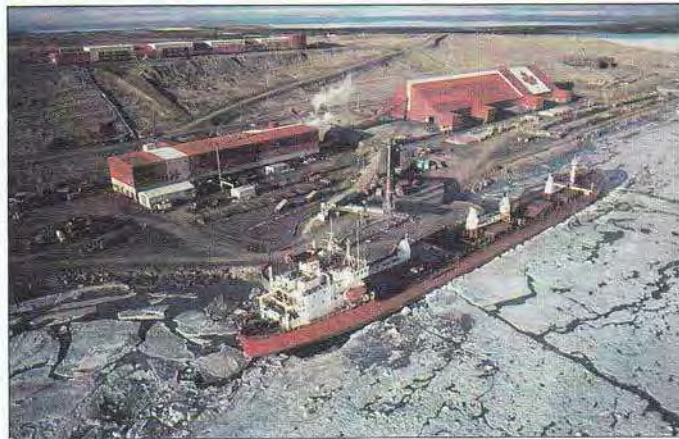
Nanisivik, wholly owned by Conwest Exploration, is situated at the northern end of Baffin Island and is managed by Strathcona Mineral Services. Production began in 1976 using mainly room-and-pillar methods with open-pit operations at various satellite deposits. An estimated 750,000 t of ore were processed in 1994, yielding 50,000 t of zinc concentrate, 1,000 t of lead concentrate and 16 t of silver.

In 1994, the mill capacity was increased 15% to 2,300 t/d after the cyclone sizes were increased and a new tailings pump was installed. A 96% recovery rate was achieved, allowing 8,000 t of lead concentrate and 93,500 t of zinc concentrate to be shipped on five voyages from May to September. Ore reserves are estimated at 2.55 Mt with grades of 8.5% zinc, 0.3% lead and 39 g/t of silver.

Past producers

No review of the NWT's mining history would be complete without mention of Cominco's Pine Point mine. Although mineralisation was first discovered in the area in 1898, and exploration during the early 1900s revealed the extent of the lead-zinc orebody, it was not until the NWT's only railway was constructed in 1964 that mining at Pine Point was able to commence. Production lasted 25 years until 1989 when the last of the stockpiled

The MV Arctic loading concentrates at Polaris mine



concentrates from the mine were shipped to Cominco's smelter in British Columbia. Pine Point contained 84 Mt of ore and yielded 1.8 Mt of lead and 3.9 Mt of zinc - a world-class deposit by any standard.

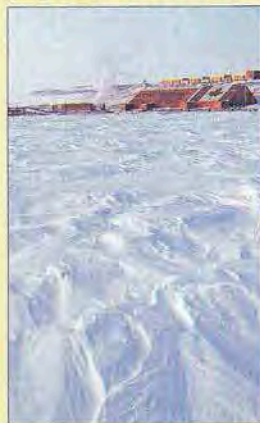
Other significant past producers include the Cantung mine, once one of the world's largest tungsten mines. Owned by Canada Tungsten Inc., the mine went into care and maintenance in 1986 due to cheap exports of Chinese tungsten. The recent upturn in world tungsten prices has justified a re-assessment of the

deposit. Proven and probable reserves at the site are 1.4 Mt grading 1.2% WO₃.

The Discovery gold mine near Yellowknife was a particularly rich mine, producing some 28,349 t gold from 1 Mt of ore. The Port Radium mine, on Great Bear Lake, operated for 50 years producing radium, uranium and silver. Nickel was produced during the late 1950s from the North Rankin mine, which also pioneered the use of sea transport in the high Arctic and employed local Inuit residents as miners.



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Exploration Booming

In 1994, exploration investment in the NWT broke all previous records, with expenditures for all commodities exceeding \$C170 million. While gold attracted considerable investment due to its proven mining record, the majority of the interest today is for diamonds.

Their discovery in 1991 set off what may be well the world's largest claim staking rush. Exploration efforts are paying off.

Mining of kimberlite pipe clusters in the Lac de Gras area appears likely, as early as 1997. Exploration continues and, with the successful development of the BHP/Dia Met diamond mine, will be sustained for many years to come.

DIAMONDS

While companies have been exploring for diamonds in the NWT for some 20 years, success, until recently, has been elusive. This is primarily because the majority of kimberlites found to date are obscured by lakes and/or a blanket of overburden deposited by the vast Quaternary glacial ice sheets.

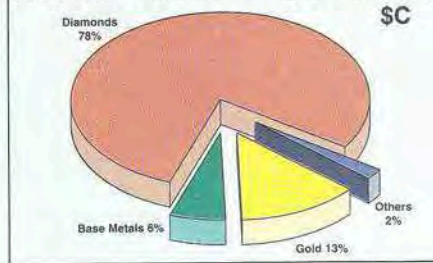
The perseverance of Dia Met's geologist, Charles Fipke, paid off with his discovery of a diamond-bearing kimberlite in 1991. The resultant staking rush eventually encompassed more than 20 Mha (50 million acres) of land, largely in the Slave Province.

While most success to date has come from the Lac de Gras region, several companies have been finding diamondiferous kimberlites in other parts of the Slave Province. The Hearne Province and Arctic Platform are also being explored. While activity was originally confined to junior explorers, the entry of major companies including BHP, Kennecott (RTZ), De Beers and Ashton has provided the exploration effort with credibility.

Exploration activities involve both geophysical and geochemical techniques for the delineation of potential drill and bulk sampling targets. Airborne geophysics has been used extensively to identify anomalies on a regional basis, with the addition of surface geophysics to pinpoint individual targets.

