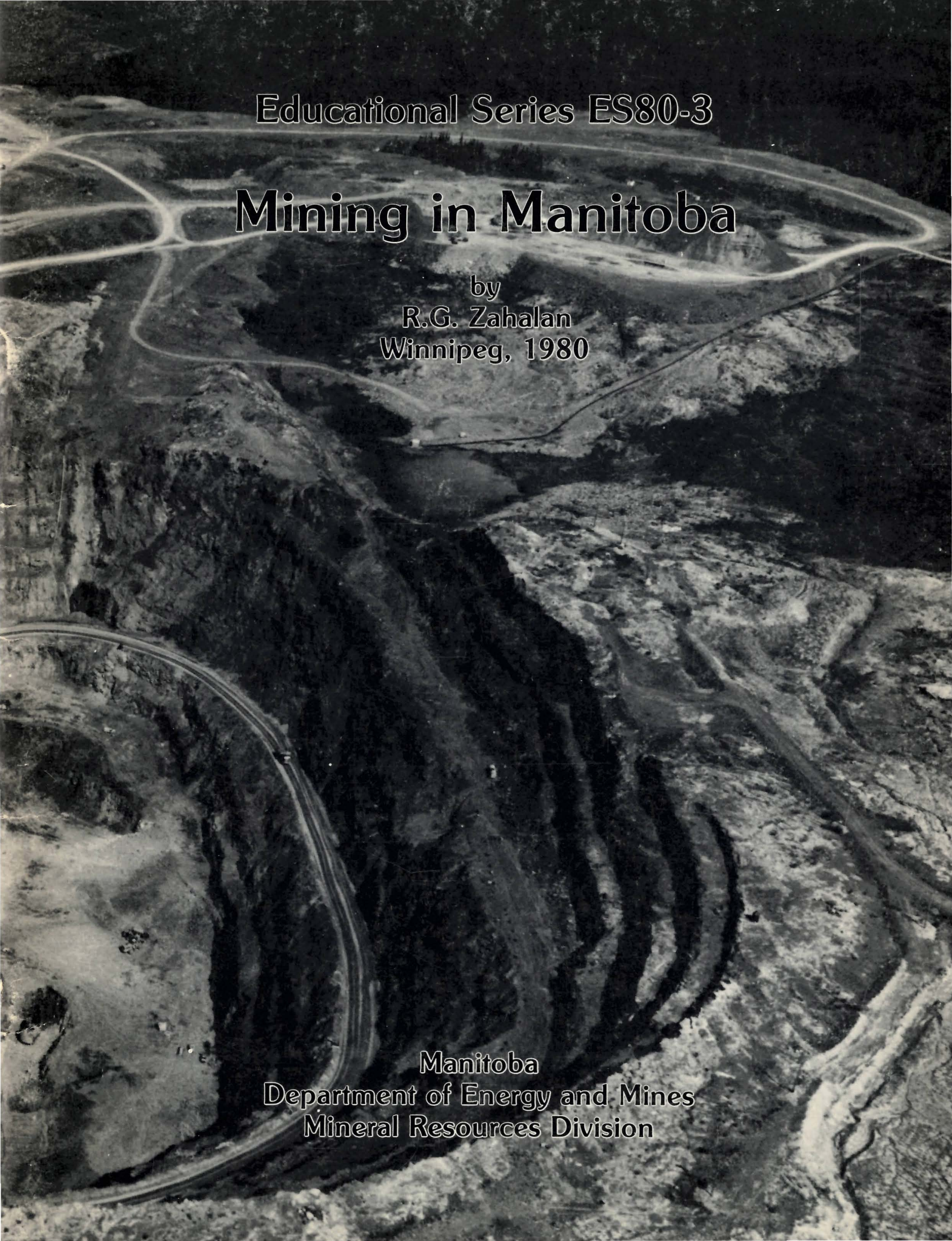

Educational Series ES80-3

Mining in Manitoba

by
R.G. Zahalan

Winnipeg, 1980

Manitoba
Department of Energy and Mines
Mineral Resources Division

ACKNOWLEDGEMENTS

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PHOTOGRAPH CREDITS

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Hudson Bay Mining and Smelting Co., Limited (HBMS)
Inco Metals Company (INCO)
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Manitoba Department of Economic Development (MED)
Mineral Resources Division, Mining Engineering and Inspection Section, Manitoba (MRD)
Royal Canadian Air Force (RCAF)
Canadian Occidental Petroleum Ltd. (COP)

METRIC CONVERSION

The following factors (approximated to three decimal places) have been used in the conversion of standard (Imperial) measurements to the metric system; for the reader's convenience gold and silver are reported in ounces as this measure is still used on a widespread basis throughout North America.

Imperial Unit		S1 Equivalent	S1 Unit
1 foot	=	0.305 **m**	metre
1 mile	=	1.609 **km**	kilometre
1 pound (avoirdupois)	=	0.454 **kg**	kilogram
1 ton (short)	=	0.907 **t**	tonne
1 ounce (troy)	=	0.031 **kg**	kilogram
1 troy ounce/short ton	=	34.286 **ppm.** or **g/t**	parts per million grams per tonne

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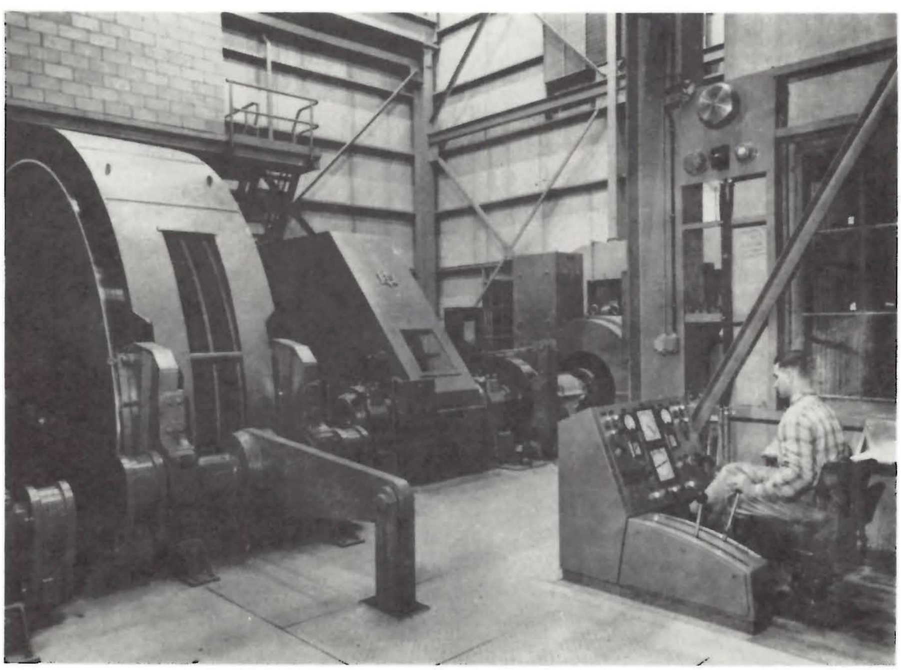
The Early Pioneer (MRD).



The Present Day Producer (INCO).

PREFACE

The following pages provide an overview of the history of mining in Manitoba. Since this is a "bare bones" account of the Province's former and current producers it is not to be taken as the sum total of mining activity within the Province's boundaries. The story of those mines which did not become producers is not told here although it is an inseparable part of the record wherever men search for and bring mines into production. The story of mining in Manitoba, as in the rest of Canada, is that of a people who not only searched for, found, and built mines in that part of the country which experts of yesteryear had written off, but who also developed a fledgling mining industry which today ranks among the world leaders — all within the space of three generations. It involves prospectors, without whom mines would not be found; financiers, without whom mines would not be born; miners and managers, without whom the ore would not come out of the ground. It is a story of self reliance, courage, perseverance and hardiness of a people who were not deterred by the physical obstacles which the inhospitable land of impenetrable forests, lakes, and swamps pitted against their efforts to find and operate mines, and who were not dismayed to live normal lives in isolated communities and accept them as home.

The saga of the founding of Canada's mining industry is Canada's own. The people involved were Canadians by birth and others who were Canadians by choice. Even the initial financing which led the way to the mineral storehouse was Canadian. The problems encountered and their solution were typical only of Canada and Canadians. Thus, it can be claimed with some justification and pride that if Canada needed a national identity the mining community could serve the purpose.

On the prosaic side, mention should be made of the benefits which the mining industry bestowed upon the country. Some of these are outlined in the following paragraphs.

Geographically, mining "opened up the North country." Wherever mines were developed, communities sprang up. Historically, these communities were built and maintained by the mining companies to house their employees and families. From modest beginnings as small isolated islands in the northern bush, some of these communities have grown to modern cities and towns with all of the facilities and amenities of their counterparts in the southern part of the country. Flin Flon, Thompson, Lynn Lake, and Leaf Rapids are Manitoba's examples of this facet of the Canadian mining scene. And let it be noted that it is the mining industry that provides the lifeblood of these communities. The establishment of these mining centers has brought with it the building of highways, railroads, and airports to service them, thus further "opening up the North" to more exploration and potential realization of the wealth of its natural resources. Thus, geographically, the overall effect has been to lay the foundation for the eventual inhabiting of the country from the American border to the shores of the Arctic Ocean.

With respect to the economic aspect, mining is a major revenue producer both in terms of the national economic base and in providing employment. In the latter regard, the accruing benefits are not confined to the mining communities alone. Cities and towns where mining material and equipment are manufactured also benefit, as do those where distribution depots and sales offices are located. An appreciation of the multiplier effect of mining in this regard may be gained by listing some of the material and equipment used by mines, e.g., drilling and ancillary equipment, ore loading and hauling equipment, hoists, wire rope cables, electrical and electronic equipment, sheet metal and structural steel products, milling and smelting machinery and equipment, fuels, precision tools and instruments, explosives, chemicals, forestry products, office supplies — the list is endless.

The statistics for the past three years, as set forth below, will serve to illustrate the importance of the Canadian mining industry to the national economy in terms of employment and dollar value of mineral production.

According to an article appearing in the December 30, 1978 issue of the Financial Post, the Canadian non-fuel mining industry employs about 85 000 people directly and, through the "ripple effect," provides more than 285 000 direct and indirect jobs. The same article places the value of Canadian mining production at $8 billion for 1977.

Preliminary statistics published by the Mining Association of Canada places the value of Canadian mineral production in 1978 at $9.2 billion, exclusive of petroleum and natural gas. The latter two categories accounted for $10.5 billion, bringing the total value of the country's mineral production to $19.7 billion in 1978. In terms of employment, the Canadian mining industry during the same year employed approximately 120 000 people directly in mining and processing operations, and in non-ferrous smelting and refining.

Preliminary figures for 1979, as published by Energy, Mines and Resources Canada, show that of the total value of mineral production for the year the non-fuel minerals sector accounted for $11.5 billion and the fuels sector $14.5 billion, yielding a total value of $26.0 billion.

The Manitoba mining industry's employment figures and value of production for 1979 were 7 700 employees and $586.6 million,* respectively.

In the world of international commerce, Canada ranks among the major suppliers of mineral products, and is the leading supplier of some, principally nickel and asbestos. In size, Canadian non-fuel mineral production ranks third in the world, after that of the United States and the Soviet Union. It should be mentioned here that Manitoba is a world leader in its own right in that the world's largest known deposit of tantalum ore is mined within its boundaries. And, of course, Thompson is the country's "Nickel Center Number Two."

Although various sections of the text are presented under the headings of minerals and metals mined, the author wishes to emphasize that minerals and metals are not the subject of the text per se. They are dealt with individually in papers, brochures and treatises which are available from the Mineral Resources Division of the Manitoba Department of Energy and Mines. In short, this is a history of the Province's mines, categorized according to product.