Indicator mineral sampling has also been an important exploration tool, with grid sampling of the glacial tills and eskers down-ice from the geophysical targets usually following anomaly location. Follow-up drilling is often confined to winter when the lakes and muskeg are frozen. Winter also allows exploration companies to move fuel and supplies using

1994 NWT Exploration by Commodity \$C



the Lupin mine's ice road, which conveniently traverses the Lac de Gras area.

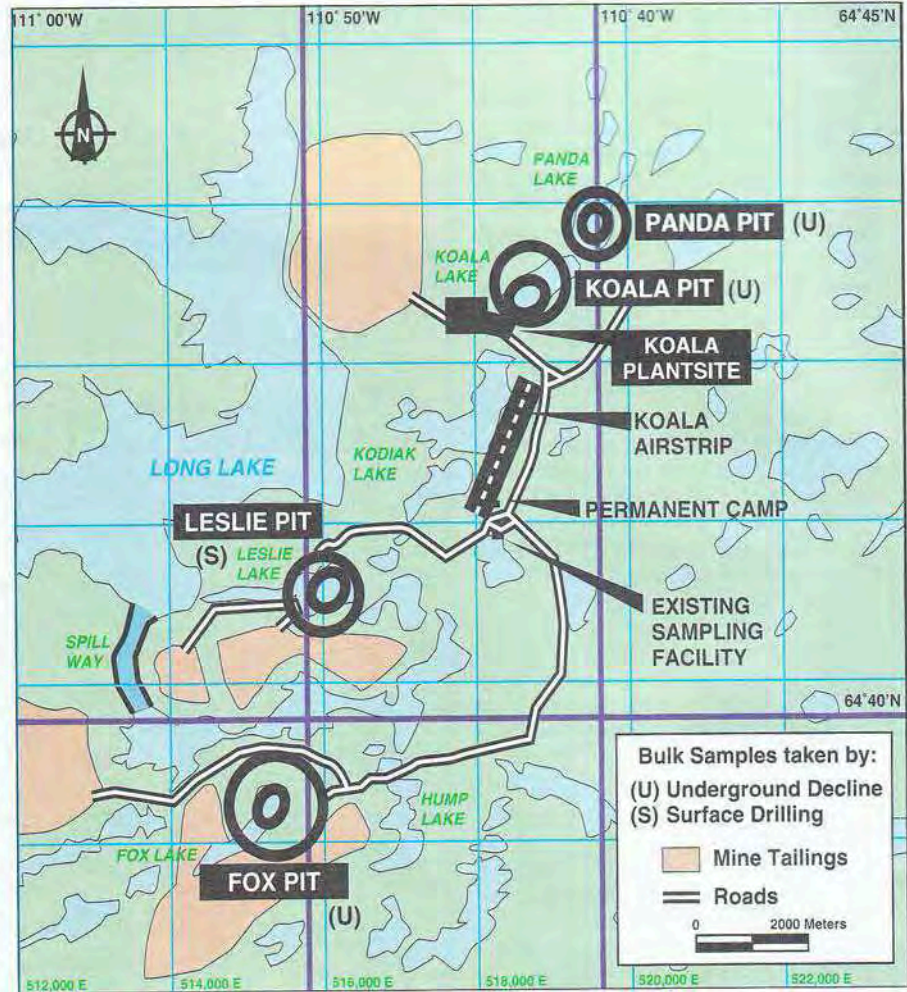
BHP/Dia Met - A mine is in sight

BHP Diamonds Inc. has reported that diamonds recovered to date from five kimberlite pipes at its Lac de Gras property, about 300 km north east of Yellowknife, compare favourably with those of existing diamond mines in the world. The company has stated that, at today's prices for rough diamonds, the project to develop the pipes is economically feasible.

The five pipes named after the lakes under which they are located: Panda, Misery, Koala, Fox and Leslie. The pipes will be mined over approximately a 30-year period. Both Panda and Koala will have open-pit and underground opera-

Pipe	Metres Drilled	Tonnes	Carats	Grade ct/t	t	Previous Results		
						ct/t	\$C/ct	\$C/t
Panda	1,262	217	275	1.27	3,143	0.93	\$C132	\$C123
Koala	1,185	205	505	2.46	1,193	0.75	\$C110	\$C82
Misery	4,428	905	3,885	4.29	132	3.30	\$C44	\$C145
Fox	1,587	251	65	0.26	7,766	0.27	\$C126	\$C34
Pigeon	905	154	60	0.39				

For perspective, the richest pipe in the world, the Jwaneng Pipe in Botswana, has values of \$C100/ct and \$C154/t.



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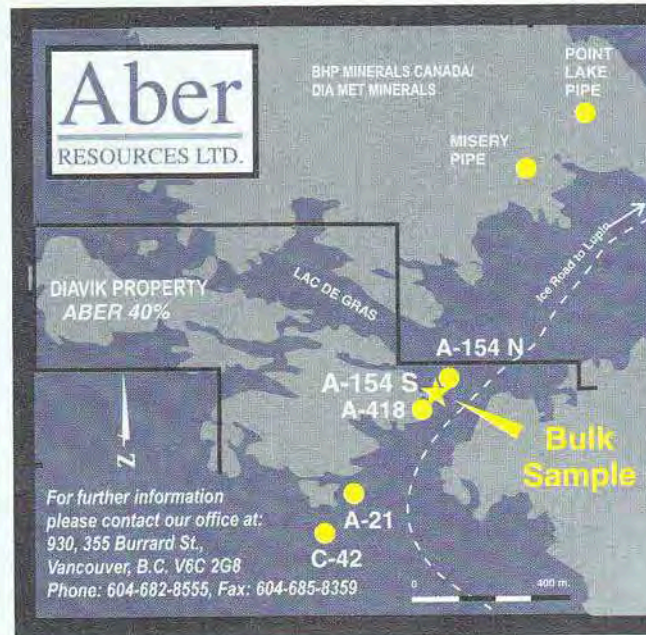
tions, the remaining three are planned to be worked from open-pit operations alone. Preliminary results on two pipes are 0.75 ct/t at an average of \$110/ct for a value of \$82/t of ore at Koala and 1.18 ct/t at \$127/ct giving a value of \$150/t at Panda.

The single centralised processing plant planned by the company will receive 9,000 t/d of ore during the first nine years of operation, after which throughput will be doubled. Processing will involve mainly crushing, scrubbing, dense media- and high-intensity magnetic-separation, X-ray concentration and sorting.

The BHP/Dia Met project is the most advanced diamond project in the NWT. A 180-man camp, an airstrip and a kimberlite processing facility were built on site to support exploration of the large property. Kimberlite processing began early in 1993, and results from underground bulk sampling of two pipes and reverse circulation drill sampling of an additional three have been outstanding:

Given this success, the BHP/Dia Met joint venture submitted a mining plan to the Federal Government for approval. Highlights include:

- First production is expected in 1997, on the assumption that government permits are granted during 1995.



Underground bulk sampling has begun on the prospective A-154 South kimberlite pipe. Large diameter core drilling during the winter of 1995 yielded 56.5 tonnes of kimberlite, with an average grade of 4.5 carats per tonne and an average value of \$56.70 per carat. The pipe has a drill indicated resource of 8.6 million tonnes to 250 metres depth and an estimated 20 million tonnes to 650 metres depth. The underground sampling program will recover and process 3000 tonnes of kimberlite to obtain over 10,000 carats for detailed value analysis.

- Initial production will be at 9,000 t/d of kimberlite, rising to 18,000 t/d after nine years of production;

- The kimberlite pipes will be developed in a phased approach over 25 years, using a combination of conventional open pit and underground mining. One central processing unit will serve all pipes.

- Annual value of production could be in the range of \$350 million.

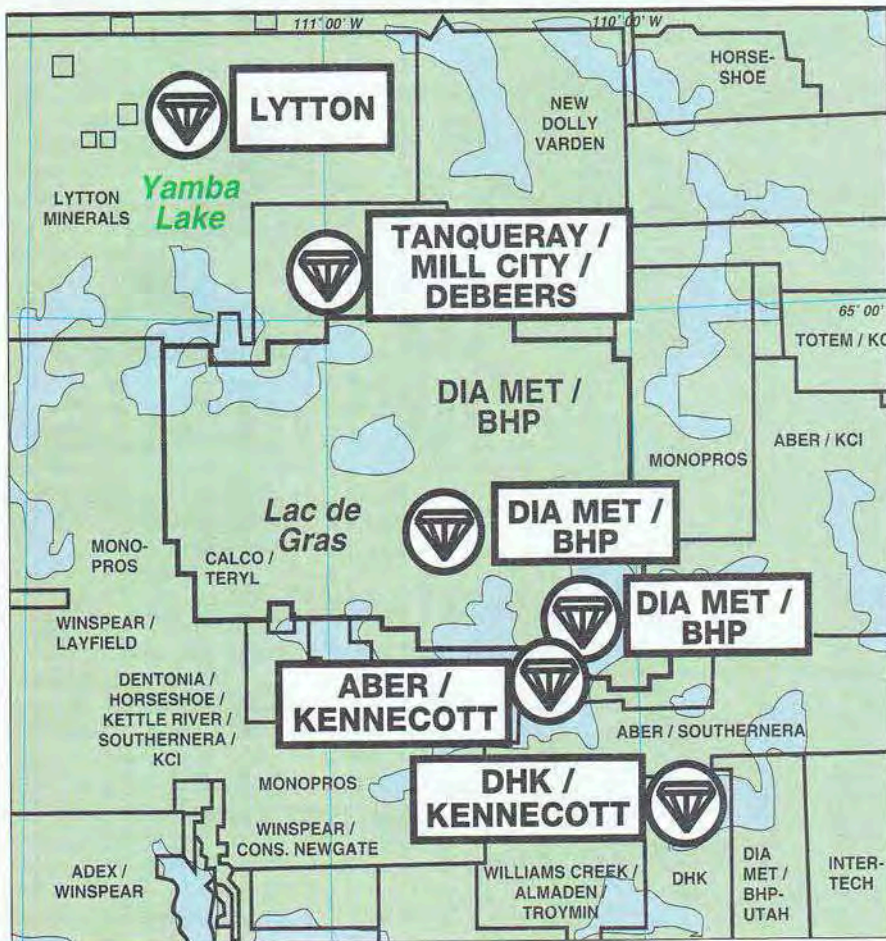
- The mine would be built at a cost of \$C500 million with a 1,000-strong construction work force; production would be maintained by 650 employees working on a two week rotation from Yellowknife and other nearby communities.

The mining proposal has been referred by government to the Federal Environmental Assessment Review Process (EARP), which in late 1994 elected a four-member panel to conduct public hearings on the project.

Given that diamond mines do not use chemicals to process ore, and taking into account the need for development in the NWT, many people believe the review process should be relatively simple and speedy.

More diamond success waiting?

Successful diamond exploration has not been confined to the BHP/Dia Met joint venture. Several other exploration companies are having success finding diamond-



BHP has discovered enough of these diamonds to propose mining five kimberlite pipes

bearing kimberlites. With the total number of known pipes in the Slave Province exceeding 150, the odds are improving that more than one mine may emerge.