In conclusion, if what follows does not appear to do justice to any or all of the subjects only hinted at in the foregoing, the fault lies in the lack of a talent in the telling and not in a lack of appreciation.

R.G. Zahalan,
March 1981

*Preliminary Estimates for 1979, Province of Manitoba, Department of Energy and Mines.

Photo 1.
Dog Sled and Snowshoes — Winter, (ca. 1928) (MRD).

Photo 2.
Portaging — Summer, (ca. 1928) (MRD).

Photo 3.
Diamond Drilling on Land (MRD).

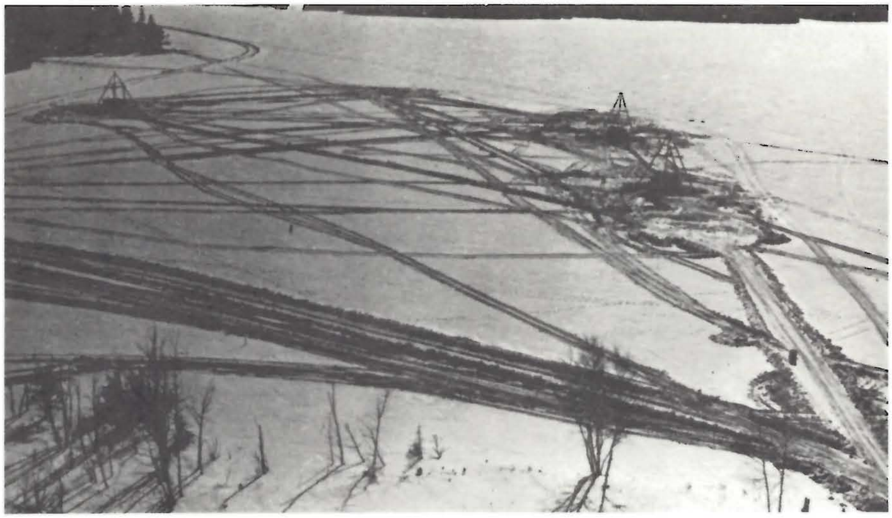
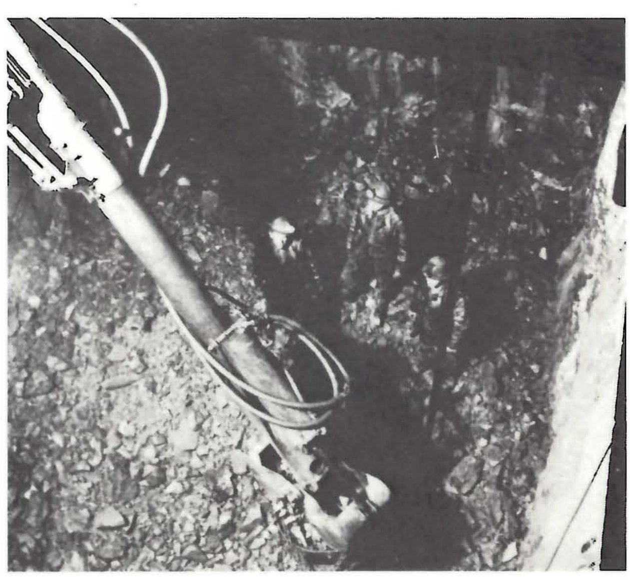


Photo 4.
Three Diamond Drill Set-Ups on the Ice of a Northern Lake; the most common method of searching for ore beneath a lake (MRD).

Shaft Sinking

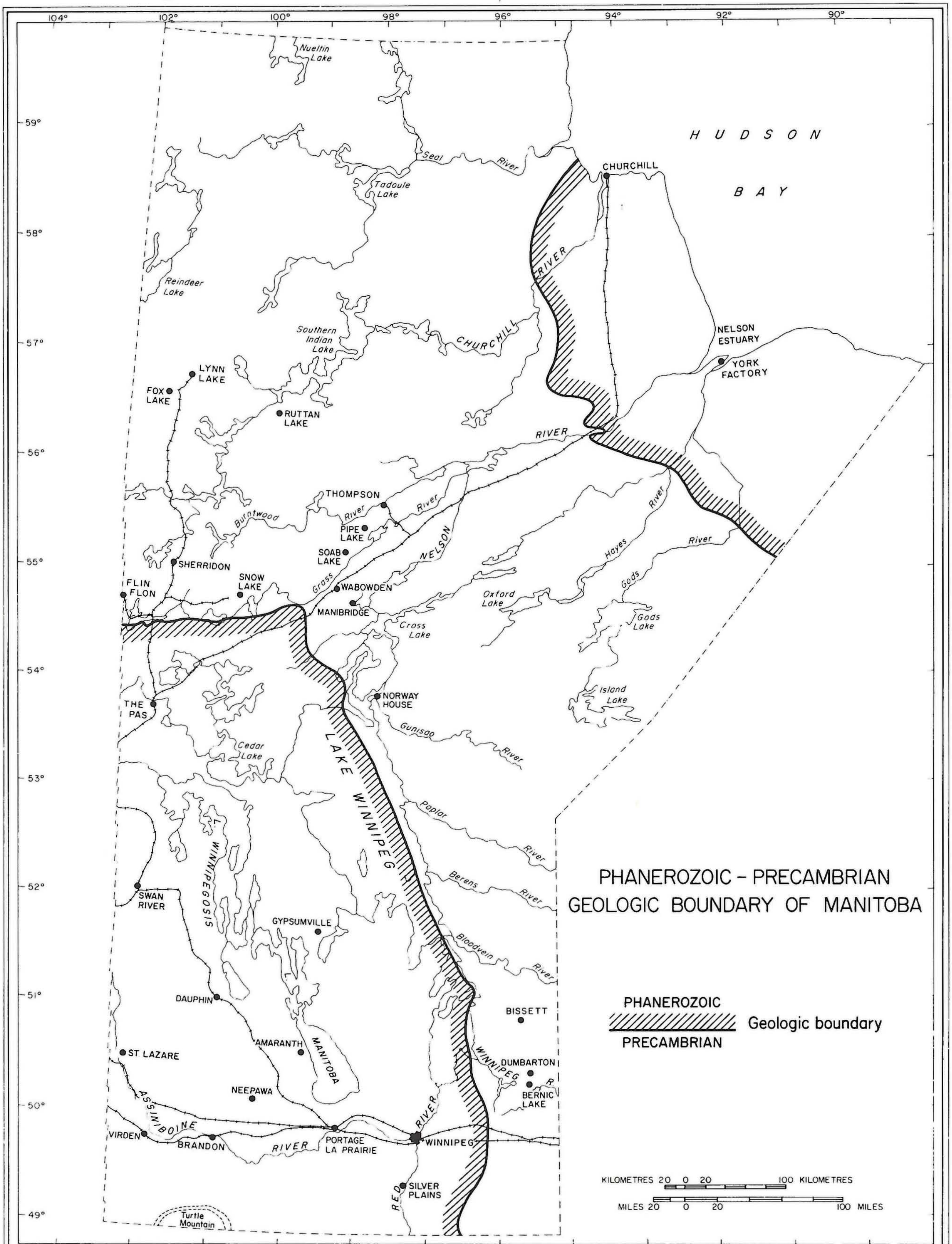
Photo 5.
Drilling the Round — After all the holes have been drilled, they are loaded with explosives and blasted, breaking the rock and deepening the shaft (MRD).



Shaft Sinking

Photo 6.
Mucking the Round — After the Blast. The photo shows a bucket (lower center) being loaded by a mechanical loader for hoisting to surface (MRD).

Figure 1. Manitoba's Precambrian Basement and the younger Phanerozoic cover rocks.



MINING IN MANITOBA

GENERAL GEOLOGY OF MANITOBA

The Province of Manitoba covers an area of 652 000 sq. km, of which approximately 386 800 are underlain by Precambrian rock formations and 265 200 by younger rocks of Phanerozoic age (see Fig. 1). The Precambrian bisects the Province in a northwest-southeast direction, splitting the Phanerozoic into the southwest prairie region (197 600 sq. km) and the Hudson Bay Lowlands (67 600 sq. km).

To date, the Precambrian region has been the source of the Province's metallic minerals, whereas the Phanerozoic southwest prairie region has been the main source of industrial minerals and fuels. The Hudson Bay Lowlands have not yet been explored to any appreciable degree due to a combination of remoteness from markets, and the ready availability of the southwest's proven vast resources.

HISTORICAL DEVELOPMENT OF THE MINING INDUSTRY

INDUSTRIAL MINERALS

SALT

The earliest recorded mining activity in the Province was the production of SALT by the men of the Hudsons' Bay Company and Northwest Company in the early 1800's, to supply the Red River settlement and trading posts such as Norway House. Salt was obtained by boiling water from brine springs found on the west side of Lake Manitoba and Lake Winnipegosis. From this beginning, an industry developed which produced 1,000 bushels of salt per year until 1874. After that year, the industry died out when better quality salt could be brought in by rail from other sources. A large-scale revival of the industry began in 1932, when the Canadian Salt Company Limited began producing salt by the vacuum pan evaporation process at Neepawa using brine pumped from wells. Annual production ranged from 18 000 to 22 500 tonnes. This plant closed down in 1970. In 1968, Dryden Chemicals Limited began processing salt 6.5 km east of Brandon. Hydrochloric acid, liquid chlorine, caustic soda, soda ash, and crystal sodium chlorate were produced from brines pumped from two wells approximately 690 m deep. In 1974, Canadian Occidental Petroleum Ltd. purchased the plant from Dryden Chemicals and continued operations under the name of Hooker Chemicals Canada Ltd. In May 1978, the wells were abandoned. Since that time, operations have been restricted to the production of sodium chlorate, from raw materials obtained elsewhere.

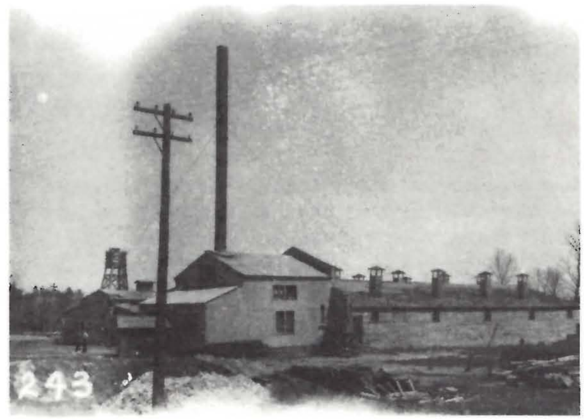


Photo 7. Neepawa Salt Works, Neepawa Area, Neepawa Salt Company, (ca. 1932) (MRD).

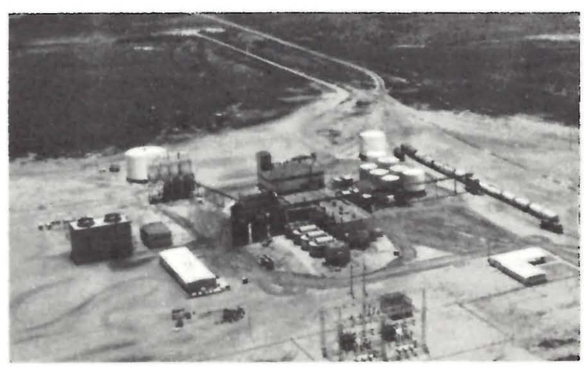


Photo 8. Salt Producer — Canadian Occidental Petroleum Ltd., Hooker Chemical Division, Brandon, 1979 (COP).