In mid-1994, the Aber/Kennecott joint venture recorded a 1.76 ct diamond in drill core from the A-154S pipe from a 56.5 t mini-bulk sample taken earlier this year. Delineation drilling and bulk sampling has produced a drill-indicated resource of 8.4 Mt grading 4.5 ct/t to a depth of 220 m; projected to a depth of 650 m, the pipe could contain a resource of 20 Mt. In July, a programme comprising sampling of 3,000 t from underground and a deep drilling programme was begun to determine grade and tonnage at depth. Two other pipes within 1 km of A-154S are also being considered for underground bulk sampling by the operator, Kennecott Canada (60%).

Lytton is the largest independent player in the Lac de Gras in terms of exploration budget and is by far the largest land holder (owning and controlling 5.1 million ha, one-third of the Slave Province). Lytton owns 100% of the mineral rights in over 0.5 million ha, and controls the remainder either through 50% ownership or through joint venture

arrangements. Since the initial discovery of a diamondiferous kimberlite pipe at the Ranch Lake site, the company has undertaken an extensive and ambitious exploration programme in association with its other partners. Five target areas have

been identified that warrant drilling including another pipe in its ICE-Ranch prospect area. A semi-bulk sample test on the Ranch Lake pipe yielded a significant number of gem quality stones, and a larger bulk test is anticipated.



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Two kimberlite pipes were discovered in 1995 in the properties held in joint venture with New Indigo Resources. Numerous other trains of kimberlite indicator minerals have been identified across this area suggesting that these pipes are only two of a cluster. Drilling of a series of other targets in the area surrounding these discoveries is planned during 1995, along with further delineation of the discoveries themselves.

Lytton also holds 47% interests in Glenmore Highlands Inc., which in February 1995, with partners Mountain Province Mining and Camphor Ventures, located a diamond-bearing pipe on the AK property. This is approximately 100 km southeast of Lac de Gras. Initial results from a small sample are more than encouraging and are reminiscent of early success by BHP/Dia Met. The pipe has since been drilled, with preliminary analysis of the drill core yielding the most prolific diamond results of any pipe yet discovered in the NWT. Drilling continues on the pipe and surrounding area and a bulk sample is planned.

De Beers, primarily through its Canadian subsidiary, Monopros Ltd, has formed joint ventures with junior explorers including SouthernEra/Noble Peak, Gerle Gold, Slave Diamond Syndicate and Tanqueray/Mill City.

Australian major, Ashton Mining, has found several diamondiferous pipes at Cross Lake southwest of Lac de Gras.

Anomalous concentrations of diamonds have also been found at Dubawnt and at Parker Lakes, many hundreds of kilometres to the east, in the Archaean Hearne Province.

GOLD

While recent exploration activity for diamonds has surged ahead, gold continues to anchor northern exploration. World class occurrences like the Yellowknife shear zone-hosted gold deposit and the Lupin iron formation-

hosted gold deposits continue to confirm that the Archean rocks of the NWT are 'elephant country'. As a result, nearly all of the gold exploration today is focused on the Slave and Hearne Provinces.

Based on the size and grade of current and past gold producers, basaltic volcanic belts and sediment-hosted iron formations, such as at Lupin mine, are the most favourable exploration targets.

BHP Minerals, a company that made a long term commitment to the NWT in 1985, has been successfully finding gold deposits in the North Slave Province. Although its first find, the ULU deposit, proved to be a small ore body, its most recent discovery, Boston, is receiving considerable company attention and an underground sampling programme is being considered.

Consolidated Ramrod and partners Athabaska Gold and Gitennes Resources, have been diamond drilling their Damoti Lake property, 150 km north of Yellowknife. Wide, high-grade intersections from a Lupin mine-type iron formation have prompted the company to mount an aggressive exploration programme, including geophysical surveys and drilling. Gitennes is also meeting with some success from drilling its own iron formations in the same area.

In the Hearne Province, gold is also being found in iron-formations. The Comaplex-Comstate joint venture has been having the most success to date, at both the Meliadine and Meadowbank projects.

The Meliadine Project is favourably located on the coast of Hudson Bay, only 24 km from the jet-serviced community of Rankin Inlet. Gold is anomalous throughout the 64 km long auriferous belt. To date, 740,000 t of the orebody, grading 31 g/t gold, has been drilled at the Discovery deposit the depth of which has not been determined. In mid-1995, the joint venture optioned the western half of the property to WMC



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SouthernEra Resources Limited

International (subsidiary of Western Mining of Australia). More exploration is planned by both companies.

The Meadowbank project is located 80 km north of the community of Baker Lake. The 1995 spring drill programme on Goose Island returned several high grade intersections, including 6.2 m at 24 g/t gold. Previous work on the Third Portage deposit identified a surface deposit of 575,000 t grading 24 g/t gold. Further exploration is planned.

Diamond exploration in the Slave province of the Northwest Territories

Our Diamond Prospects Have Never Looked Brighter

Together with Monopros Limited, a wholly-owned diamond exploration subsidiary of De Beers, Gerle Gold has embarked on a \$650,000 diamond exploration program in the Slave Craton diamond region. The program will include drilling on properties in the Doyle Lake area where Gerle has interests.

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EXPLORATION

Glacial and stream sediment processing for diamond indicator minerals

Petrographic identification and description of kimberlite and lamproite

Microdiamond and indicator mineral extraction using attrition milling process

Microdiamond extraction using caustic dissolution process

BULK SAMPLE EVALUATION

Pilot plant bulk sample processing for macrodiamonds*

On-site pilot plant bulk sample processing*

Examination of concentrates and residues for diamonds and diamond indicators

Diamond measurements, stone size and grade estimation

Contact: Greg Davison or Russ Calow

* with Melis Engineering



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Cyprus Canada, in joint venture with Noble Peak Resources, explored two gold-bearing zones at the Southwin project; the Cache and Mac zones. At the Cache zone, the gold occurs in altered pyrite-bearing felsic volcanics, with preliminary reserves estimated at 0.36 Mt grading 9.26 g/t gold. At the Mac zone, mineralisation occurs in altered mafic volcanics with the best drill intersection being 9.26 g/t over 12.1 m.

GMD Resource Corp. is an active player in NWT's mining industry. Since its corporate reorganisation in mid-1994, the company has accumulated a number of diverse mineral properties, including:

- a joint venture partnership with New Discovery Mines to recover gold from the Discovery mine property, including the old operations, and the adjacent Ormsby ore zone.

- 100% ownership in various gold claims, such as the Lip and Ear properties, north of the Discovery mine, which produced over 435 t of gold in the past.

- several diamond property joint ventures.

- various copper, gold and cobalt claims located close to Fortune Mineral's NICO properties. GMD's interests include the 4.2 km² Treasure and 25.3 km² Island claims, as well as a joint venture with Fortune on the 41.6 km² JBG.

GMD has the option of acquiring a 60% interest in Fortune's JBG group of claims, located 3 km east of NICO in the same mineralised belt. Current exploration activity is in the form of airborne geophysical surveys, to be followed up by geological and geophysical surface programmes, which are expected to be completed by the end of the 1995 summer exploration season. The Discovery property should be in production by the end of 1997 with an operating cost of \$US225/oz.

BASE METALS

Base metal mining has been made possible due to the availability of transporta-

tion. Over the years, production has come from the Pine Point, Polaris and Nanisivik mines, all MVT deposits.

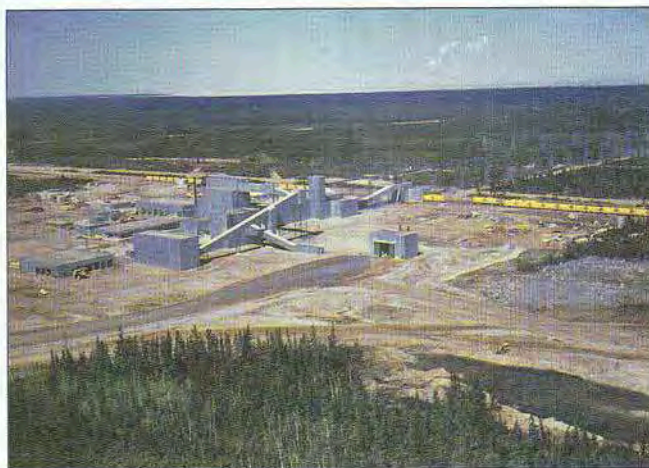
However, exploration in the northern Slave Province has identified several Archaean volcanogenic massive sulphide (VMS) deposits, although the remoteness of these deposits has impeded their development. Experience gained in operating the world's only ice-breaking ore-carrier to the Polaris and Nanisivik mines, complemented with new hydrographic surveys, is revealing that commercial marine shipping to and from the North Slave coast is viable. Already, Russian icebreakers routinely take tourists through the Northwest Passage. The implications of this are enormous for the long-term development of the region's base metal deposits.

The Izok deposit, discovered in 1974, is the largest known undeveloped zinc-copper deposit in North America. Located 90 km west of the Lupin mine, it is owned by Inmet (formerly Metall) Mining Corp. Exploration has revealed at least 18.5 Mt of polymetallic reserves, including the newly discovered Inukshuk deposit with grades of 14.6% zinc, 2.5% copper, 1.6% lead and 77.7 g/t silver. A 300 km all-weather road and port facility on the Coronation Gulf will need to be constructed if this deposit is to be developed and mined successfully. Clearing the financial hurdle of building this infrastructure is proving challenging.

Continental Pacific has been exploring the coastal areas for over six years and currently is the largest base metal claim holder in the north Slave region. The company has identified 21 potential polymetallic zones adjacent to the High Lake base metal deposit and recently announced that a significant discovery had been made.

While the Slave Province is receiving increased interest in VMS style deposits, Noranda and Rhonda Mining have made significant discoveries in the Bear Province, with the delineation of a new copper province south of the Coronation

Pine Point was a world class base metal deposit until production ended in 1989



Gulf coast. Noranda initially discovered a series of fault-hosted copper veins up to 100 m thick which cropped out at surface, the source of the mineralisation was then traced down to the stratabound sedimentary deposits with associated lead, zinc, gold and silver mineralisation.

Exploration on Victoria Island by Aber Resources, WMC International (a subsidiary of Western Mining), and Cominco for Noril'sk-type nickel-copper-PGMs in the Minto Inlier, a belt of Bear Province rocks that transect the island is looking promising.

Much further to the southwest in the Cordillera, San Andreas Resources is continuing to explore its Prairie Creek deposit. A complete mine and processing plant was built at Prairie Creek in 1982, but was never operated due to the silver market price crash. Since acquiring an option to the property in 1991, San Andreas has successfully delineated additional mineralisation including new discoveries of MVT mineralisation underlying the known vein mineralisation. The delineated resources in all zones are 6.2 Mt grading 12.82% zinc, 12.15% lead, 0.3% copper and 173,847 g/t silver. In late 1994, the company submitted a mining proposal to the government for approval.