LIMESTONE

The LIMESTONE mining industry had its beginnings during the early days of the Red River settlements. In contrast to salt production, mining of limestone once begun has continued uninterrupted and, now, holds a significant place in the Province's industrial minerals sector. High quality building stone was readily available for the Red River settlements. The first recorded use of the now well-known Tyndall Stone (a mottled dolomitic limestone) was in 1832, when it was used to build Lower Fort Garry. Many buildings in Winnipeg and across Canada are faced with Tyndall Stone. The oldest church in the west at St. Andrews near Winnipeg, the Provincial Legislative Building in Winnipeg, and the Parliament Buildings in Ottawa are but a few examples.

Although limestone deposits occur throughout the southwestern prairie region, limestone mining operations for the most part are concentrated in the vicinity of Winnipeg, the principal market. Tyndall Stone is quarried at Garson. The more common calcium variety is quarried in the vicinity of Lily Bay, Steep Rock, Faulkner and Mafeking. The magnesian variety, dolomite, first quarried about 1850 at Little Mountain, today is quarried on a larger scale in the Stony

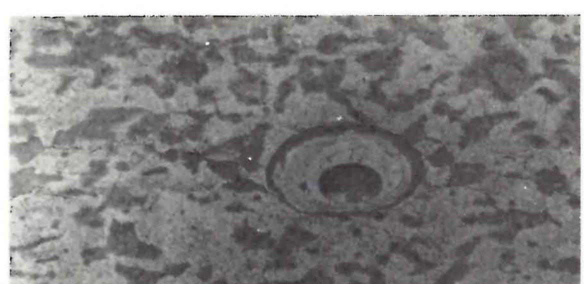


Photo 9. Tyndall Stone — A clearly defined fossil form may be seen in the center of the photo (MRD).

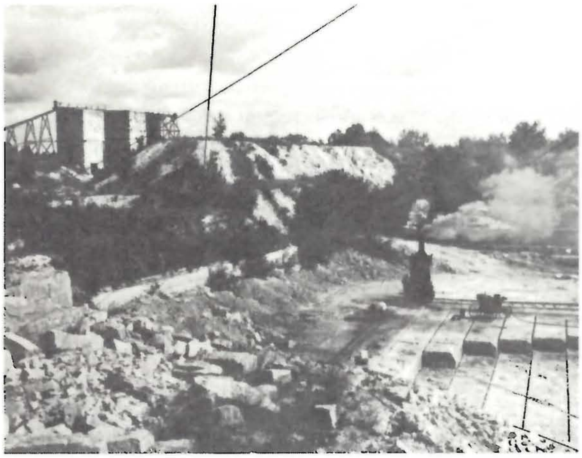


Photo 10. A study in the evolution of limestone quarrying: The Old — cutting channels by steam operated chisel-tipped hammer (MED).

Mountain-Stonewall area. Quarrying activity elsewhere is dependent principally on highway construction and maintenance and is characteristically of an intermittent nature. The main rock type used is DOLOMITE. As an example, in recent years dolomite quarrying on a modest scale took place in the Interlake Region while Highway No. 6 was being extended northward to join Highway No. 391. With completion of this project, dolomite quarrying activity all but ceased in this region.

Limestone, both in the form of Tyndall Stone and the "high calcium" variety, as well as dolomite, find their major application in the construction industry. The former is used exclusively as a building stone, highly prized for the decorative value of its distinct mottled appearance and the recognizable fossil forms it displays. Aside from its functional qualities, this is its marketable characteristic and, for this reason, Tyndall Stone is used only in its natural state, just as it comes out of the quarry. In contrast, "high calcium" limestone and dolomite are used for a variety of purposes. In the natural state, the most common use of dolomite is as a road surfacing material. "High calcium" limestone is used both in the manufacture of cement and, in its processed form, to produce lime for the chemical, metallurgical, and pulp and paper industries. Dolomite is either crushed for aggregate or burned for lime.

Photo 11. Moosehorn Lime Company Kilns at Spearhill, Moose Horn (ca. 1914) (MRD).

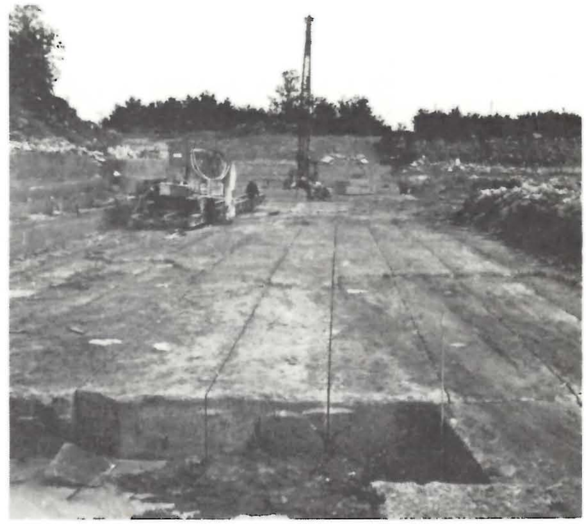


Photo 12. A study in the evolution of limestone quarrying: The New — cutting channels by electrically operated tungsten carbide-toothed circular saw (MRD).

Photo 13. Quarrying Limestone at Steep Rock, 1925; Canada Cement Co. (now Canada Cement Lafarge Limited) (MRD).

Photo 14. Limestone Kilns at Spearhill (ca. 1940), The Winnipeg Supply and Fuel Company Limited (MRD).

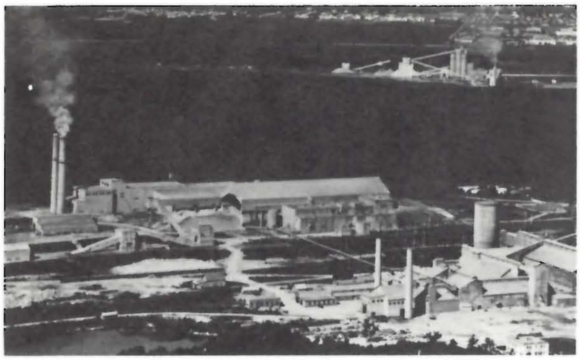


Photo 15. Cement Manufacturing Plants at Fort Whyte. Foreground to background: Canada Cement Lafarge Limited; Inland Cement Industries Limited, City of Winnipeg (MED).

CEMENT

The history of the CEMENT industry in Manitoba dates from the turn of the century when the first mill was erected at Arnold, 112 km southwest of Winnipeg, for the manufacture of natural cement. Another natural cement plant was established at Babcock, west of Roseisle. However, both of these plants closed down well before World War II. The first portland cement plant was erected in 1911 at Fort Whyte, a few kilometres southwest of Winnipeg. The Province's cement production currently comes from two companies: Canada Cement Lafarge Limited and Inland Cement Industries Limited. Both have their cement producing plants at Fort Whyte. According to the most recent available data*, a total of 688 500 tonnes of cement valued at $38.7 million, were produced in 1979. Adding to this the dollar value of limestone production for the same year ($9.9 million) brings to $48.6 million the total value of the limestone and cement industries' production. This represents 54% of the estimated total value of the Province's industrial mineral production for 1979 ($90.5 million).

Photo 16. Clay Pit — Snyder's Brick Plant, Portage La Prairie, 1925 (MRD).

CLAY

CLAY deposits in the Province were much used for making common bricks in the early days. In 1886, when the first Canadian transcontinental train passed through Winnipeg, there were four brick plants in Manitoba. By 1910, this number had increased to twenty-six. However, brick production soon declined from this peak. Locally produced bricks became a rarity until 1970, when a large face-brick plant was opened in the Winnipeg area at Lockport, by the Medicine Hat Brick and Tile Company. This company is currently named Red River Brick & Tile, a division of IXL Industries Ltd. The clay is obtained from the Company's pits in the Ste. Rose du Lac and Pembina Mountain areas.

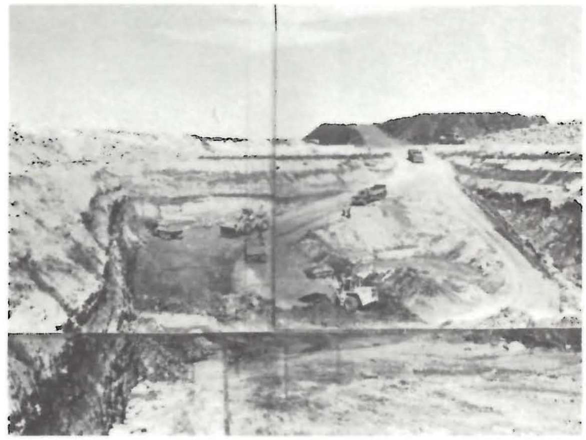


Photo 17. Clay Pit — Red River Brick & Tile, Ste. Rose du Lac (MRD).

BENTONITE clay, the non-swelling variety, is mined by the Pembina Mountain Clays Limited, and is processed in the Company's plants in Morden and Winnipeg. The pits from which this clay is mined are the only sources in Canada yielding commercial production of non-swelling bentonite. Production has been continuous since the late 1930's. The main market for this type of bentonite is the chemical industry where it is used in the clarification of vegetable and mineral oils.

The Province's clays are also used as road building material and in lightweight aggregates.

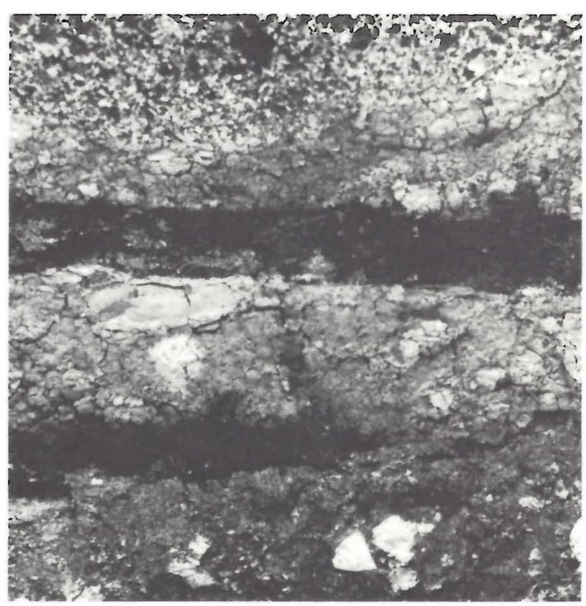


Photo 18. Bentonite Seam (light coloured), Morden Area (MRD).

* Preliminary Estimates for 1979, Province of Manitoba, Department of Energy and Mines.

Photo 19. Mining a Bentonite Seam, Pembina Mountain Clays Limited, Morden Area. Today, the workmen would be wearing hard hats and the tractor would be equipped with a roll-over protective structure (MRD).

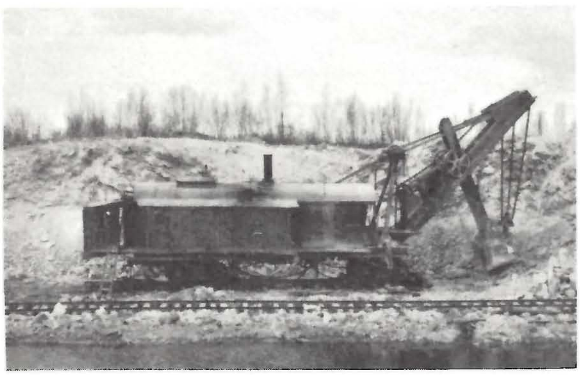


Photo 20. Quarrying Gypsum at Gypsumville, Manitoba Gypsum Company (ca. 1927) (MRD).