One of the most promising new deposit discoveries is Fortune Minerals' NICO properties, located near Lou Lake 150 km northwest of Yellowknife, which have yielded significant results in all explo-

ration programmes conducted to date. The NICO properties have a combined area of over 65 km².

Both Fortune and the Geological Survey of Canada (GSC) have conducted airborne geophysical surveys over the area, which indicated gravity, magnetic and very strong potassium anomalies centred on the NICO claims. The potassium high was caused by extensive hydrothermal alteration, resulting in magnetite-rich copper, uranium and gold bearing veins and breccia fillings. Of particular interest is that the GSC has identified similar tectonic, geological and geophysical characteristics at NICO to those at the 2,000 Mt copper-gold Olympic Dam deposit in southwestern Australia.

Two main ore zones have been traced for 300 m and 150 m respectively before being obscured by overburden. A total of eight mineralised zones are known to exist, the other showings are currently under investigation. Preliminary chip samples have indicated the potential for combined metal values over \$US1,000/t.

Fortune has also staked three additional blocks of claims referred to as the JBG Group, which are located approximately 5 km northeast of the NICO Group. The JBG properties, owned by Fortune and joint venture partners GMD Resource Corp., have coincident potassium and aeromagnetic anomalies, and early exploration has indicated copper, gold and iron mineralisation.

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Minerals Administration

Aimed at attracting industry

The NWT is one of the two Canadian territories constituted by an Act of Parliament. It is administered by both the federal and territorial governments, with the native peoples groups effectively forming a third level of quasi-government. All three groups support mineral exploration and production.

In August 1988, the federal government published the 'Northern Political and Economic Framework' which outlined its policies on the NWT, giving the Territories the responsibility to promote economic development, to settle any remaining northern land claims and to enhance Canadian Arctic sovereignty.

As a whole, Canada has a legislative framework that has traditionally encouraged the exploration and development of mineral resources. Through geological surveys, the government has provided a high quality geoscience database in support of exploration.

In September 1993, the *Inter-governmental Working Group on the Mineral Industry* completed a study on taxation in Canada. From an income and mining taxation perspective, the NWT is one of the most attractive jurisdictions in the world. Tax rates at high and low profit levels are on a par with Chile and the U.S. and are more advantageous than comparable regimes in Australia, Brazil, Indonesia and Mexico. Part of the reason for this is the NWT's three year mining tax holiday and its graduated tax rate schedule. Given that the costs of mining are high in the remote NWT, the continuation of such an attractive taxation level will be an important factor in maintaining exploration and mining interest.

Favourable fiscal and non-fiscal incentives also encourage exploration in the

NWT. Two main fiscal incentives offered by the Canadian governments include 100% write-off of all pre-production exploration and development expenditures, and a flow-through share mechanism. The latter permits the transfer of deductions for exploration and development expenses to flow-through shares, government currently allowing a 100% deduction of eligible exploration expenditures against personal income.

In June 1993, the federal government announced an amendment to tax rules such that all diamond deposits now fall under the definition of a mineral resource. This means that more companies will now qualify for a Canadian

Exploration Expense, making exploration more financially attractive.

Both the territorial and federal governments realize that the minerals industry has the greatest potential of bringing significant long-term investment to the Territories. To date, they have maintained a positive policy framework, allowing the NWT to become more attractive to potential minerals investors and refuting a long-held assumption that more remote means less economic.

The rich mineral potential of the Izok base metal deposit and the Lac de Gras diamond fields has instigated substantial interest in expanding the transportation and hydroelectric infrastructure in the Slave Province. A recent joint industry/government consortium confirmed that commercial shipping to the Coronation Gulf area is possible for at least five months of the year. This has raised hopes that development of the

ROYALTY PROVISIONS UNDER THE CANADIAN MINING REGULATIONS

- Annual royalties are payable to the Canadian government on an individual mine if the value of output for a fiscal year exceeds \$C10,000. Royalties are calculated on a graduated basis as follows:
 - Value of output under \$C1 million, the rate is 3%
 - Value of output between \$C1 million and \$C5 million, the rate is 5%
 - For every increase of \$C5 million in the value of output above \$C5 million, the rate increases by 1% to a maximum of 12%.
- A royalty-free period of 36 months commencing with the date on which the mine commences production is allowed.
- In determining the 'value of output', as defined in the Canada Mining Regulations, various deductions are permitted, including:
 - Exploration and development costs at the mine, valid only for the year in which they were incurred; 100% deduction is permitted.
 - Off-site exploration, valid only for the year incurred; the lesser of the said costs or 10% of the total value of output, before mine deductions, for the year.
 - A pre-production allowance not exceeding 15% per year and 100% in the aggregate of all expenses incurred for prospecting and exploration and development of the mine prior to the date on which the mine commences production.
 - Depreciable assets: straight line depreciation not exceeding 15% per year and 100% in the aggregate. The rate determined by the operator.
 - A number of special allowances are available, particularly relating to treatment costs.

At present, the royalty regime of the NWT is undergoing a review, and, some changes are likely to be forthcoming. However, it is fully expected that on the basis of total tax burden, the Northwest Territories as a jurisdiction will remain competitive for investment in mineral exploration and mine development both within Canada and internationally.



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For information on federal mining legislation and the geology of the NWT, contact:

Indian and Northern Affairs Canada, at either
Ottawa, Ontario, Canada
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Yellowknife, NWT, Canada
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Canada

high-grade, but remote, base metal deposits of the northern Slave Province may finally be within reach. Representatives from industry and the territorial government have been pressing the federal government to support construction of a shipping port on the Coronation Gulf and an all-weather road into the region. In addition, one native group has commissioned construction of the first of two planned hydroelectric plants and they have expressed interest in servicing the power needs of new diamond mines.

Land Claims

Increased aboriginal participation

Land claim settlements have been moving forward very successfully in the NWT over the past four years, lending a greater sense of security of land tenure for mining companies. There are two distinct areas of these settlements, related to the different ancestry of the native residents.

In the High Northern and Eastern Arctic, the Inuit people ratified their land claim in mid-1993. As part of this process, the federal government has agreed to pursue the creation of a new territory - Nunavut - encompassing traditional Inuit lands. The settlement gives financial and

other participatory rights to the Inuit plus title to 350,000 km² of land, of which 36,000 km² includes mineral rights.

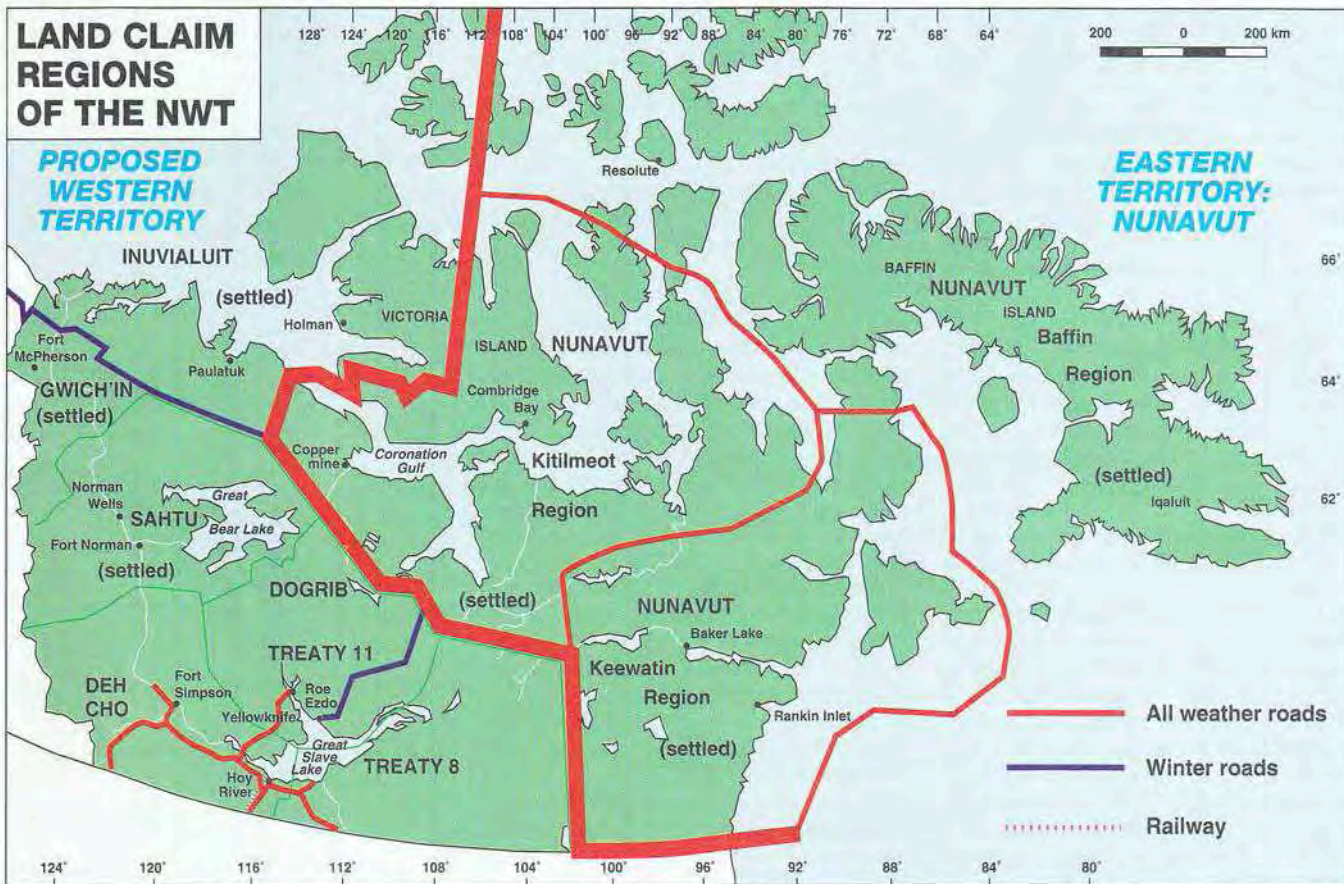
In the Western Arctic, meanwhile, land claim settlements have progressed more slowly. Following the 1990 demise of a comprehensive land claim agreement involving several native groups, individual groups have been pursuing their own regional land claims. The first of these was ratified in late 1992 between the federal government and the Gwich'in people, resulting in the transfer of some 22,400 km² in the NWT and 1,550 km² in the Yukon Territory, including subsurface rights and a share of resource royalties.

The Sahtu Dene and Metis peoples, southern neighbours of the Gwich'in, negotiated a similar land claim, resulting in the transfer of over 41,400 km² plus financial benefits. While the Dogrib people are in the process of negotiating a joint land claim/self-government package, the Dene and Metis of the South Slave and Deh Cho regions have rejected the concept of regional comprehensive claims. The South Slave Dene are pursuing the Treaty Land Entitlement process and planning to establish reserves similar to those in southern Canada. The Deh Cho Dene and Metis have presented a self-government proposal which is being reviewed in exploratory discussions with the government.