GYPSUM

GYPSUM was first reported in 1889 when the Western Plaster Company Limited (currently Domtar Inc.) was incorporated to operate in the Interlake area. In the late 1890's, deposits north of Lake St. Martin were mined. A calcined product was produced and shipped by water transport from Old Gypsumville (Davis Point) on Lake Manitoba to Totogan (near Delta). From there, it was shipped by river to the railhead and thence by rail to Winnipeg. In 1910 the railway reached Gypsumville and up to 1979 gypsum was freighted solely by rail. Quarrying at Gypsumville is still being carried on by Domtar Inc., the product being trucked to Winnipeg.

Gypsum was also mined in the vicinity of Amaranth, 176 road km northwest of Winnipeg, and at Silver Plains, 38.4 road km south of Winnipeg on the west bank of the Red River. These were underground mining operations which are presently closed down. In the Amaranth area, Western Gypsum Products Limited (now Westroc Industries Limited) operated a mine from 1948 until 1964. In 1964, production commenced at the Company's mine at Silver Plains and the Amaranth mine was closed down. The Silver Plains mine produced gypsum until June 1975, when an uncontrollable inflow of water from an aquifer below the workings forced the closure and abandonment of the mine. During its life, gypsum from this mine was hauled by truck to the Company's processing plant in Winnipeg, while gypsum destined for other points was shipped by rail.

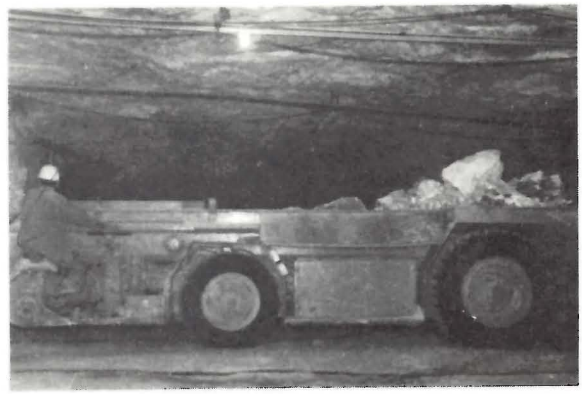


Photo 21. Shuttlecar Hauling Gypsum to the Crusher Station Westroc Industries Limited (MRD).

Photo 22. Crusher Station. The crusher discharges onto a conveyor belt, which transports the crushed gypsum to bins on surface, Westroc Industries Limited (MRD).

Photo 23. Quarrying Gypsum at Harcus, Western Gypsum (1978) Limited. Drilling the Bench.

The Amaranth area was again the scene of gypsum mining when B.A.C.M. Limited commenced underground mining in 1966 on ground adjoining Western Gypsum's dormant operation. The B.A.C.M. mine closed down in 1970 reportedly on account of high freight rates. The property is maintained in good standing under the name of Truroc Gypsum Products Ltd.

All three of the underground operations previously mentioned employed the room-and-pillar method of mining.

Westroc Industries Limited returned to the Amaranth area in 1977 when the Company commenced development of a gypsum deposit in the vicinity of Harcus. Quarrying operations commenced on a production basis on July 7, 1978, at an annual production rate of 90 000 tonnes. The gypsum is trucked to the Company's plant in Winnipeg for processing. This operation is carried out under the name of Western Gypsum (1978) Limited.

Gypsum production figures available for 1979 are 126 900 tonnes produced, valued at $963 000.*

* Preliminary estimate for 1979 production, Province of Manitoba, Department of Energy and Mines.

Photo 24. Mucking the Blast and Pumping Spring Run-Off. A time of flooding conditions in Southern Manitoba (MRD).

FUELS

LIGNITE

The search for fuels began at an early stage in the history of the Province. In 1884, the Nelson Prospecting and Mining Company Limited was incorporated to search for oil, coal, and salt. In 1889, The Manitoba Coal Company Limited was incorporated to mine LIGNITE at Turtle Mountain in southwestern Manitoba. The old McArthur Mine and Vaden Mine, on the northwest flank of the mountain, were worked in the 1890's.

The industry died out with the opening of the Estevan Field in Saskatchewan (circa 1900), which made the Turtle Mountain lignite seam uneconomical.

In 1931, lignite mining was revived near Deloraine, but again died out during 1943. Maximum production in one year was 3 701 tonnes in 1934 from three small operations.

PETROLEUM

Exploration for PETROLEUM dates from 1887, but it was not until 1951 that the Province's first commercially productive oil zone was located near Virden in southwestern Manitoba by the California Standard Company (now Chevron Standard). In 1953 the Virden-Roselea and North Virden-Scallion fields were discovered. By 1956, it was realized that the Town of Virden was underlain by extensive accumulations of crude oil.

Since discovery of the oil fields, oil production has been continuous with the Virden area fields being the Province's major source. During the late 1960's total oil production reached a volume in excess of 6 million barrels per year. However, recent years have seen a steady decline with the latest production figures (1979) placed at approximately 3.7* million barrels per year, valued at approximately $48.3 million. The cumulative oil production as of December 31, 1979, was approximately 127 million barrels. All production to date has been from the Mississipian formation. Relatively few wells have been drilled below this horizon, although there is some evidence that the underlying Devonian and Cambrian may be geologically favourable. Very little drilling has been done in the Hudson Bay Lowlands, although some exploration interest has been shown there during the past decade. Six wells have been drilled, three of which were located in the central area of the Bay in 1974. The hydrocarbon potential of the area remains relatively untested.

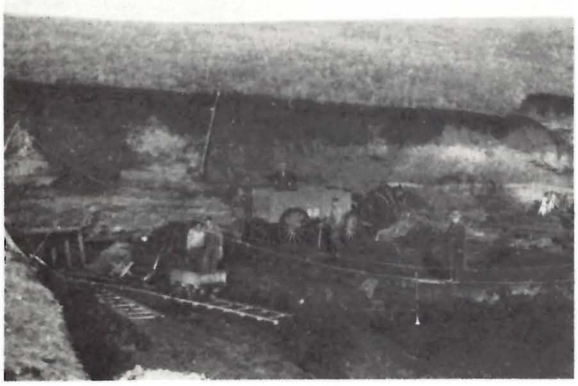


Photo 25. Coal Mining, Southwestern Manitoba (ca. 1935) (MRD).

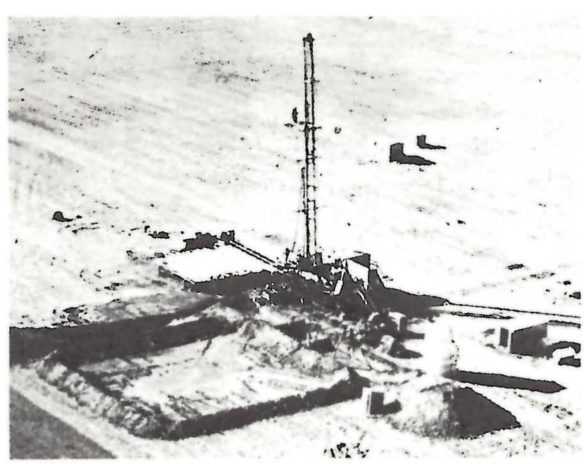
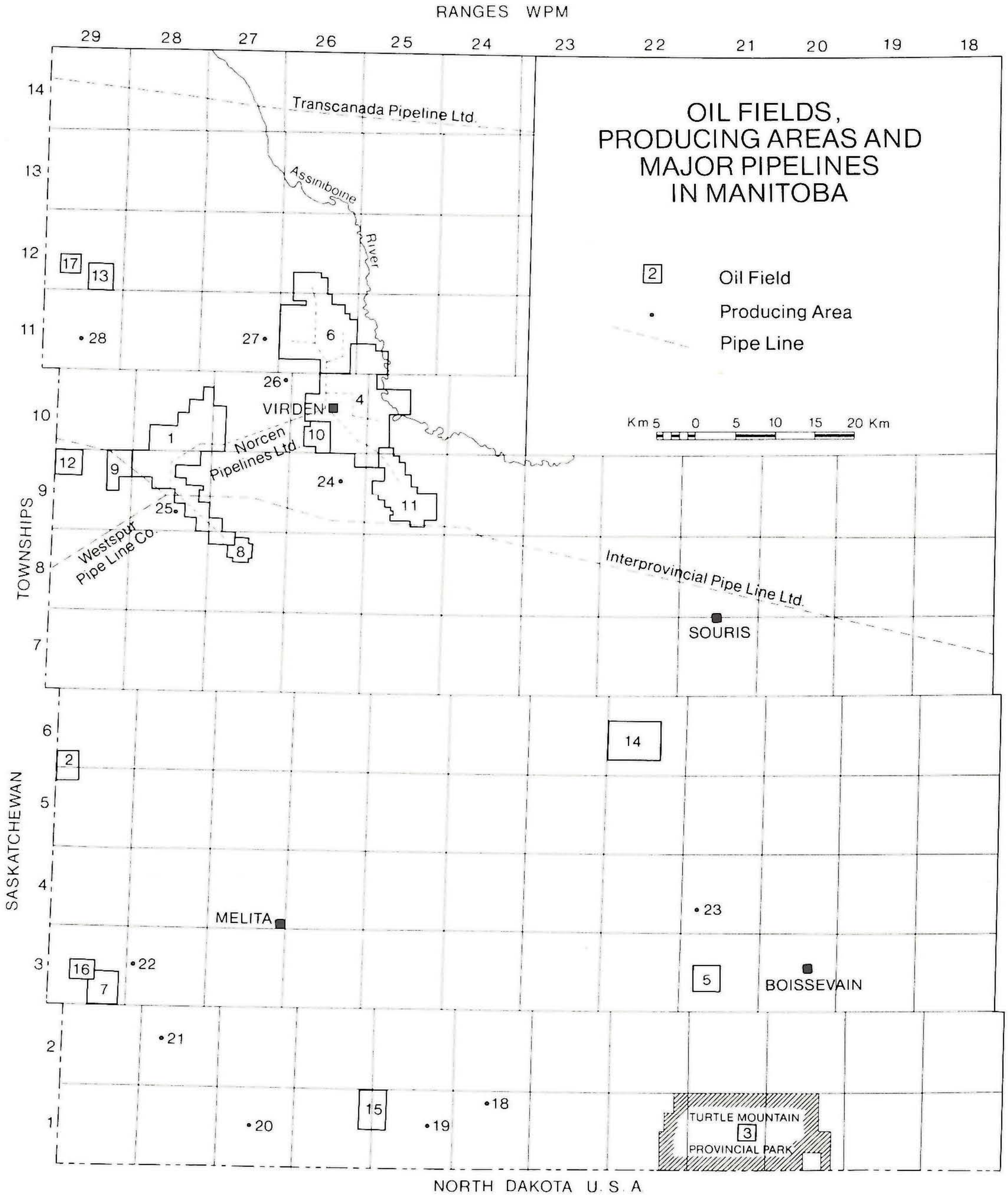


Photo 26. Drilling for Oil, Virden Area (MRD).

*Preliminary estimate for 1979 production.



OIL FIELDS

1. Daly
2. Tilston
3. Lulu Lake
4. Virden-Roselea
5. Whitewater
6. North Virden Scallion
7. Pierson
8. Woodnorth
9. Ebor
10. Maples
11. Routledge
12. West Butler
13. Kirkella
14. Souris Hartney
15. Waskada
16. Northwest Pierson
17. West Kirkella

PRODUCING AREAS

18. Goodlands
19. East Waskada
20. Coulter
21. South-east Pierson
22. North-east Pierson
23. Regent
24. South Maples
25. South Daly
26. West Scallion
27. East Hargrave
28. West Elkhorn

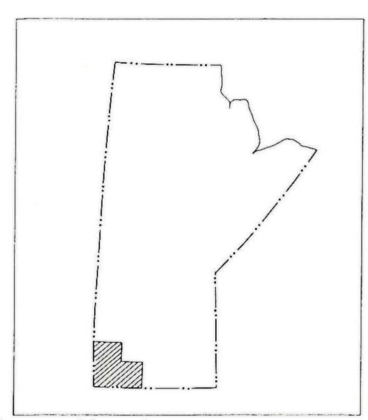


Figure 2. Oil Fields, producing areas and major pipelines in Manitoba.