An Inuit youngster in traditional attire during the Rankin Inlet spring festival

In essence, the content of each of the territorial land claims is similar, with native groups receiving a combination of surface lands, subsurface rights, cash and the right to participate in the management and regulation of surface rights, wildlife, land and water use, as well as environmental impact reviews.



From a minerals industry perspective, benefit agreements are a notable feature of land claims, requiring developers to show how their projects will involve and benefit native groups. When combined with clarification of title and guaranteed participation in resource management and development, they have encouraged many native peoples to support mining development.

Doing Business

Services and information

The NWT is a large jurisdiction and is sparsely populated. Although the working language is English, most small communities use various aboriginal languages. Companies interested in obtaining further information on the NWT mineral industry and on working or investing in the NWT should contact the northern mining industry's representative, the NWT Chamber of Mines. Formed in 1967 the NWT Chamber of Mines provides a voice for the region's mining operations, exploration companies, and prospectors, and serves as a centre of contact for the northern mining industry. Representatives from the federal and Territorial governments can also provide valuable insights and information.

Today, the aboriginal people have considerable influence on the success of a project. On aboriginal-owned subsurface lands, they have direct control; on Crownlands, they share control with the government. It is, therefore, essential that companies communicate with the appropriate land claimant groups. Contact details for some of the groups are provided in this supplement, however the Chamber of Mines can provide additional contacts.

Yellowknife has a long history of mining and exploration and is the major jumping-off point for exploration programme. Considerable support is available in services ranging from transportation, diamond drilling, geophysical and geological consulting services.

Since the all-weather road network is limited, alternate transportation must be used for moving bulk materials to remote locations.

- Ice roads and overland winter freight hauling is common in the north and can be quite cost effective. Expertise is available in most larger centres, especially Yellowknife, as well as in some smaller communities, for example Baker Lake.

- Marine transportation is available in two forms: shallow draft for Mackenzie River, Arctic Coast and Hudson Bay transport; deep water transport to the eastern and high Arctic.

- A number of air carriers, with capabilities ranging from single engine to jet aircraft, are available in the NWT.

NWT is an Arctic and sub-Arctic region with short daylight hours in winter and long daylight hours allowing around the clock work in summer. Temperatures are also quite extreme and need to be taken into account when planning an exploration programme. Local suppliers, contractors and expeditors have the experience to supply appropriate services, camps, equipment and materials to work successfully in the area. The NWT Chamber of Mines can provide more information on these companies.

CANMET, the Canada Centre for Mineral and Energy Technology is the main research and technology development arm of Natural Resources Canada. It is the only organisation of its kind serving the resource sector in Canada. In partnership with its clients, CANMET performs and sponsors predominantly commercial and cost-sharing research and development, and technology transfer, with the following objectives:

- to enhance the competitiveness of Canadian minerals, metals and energy industries;
- to improve and develop energy efficiency and alternative energy technologies;
- to improve health, safety and environmental control in the mining industry; and
- to support government policy initiatives.

One such successful CANMET project involved the development of a strategy now being used at the Nanisivik mine to safely recover more than 600,000 t of ore from pillars. By the beginning of 1995, 40 of the 300 pillars had been successfully mined.

The Geological Survey of Canada (GSC) supplies fundamental geoscientific information and support to companies involved in mineral exploration and development. It has extensive capabilities in both onshore and offshore surveys, and in interpreting and managing geo-data. The GSC's expertise is also applied to mineral and energy resource assessments, natural hazards, environmental issues and the development of exploration technology.

Recent work in the NWT includes: the production of a bedrock map of the Archaean rocks to a scale of 1:1,000,000, which is also available on CD-ROM; the production of a comprehensive geological and geophysical atlas of the 'Mackenzie Corridor' compiled by the GSC and NWT Department of Energy, Mines and Petroleum Resources; and an inventory of landslides over 420,000 km² in the Mackenzie Valley area, which will be used to aid the design and routes of new

northern pipelines, roads and infrastructure.

GSC's National Geoscience Mapping Program (NATMAP) was developed in 1991 to assist mapping projects in the country. In the NWT, the Slave NATMAP project is designed to understand further the geological evolution and mineral potential of the Slave Province. GSC's partners in this project include the NWT Geology Division of the Department of Indian and Northern Affairs, the Canadian-NWT Minerals Initiatives Office of the territorial government and several universities. The project has provided important details of major tectonic boundaries and lithologies, and their implications with regard to mineralogy.

SOURCES OF INFORMATION

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presently underway. All kimberlite targets
identified will be scheduled
for drilling early September.

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DID YOU KNOW?



- We represent over 200 members actively engaged in the exploration for and extraction of mineral resources in the NWT or who are dependent on this activity for all or part of their earnings.
- We maintain effective communications with all levels of government and special interest groups on relevant matters.
- Operating from our office in Yellowknife, we maintain continuous communications with members all across Canada. Our newsletter and annual magazine provides members with up to date and relevant information.
- We effectively express the viewpoint of our industry at all levels of the decision-making process of our society.
- We are the most informed industry organization on issues of interest respecting the Northwest Territories.
- Our membership includes Service and Supply companies, Consulting Firms, Prospectors, Surveyors and Individuals from all walks of life, as well as National and Multi-National Firms engaged in mineral production and exploration.
- We actively pursue matters of importance to our members with vigor at every opportunity.
- We encourage and promote our industry whenever and however possible.

If your curiosity is aroused, or you think we might be of service, please contact us. We will be pleased to talk to you. Chances are we are already being of assistance and you are not aware of it.

Write, phone or fax
Tom Hoefer, General Manager

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