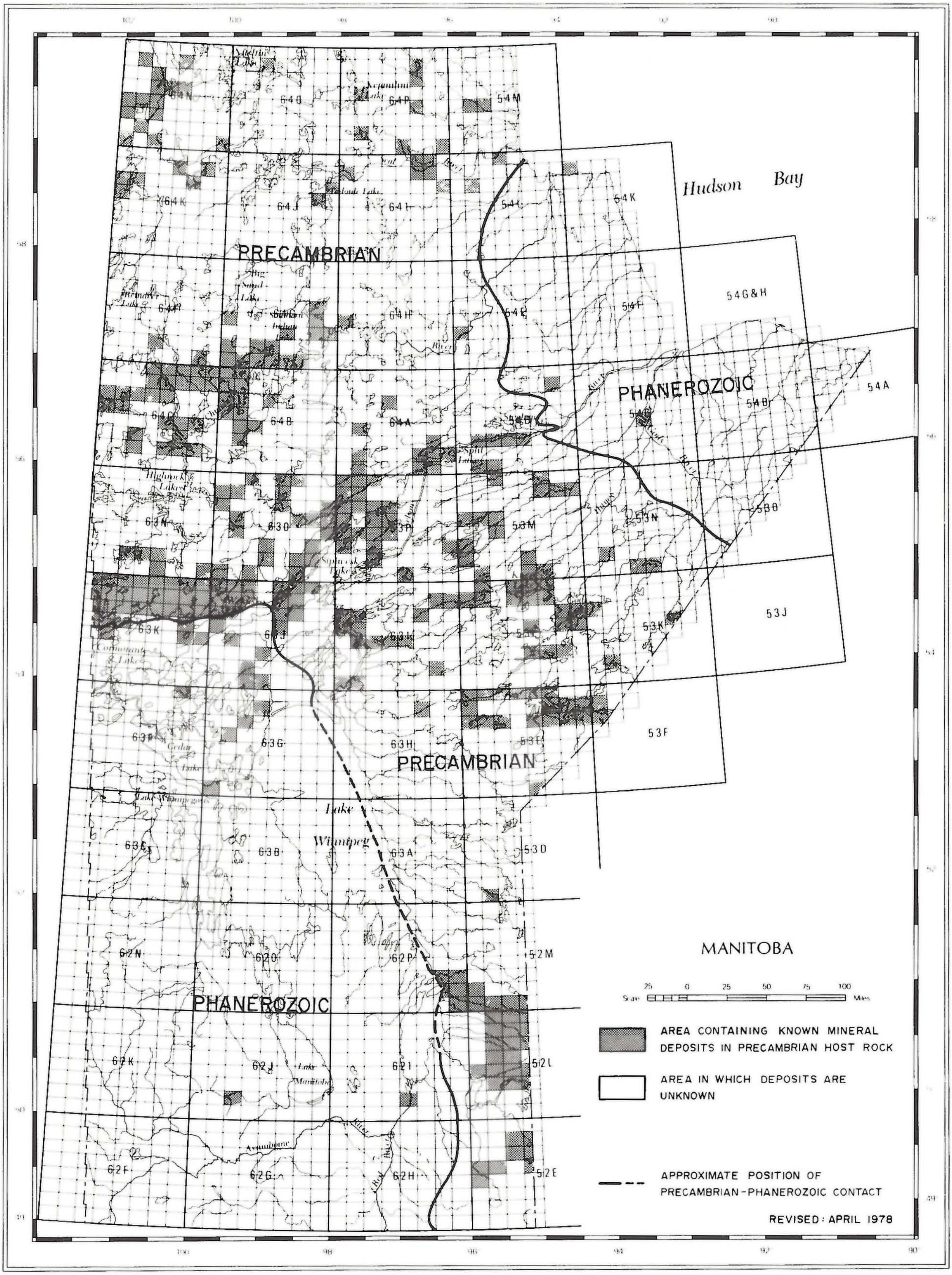


Figure 3. Areas containing known mineral deposits in Precambrian host rock.

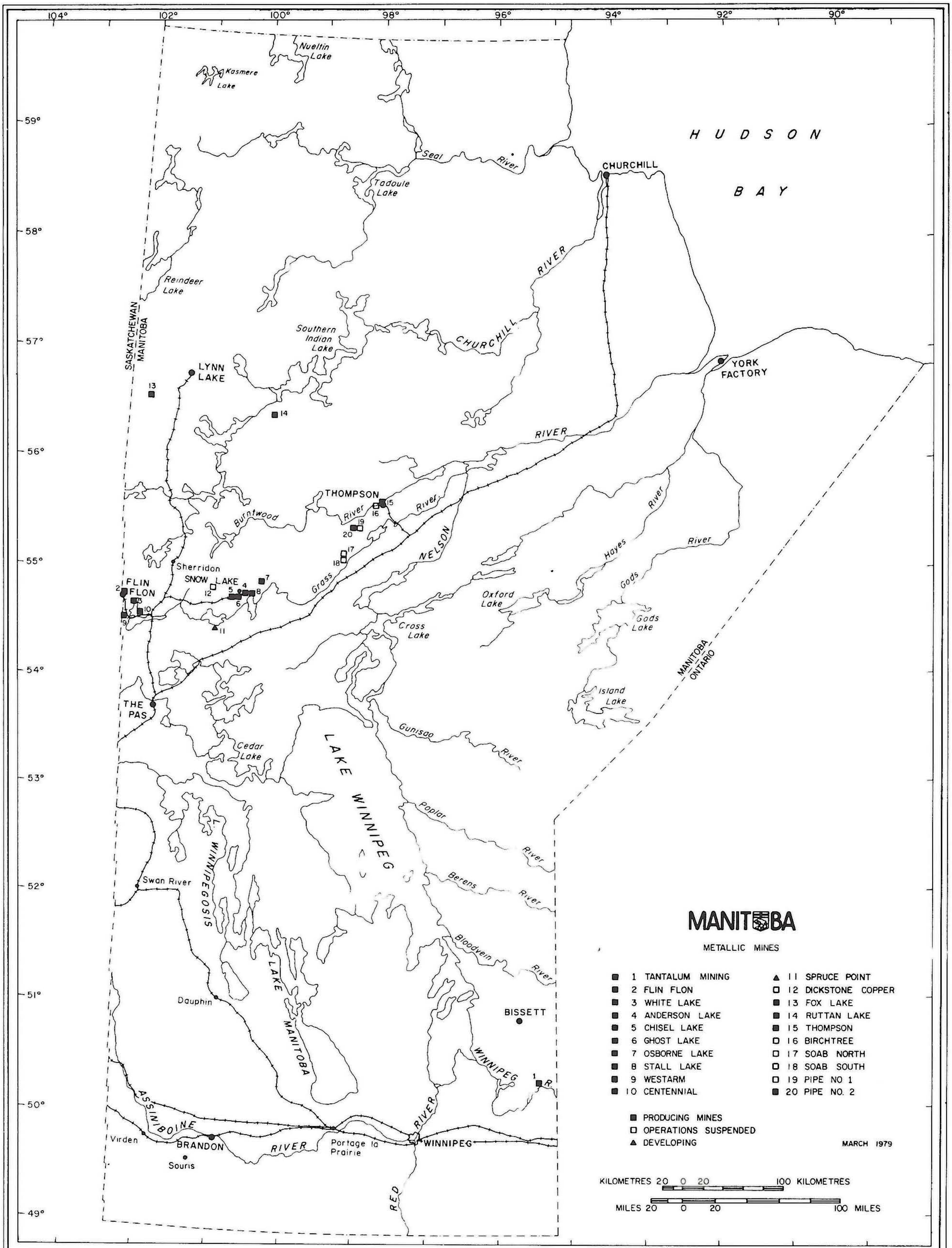


Figure 4. Location of Metallic Mines.

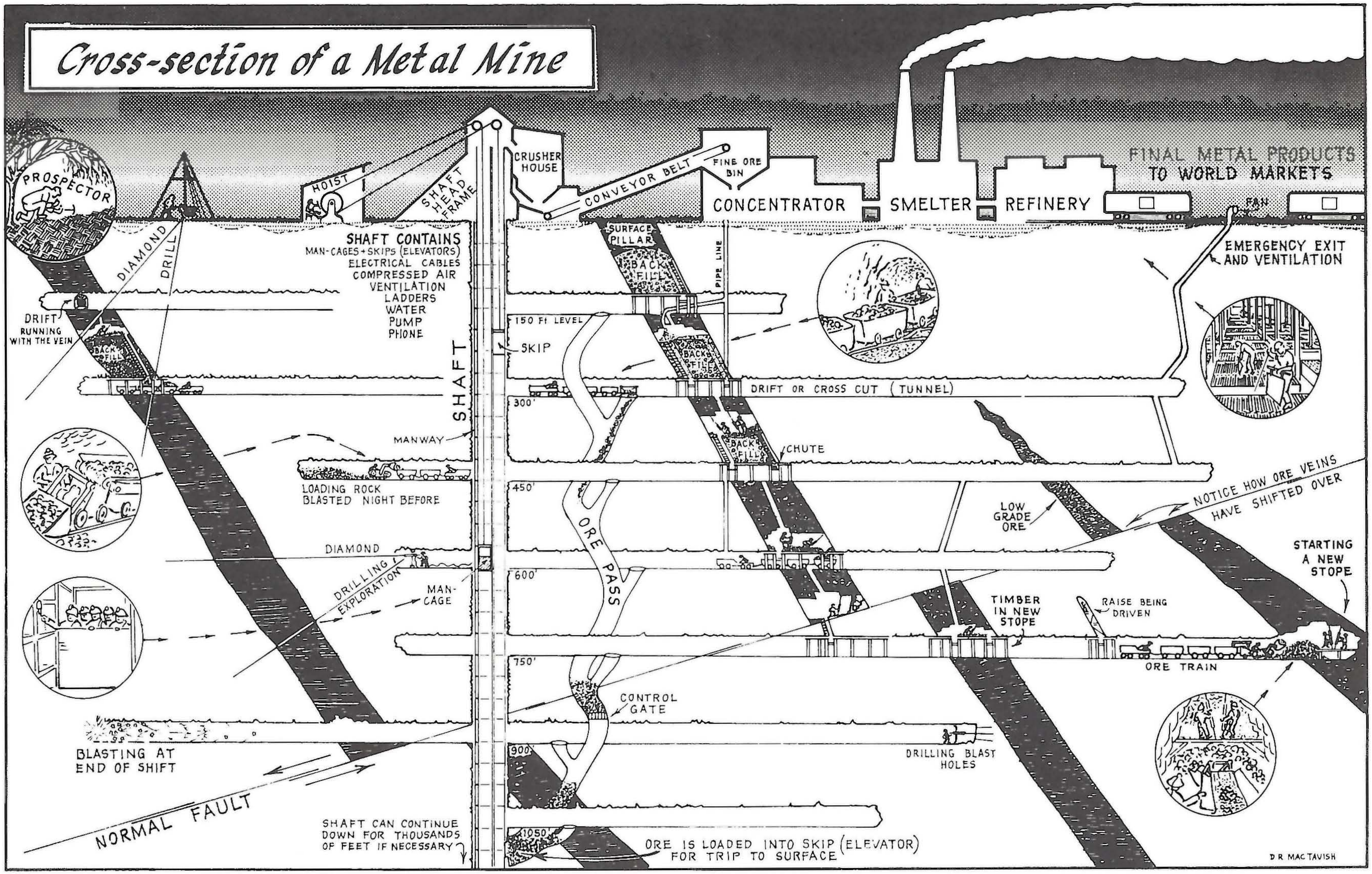


Figure 5. Cross-section of a typical underground mine.

Photo 27. Commemorative Monument, San Antonio Mineral Claim. The monument is located in Bissett, and marks the site of the northwest corner post of the San Antonio mineral claim, staked on May 17, 1911 (MRD).

GOLD (early developments)

Serious prospecting for metallic minerals in the Province started before World War I, with GOLD providing the main impetus. Manitoba's first significant gold discoveries were made in the Rice Lake area in 1911, some 160 km north-east of Winnipeg. In that year the first claims were staked of what later became the San Antonio Mine at Bissett, on the north shore of Rice Lake. A great deal of staking and prospecting followed in the succeeding years. Numerous shafts were sunk in the area and underground workings were driven, but it was not until 1927 that the area had its first gold producer, the Kitchener Mine of the Central Manitoba Mines, Limited. In 1932 the same company commenced production at the Tene, Growler and Hope Mines on ground adjoining the Kitchener. By the end of July 1937, operations at all four mines had ceased, after producing a total of 160,034 oz. of gold and 26,032 oz. of silver. These mine sites are located approximately 35.2 km east of Bissett by road.

The richest and longest lived producer in the Rice Lake area was the San Antonio Mine of San Antonio Gold Mines Limited. This mine commenced production in 1932 and operated continuously until 1968 when operations were suspended because of financial difficulties, compounded by a fire which destroyed the surface hoist room of the main shaft. Since that time, the hoist room has been rebuilt, a new hoist has been installed and the property is being maintained in readiness to resume operations should the market price for gold reach a level which would make operations profitable.

The mine was re-opened in February 1975 for examination and evaluation of the upper ten levels, but was closed again nine months later.

During its life, the San Antonio Mine produced 1,178,538 oz. of gold and 188,422 oz. of silver from 3 951 510 tonnes of ore mined. The mine employed 180 men and provided the sole economic base for Bissett, a town with a population of 800 people at the time.

From the start of operations at the mine until shut-down, Bissett was maintained and administered by the mining company. Since the mine closed down, the town has been maintained and administered by the Provincial Department of Northern Affairs.

The history of the San Antonio mine would not be complete without mention of its satellite, the Jeep Mine, located approximately 13 km to the east of Bissett. During its brief period of operation, 1947 to the end of 1950, it was operated by the Jeep Gold Mine Limited, a subsidiary of San Antonio Gold Mines Limited. Throughout the mine's life, the ore produced was milled at the San Antonio plant. 13,890 oz. of gold were produced from 16 192 tonnes of ore mined.

Other producers in the Rice Lake area were Oro-Grande Mines Limited and Gunnar Gold Mines Limited at Beresford Lake, and Ogama-Rockland Gold Mines Limited at Long

Photo 28. Surface Plant, San Antonio Mine, San Antonio Gold Mines Limited, Bissett (ca. 1940) (MRD).

Photo 29. Gold Bearing Vein (light colour) in the Back, Underground at the San Antonio Mine, San Antonio Gold Mines Limited (MRD).

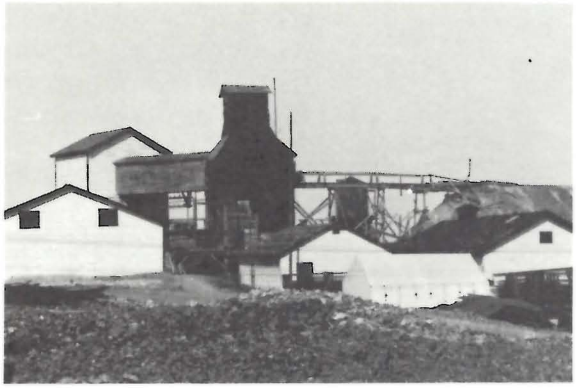


Photo 30. Surface Plant, Kitchener Mine, Central Manitoba Mines Limited, Bissett Area (ca. 1930) (MRD).

Lake, all approximately 56 km southeast of Bissett. Of these, the first to go into production was Oro-Grande which operated from 1932 until 1934, producing 5,305 oz. of gold and 525 oz. of silver. Gunnar was next which operated from 1936 until 1941 producing 99 700 oz. of gold. Ogama-Rockland commenced operations in 1941 and produced for one year before closing down temporarily for the duration of World War II. The ore produced was hauled by tractor and wide tread wagons to the Gunnar mill for treatment. In 1946 the complete mining plant at the Gunnar Mine was moved to the Ogama-Rockland Mine and the latter was reactivated. Milling commenced in 1948 and continued for three years before the mine and mill closed down in 1951. During that period, 50,000 oz. of gold were produced, valued at $1.75 million.

With the closure of the San Antonio mine in 1968, the Rice Lake area — long the domain of mines and miners — has become in recent years a tourist and cottagers' resort, with Bissett as the "capital." However, the current high market price of gold has spurred exploration activity in the area and mining may yet assume its former dominant role in the area.

Photo 31. Erecting Headframe and Compressor, Oro Grande Mine, Oro Grande Mines Limited, Beresford Lake (ca. 1930) (MRD).

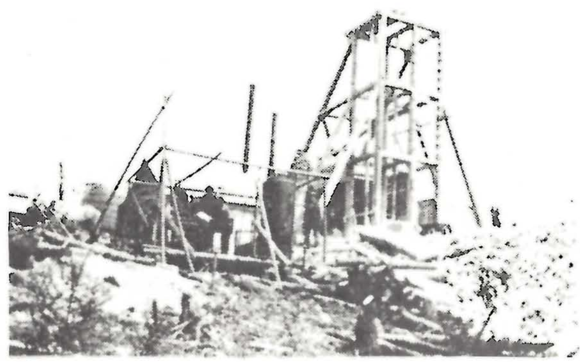


Photo 32. Surface Plant, Oro Grande Mine, Oro Grande Mines Limited, Beresford Lake (ca. 1930) (MRD).

Photo 33. Surface Plant, Gunnar Mine, Gunnar Gold Mines Limited, Beresford Lake, 1935 (MRD).

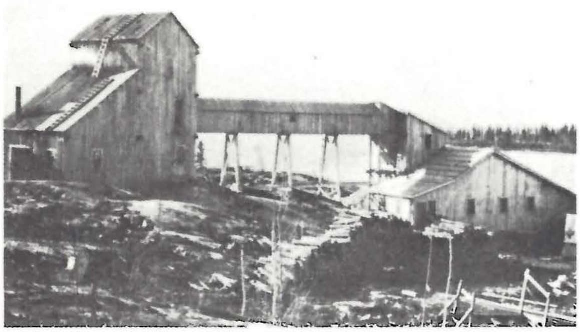


Photo 34. Stamp Mill Plant, Herb Lake Gold Mines Limited, Herb Lake (ca. 1925) (MRD).

Prospecting activities in the Flin Flon-Snow Lake belt north of The Pas are known to have taken place as early as 1896 when small amounts of GOLD are reputed to have been obtained from a claim near Reed Lake. The first known systematic search for gold north of The Pas began in 1907, with the Province's first recorded production of gold coming from the Moosehorn claim at Herb Lake in 1917. Twenty-six tonnes of gold-quartz ore were shipped from this claim to the smelter at Trail, B.C. The average yield was $73 per tonne.

In 1918, shafts sunk on the Rex group of claims on the east shore of Herb Lake led to GOLD production (1,377 oz.) by Herb Lake Gold Mines, Limited. During the period 1924-25, Manitoba Metals Mining Company, Limited produced 5,517 oz. of gold from the same workings. In 1934, the property was acquired by Laguna Gold Mines Limited which produced gold and silver valued at $1.83 million between the years 1936 and 1939.

The Gurney Mine, 40 km east of Flin Flon, operated intermittently between 1937 and 1939 producing over 25,000 oz. of gold.

Photo 35. Surface Plant, Gurney Mine, Gurney Gold Mines Limited, Flin Flon Area (ca. 1938) (MRD).

The longest lived gold producer north of The Pas was the Snow Lake Mine of the Britannia Mining and Smelting Co., Limited at Snow Lake. From 1949 until 1958 this mine produced 511,816 oz. of gold and 41,406 oz. of silver valued at $19.36 million.

No account of gold mining in Manitoba would be complete without reference to the Gods Lake and Island Lake area northeast of Lake Winnipeg. Although gold was discovered in that region early in this century, it was not until 1928 that high grade discoveries at Island Lake culminated in a producing mine. This was the Island Lake Mine which operated from 1928 until 1934, producing 5,000 oz. of gold valued at $175 000. In 1932 gold was discovered near Elk Island, an island in Gods Lake. Many other discoveries followed, culminating in God's Lake Gold Mines Limited developing the Akers claim group on Elk Island into a mine which, during the period 1935 to 1943, produced 471 600 tonnes of ore worth nearly $6 million.

Since the closing of the San Antonio Mine in 1968, the Province has not had a producing gold mine. However, gold

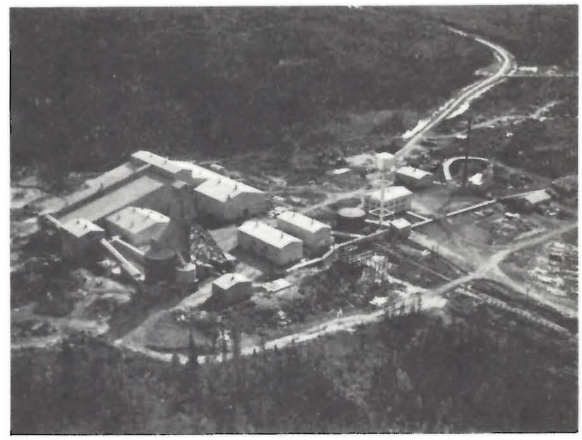


Photo 36. Surface Plant, Nor-Acme Mine, Britannia Mining and Smelting Co., Limited, Snow Lake (ca. 1958). The same picture today would show the outskirts of the town of Snow Lake in the upper right had corner (MED).

Photo 37. Surface Plant and Camp, Island Lake Mine, Island Lake Mines Limited, Island Lake (ca. 1934) (MRD).

Photo 38. Surface Plant, God's Lake Mine and Townsite, God's Lake Mines Limited, Gods Lake, 1935 (RCAF).

is produced as a by-product from the base metal mines which today constitute the Province's metal mining industry.

Two subsequent attempts at bringing in a gold mine are worthy of mention. In 1968 the Royal Agassiz Mines Ltd. sank a shaft to a depth of 149 m (488 feet) on its property 6.4 km to the south of Lynn Lake and established levels on the 200 (61 m) and 400 foot (122 m) horizons. A lateral development and underground diamond drilling program was carried out until 1969, when operations were suspended. In 1973 the workings were re-opened and further exploration work from underground was done in conjunction with a limited amount of surface diamond drilling during the following two years. The mine was again closed down in 1975. This drilling program indicated reserves of 1 424 700 tonnes grading 0.32 oz. of gold and 1.20 oz. of silver. During the winter of 1979-80, Sherritt Gordon Mines Limited optioned the property and commenced a diamond drilling program which is currently in progress.

The year 1973 again saw the Herb Lake area reactivated, with Crowduck Bay Mines Ltd. re-opening the former Ferro Mine, approximately 8 km east of the lake. Following assessment work in 1973 and 1974, the surface plant of the former operation was rehabilitated, and development on the first level began in August of 1974. Operations, however, were suspended late in that year due to financial problems. During this brief period of operation, 810 tonnes of ore were delivered to the mill and surface dump from underground.

Summarizing the Province's present gold mining situation, it can be said that although there is no active gold mine in the Province now, there is one dormant gold mine and two possible producers which could possibly be reactivated. This does not take into account former producers now abandoned, which operated during the years when gold was valued at $35.00 per oz. and less.

Although the role gold mining played in the Province's mining industry tends to be overshadowed by the base metal mining industry, it should be remembered that it was the search for gold that resulted in the discovery of the base metal deposits.

In order to preserve as much as is practicable the historical order in which the Province's mines came into being, the story of gold mining must be interrupted at this point and resumed later.

COPPER-ZINC

Manitoba's base metals mining industry may be said to have originated in the summer of 1915, when Thomas Creighton staked a mineralized outcrop near what is now the town of Flin Flon while prospecting and trapping in the area. In October of the same year, a COPPER-ZINC deposit was found 5.5 km to the southeast. This was to become the Mandy Mine, Manitoba's first base metal producer, operated by the Mandy Mining Company. Production commenced in 1917 from a high grade orebody containing 22 500 tonnes of massive chalcopyrite averaging about 20% copper. The ore was shipped to Trail, British Columbia, for smelting. Operations were suspended in 1920 when the high grade deposit was worked out. During the period 1928-29 additional reserves of lower grade ore were outlined. However, re-opening of the mine did not come about until World War II, when it was operated during 1943-44 by Hudson Bay Mining and Smelting Co., Limited (H.B.M. & S.). During that period 112 500 tonnes of ore were produced. The Mandy has been closed since 1944.

Photo 39. Surface Plant, Mandy Mine, Mandy Mining Company, Flin Flon Area, 1929. Manitoba's first base metal producer (MRD).

Photo 40. Transporting Mandy Ore by Barge to Railhead (MRD).

In 1927, H.B.M. & S. set up a pilot mill near Creighton's claim on what was to become the Flin Flon Mine. (Although Creighton is reputed to be the discoverer of the Flin Flon Mine, information recently brought to light credits an Indian, David Collins, with making the discovery and guiding Creighton to it.) The development of the mine and construction of the concentrator, zinc recovery plant and copper smelter, as well as the hydroelectric plant at Island Falls, Saskatchewan, started in 1928. The mine commenced production in 1930, and later in the year the first production of blister copper and zinc slabs commenced.

The Flin Flon mine and surface plant straddle the Manitoba-Saskatchewan border at latitude 54°45' and longitude 101°53'.

Rock formations in the vicinity of the mine are Precambrian in age. A large portion of the top of the orebody was overlain by water and silt. This necessitated damming and pumping out of a lake, and removal of one million cubic

Photo 41. Open Pit, Flin Flon Mine, H.B.M. & S., Flin Flon (ca. 1930). Open Pit mining was discontinued when the underground mine came on stream (MRD).

yards of clay and mud before mining operations could begin. The top 100 m of the orebody was mined by an open pit method. While this was in progress, the underground portion being developed furnished part of the daily production. Since 1937, all of the ore produced at Flin Flon comes from the underground mine. It is hoisted to the surface through two shafts, South Main on the Saskatchewan side of the border and North Main on the Manitoba side. Operations originally started at 2 700 tonnes per day and gradually increased to a peak of 5 400 tonnes per day during World War II.

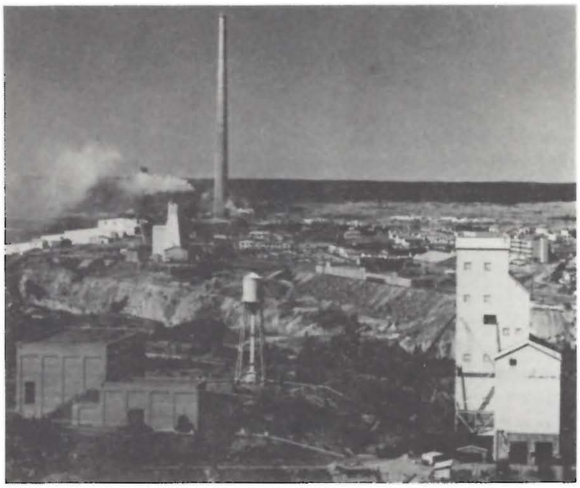


Photo 42. Surface Plant, Flin Flon Mine, H.B.M. & S., Flin Flon. Foreground to background: South Main (Saskatchewan). Open Pit, North Main (Manitoba). The town of Flin Flon may be seen in the right-center of the photo (H.B.M.S.).

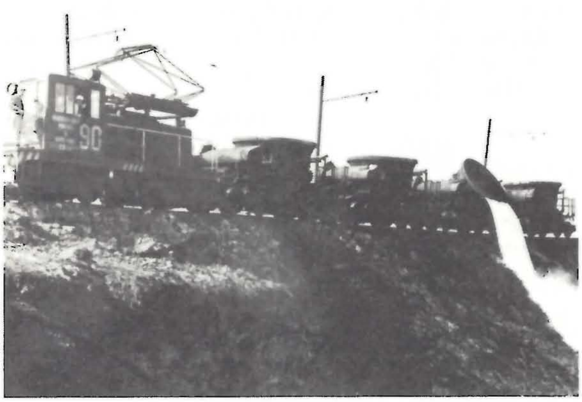


Photo 43. Slag Train, H.B.M. & S., Flin Flon. Dumping slag from the smelter (MRD).

The large capital investments in mining and rail equipment, and especially the construction of smelting and refining plants, were decisive for Manitoba's base metal mining industry. They made possible the opening up of other copper-zinc mines to the north and east, and expansion of the Flin Flon-Snow Lake mining districts by H.B.M. & S. since World War II. In summary, between 1948 and 1960, ore was trucked to Flin Flon for treatment from nearby small mines, now closed, such as the Cuprus, Northstar, Don Jon, Coronation and Birch Lake, the latter two located in Saskatchewan. The

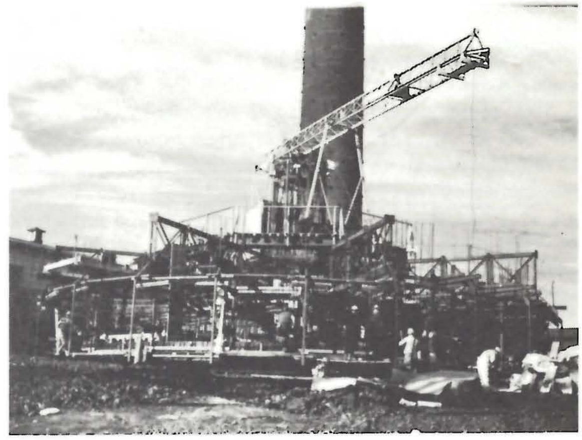


Photo 44. Flin Flon Smelter, H.B.M. & S. Construction of base of new stack, 1972. One of the old stacks in the background of the picture (MRD).

Photo 45. Flin Flon Smelter, H.B.M. & S. Construction of new stack completed, 1973 (MRD).

Photo 46. Main Street, Flin Flon, 1930 (MRD).

Photo 47. *Aerial View of Part of Town of Flin Flon (Contemporary). North Main Headframe and Plant in Background (H.B.M.S.).*

Schist Lake Mine, also operating during this period, closed down in 1976 due to uncontrollable ground conditions. Meanwhile, the old gold mining district of Herb Lake was transformed into the Snow Lake copper-zinc district when, by 1960, the first of the Snow Lake satellite mines, Chisel Lake, came into production. This was followed by Stall Lake in 1964, Osborne Lake in 1968, Anderson Lake in 1970, Ghost Lake in 1972 and Lost Lake in 1977. Access to the Lost Lake Mine is gained through the Ghost Lake workings.

The mines in the Snow Lake area figure prominently in the Company's total production picture. An appreciation of the magnitude of their contribution may be realized from a comparison of Snow Lake production figures with those of Flin Flon area mines for 1979. The former is reported at 686 552 tonnes and the latter 1 007 051 tonnes. The ore was formerly transported by rail to Flin Flon for treatment, with slag for backfill brought in on the return haul. With a view to reducing transportation costs, a concentrator was built at the Stall Lake minesite to treat ore from all the mines in the Snow Lake area and produce a concentrate for shipment. The concentrator was officially opened on June 28, 1979. Its rated capacity is 3 420 tonnes of ore per day treated to produce 144 000 tonnes of concentrate per year, which is shipped to Flin Flon for processing.

In addition to satellite mines in the Snow Lake area, H.B.M. & S.'s producing mines in the Flin Flon area include the Flin Flon Mine, straddling the Manitoba-Saskatchewan border; the White Lake Mine, 24 road kilometres southeast of Flin Flon; the Centennial Mine (so named because the discovery year was 1970, the Province's Centennial Year) 15 km southeast of Flin Flon, at lake Athapapuskow; and the Westarm Mine, the latest to come on-stream, on the west arm of Schist Lake. The White Lake Mine came into production in June 1972; the Centennial in June 1977; and the Westarm in January 1978. Ore from these mines is trucked to Flin Flon for treatment. The total daily tonnage treated in 1979 at the Snow Lake and Flin Flon mills was 6 722 tonnes.

Approximately 32 km west of Snow Lake at Beavertail Lake, H.B.M. & S. operated the Dickstone Mine for the Dickstone Copper Mines Limited on a profit-sharing basis. Development commenced in 1968 and production in 1970. Approximately 360 tonnes of ore per day were produced and

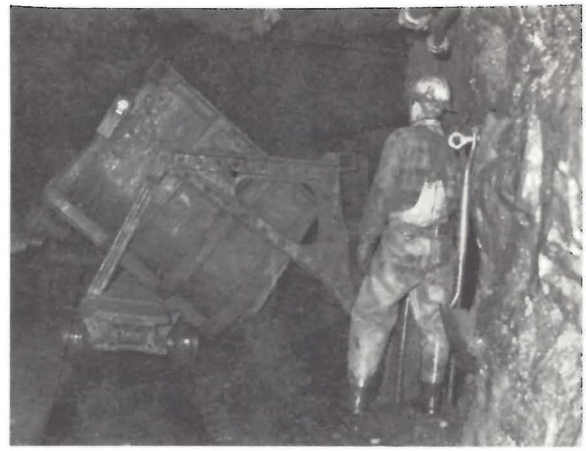


Photo 48. *Train Dumping Ore at the Ore Pass, Chisel Lake Mine, H.B.M. & S., Snow Lake (H.B.M.S.).*

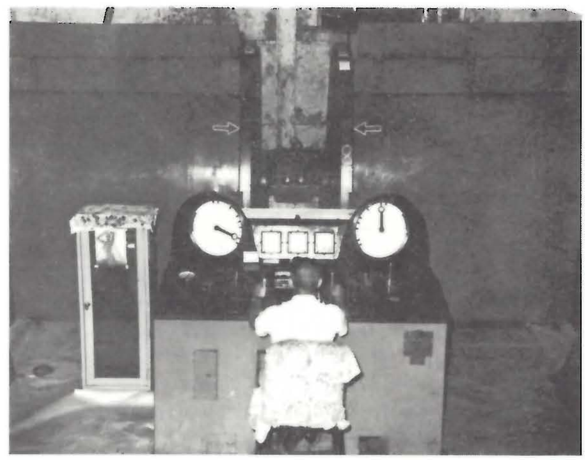


Photo 49. *Hoistman at the Controls of a Mine Hoist, H.B.M. & S., Snow Lake (H.B.M.S.).*

Photo 50. *Drilling in the Stope at a Snow Lake Mine, H.B.M. & S. (MRD).*

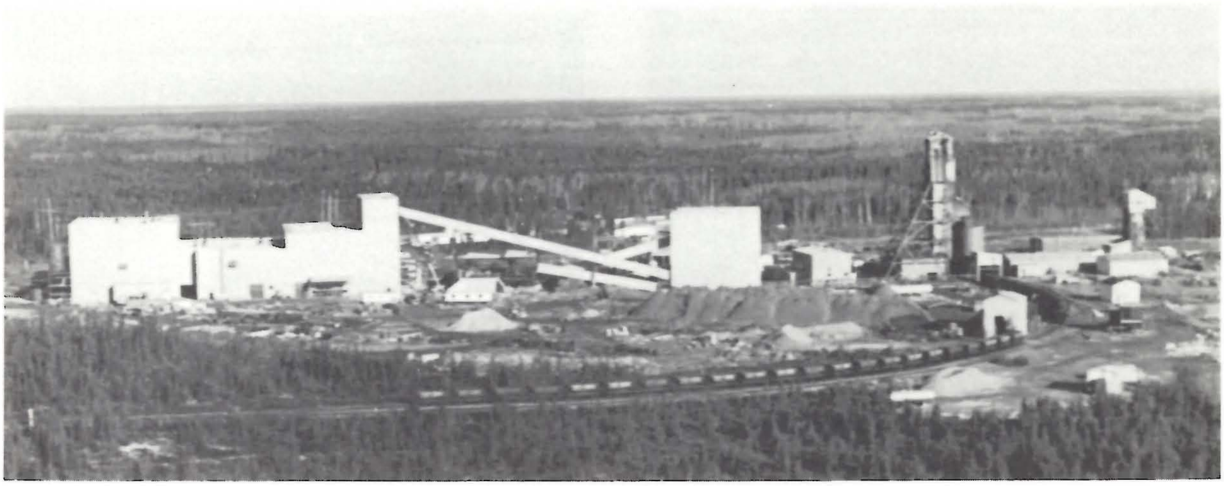


Photo 51. Surface Plant, Stall Lake Mine, H.B.M. & S., Snow Lake (H.B.M.S.).

transported by H.B.M. & S. rail to Flin Flon for treatment. In August 1975 recovery of the developed ore was completed and operations terminated. The mine is currently on stand-by basis.

To summarize the H.B.M. & S. history to date, ore reserves at the start of the Company's operations in one mine, the Flin Flon, in 1930 totalled 16.2 million tonnes. Since then, to the end of 1979, over 70.2 million tonnes of ore have been mined in the Flin Flon and Snow Lake areas. At the end of 1979 total ore reserves in the Company's currently producing mines were 15.71 million tonnes, assaying at 0.037 oz. gold, 0.55 oz. silver, 2.68% copper, and 2.7% zinc. However, this is not to say that this is the end of the H.B.M. & S. story. It is a fact of mining life that a company has to continually search for and develop new mines to replace depleted ore reserves, if it hopes to remain alive. H.B.M. & S. is no exception to this rule. Accordingly, three mines are currently being added to the Company's roster: one at Reed Lake, one adjacent to the Company's Stall Lake Mine, and one at Trout Lake.

Development of the Spruce Point Mine, located on the south shore of Reed Lake, commenced in September 1978. This is a copper-zinc deposit, 96 km southeast of Flin Flon, where diamond drilling has outlined a zone containing 450 000 tonnes grading 2.8% copper and 4.5% zinc. Construction of the surface plant began in 1978 and by year-end 1979 was well on the way to completion. Shaft sinking commenced on February 1980, with target depth set at 2,200 feet (671 m).

Early in the 1960's, Stall Lake Mines Limited operated a mine in the Snow Lake area, adjoining H.B.M. & S.'s Stall Lake Mine on the east. Original ore reserves as defined by diamond drilling were estimated to be 27 000 tonnes grading 5.62% copper, 3.52% zinc, 0.08 oz. gold, and 1 oz. silver. Production commenced in 1962 at a rate of 135 tonnes per day, and continued until April 1964 when mining was terminated. During this period, 11 290 tonnes were mined, producing 760 984 kg copper, 344 534 kg zinc, 1,086 oz. gold, and 8,018 oz. silver. Crude ore from this mine was sold to H.B.M. & S. and transported by rail to Flin Flon for treatment.

In 1965, the property was optioned by Falconbridge Nickel Mines, Limited which, during the following four years, carried out an exploration and evaluation program, including surface diamond drilling and examination of the underground workings. As a result of this program, part of which was undertaken jointly with H.B.M. & S., ore reserves are currently placed at 605 377 tonnes averaging 5.38% copper and 2.28% zinc. Plans to proceed with mining were formulated, but beyond the collaring of a new shaft to a depth of 50 feet (15.2 m), no further work was done during this period. The property closed down in 1971, with Falconbridge holding 50% interest. Early in 1980, H.B.M. & S. acquired a 10-year lease from the property holders to mine the orebody. Commencement of production is scheduled for the last half of 1982. Ore mined will be trucked to the H.B.M. & S. concentrator at Stall Lake for processing. Annual production of the mine, to be called the Rod Mine, is expected to be in the order of 112 500 tonnes of copper-zinc-silver-gold ore.

During the first half of 1980, H.B.M. & S. signed a memorandum of intent with Sweden's Granges Exploration AB respecting a copper-zinc deposit which the latter company discovered at Trout Lake. According to the terms, H.B.M. & S. would develop and operate the mine in a joint venture with Granges and Manitoba Mineral Resources Ltd., a Crown Corporation of the Manitoba Government, on a 44%, 29%, and 27% basis, respectively. Ore would be treated at the H.B.M. & S. Flin Flon plant. The deposit, located 8 km northeast of Flin Flon, is reported to contain 2 700 000 tonnes of ore grading 3.0% copper and 4.5% zinc.

TUNGSTEN

Although this section deals with copper and zinc, another base metal, TUNGSTEN, may properly be included here because it figures, albeit briefly, in the history of the Flin Flon-Snow Lake area. Prior to World War II, tungsten was not produced in significant quantities in Canada. The requirements of the country's industrial and military needs were supplied principally from sources outside the country. With the outbreak of World War II, off-shore sources of the metal, vitally important to armament production, were cut off. Faced with supplying its needs from within its borders, the country called upon its mines, be they tungsten producers or not, to supply the need. It is interesting to note that the gold mining industry, which is not classed as an essential industry during wartime, played a part in supplying the "essential" tungsten. At one gold mine with which the writer is familiar, the Dome Mine in Ontario, scheelite was hand picked from the stopes and shipped to tungsten milling and refining facilities elsewhere in the country.

Spurred by the defence requirements of the "cold war" which followed on the heels of World War II, the search for, and production of, tungsten in Canada continued. The search in Manitoba culminated in the discovery of a scheelite

Photo 52. Surface Plant, Sherridon Mine, Sherritt Gordon Mines Limited, Sherridon, 1932 (MRD).

deposit 0.8 km north of the west end of Snow Lake. In May 1952 Northern Tungsten Limited, a Manitoba company owned and operated by a group of Winnipeg residents, commenced production from the deposit. At that time, according to a newspaper report* attributed to Company officials, 4 500 tonnes of ore had been blocked out grading approximately 2.5% tungsten. Ore was mined from underground workings driven into the side of a high ridge. A small mill produced 9 tonnes of scheelite concentrate per day. Concentrate was bagged and shipped via a 64 km road to Wekusko on the Hudson Bay Railroad for shipment to market. There are no available records of total tonnage produced nor of duration of production life of the property. Operations are known to have ceased by 1954. Despite the fact that Northern Tungsten Limited is no longer an incorporated company, it is still the recorded owner of the property.

*The Winnipeg Free Press, October 25, 1952.

COPPER-ZINC-NICKEL

As a result of the Flin Flon discoveries, prospecting was extended north to Kississing Lake where a deposit, which was to become the Sherridon Mine of Sherritt Gordon Mines Limited, was located in 1922 near Camp Lake. Production at the Sherridon Mine began in 1931 but was suspended in 1932 due to the low price of copper prevailing at that time. The mine was re-opened in 1937 and operated until 1951, when ore reserves were exhausted. During this 14-year period, over 7.65 million tonnes of ore were milled yielding a total production value of nearly $58.75 million.

Sherridon proved to be the spring board for larger operations in what is today the Lynn Lake-Ruttan Lake mining district. There appears to have been little systematic prospecting in this region until 1937 when a group from Sherridon discovered gold at Lasthope Lake, approximately 32 km south of Lynn Lake. In 1941, sulphide float was traced to an outcrop in the vicinity of East Lynn Lake. This was to become Sherritt Gordon's "A" Mine at what is now the town of Lynn Lake. The first sample containing less than 1% COPPER but more than 1.5% NICKEL was to lead to the first mining of nickel-copper ore in Manitoba. Extensive sulphide deposits were located in this area in subsequent years by magnetic and electromagnetic surveys and closely spaced diamond drilling.

Photo 53. Aerial View of the Town of Lynn Lake. The surface plant of the "A" Mine of Sherritt Gordon Mines Limited may be seen in the background (MED).

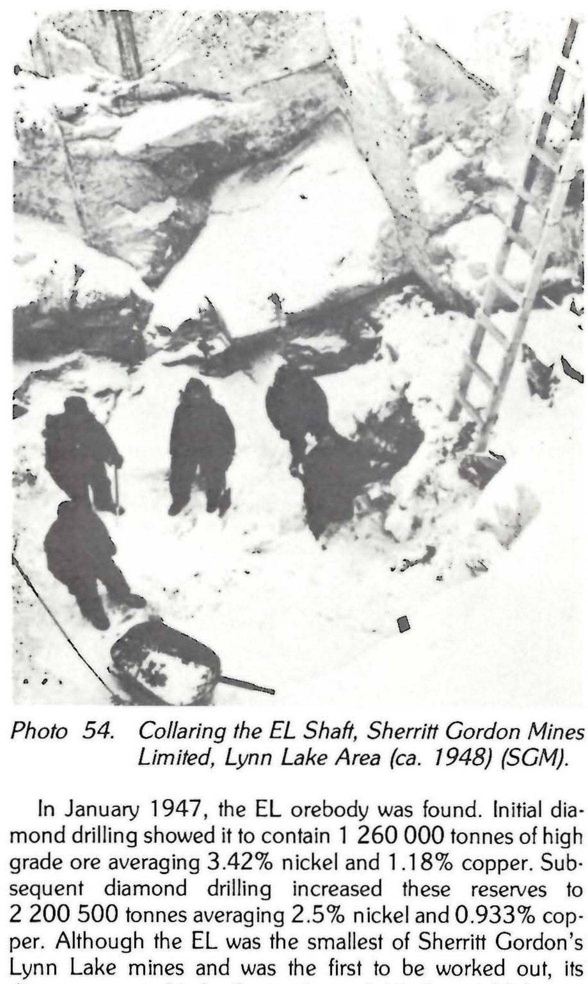


Photo 54. Collaring the EL Shaft, Sherritt Gordon Mines Limited, Lynn Lake Area (ca. 1948) (SGM).

In January 1947, the EL orebody was found. Initial diamond drilling showed it to contain 1 260 000 tonnes of high grade ore averaging 3.42% nickel and 1.18% copper. Subsequent diamond drilling increased these reserves to 2 200 500 tonnes averaging 2.5% nickel and 0.933% copper. Although the EL was the smallest of Sherritt Gordon's Lynn Lake mines and was the first to be worked out, its discovery proved to be the turning point in the establishment of the Lynn Lake mining operations. Ironically, it was not the first nickel producer to come into production in the Province. That distinction belongs to the "A" Mine.

Underground development and diamond drilling was carried out at the "A" Mine during the late 1940's. By 1950, Sherritt Gordon had outlined at least 12 600 000 tonnes of ore reserves. This was sufficient to warrant mining operations. With the closing of the Sherridon Mine in 1951, the

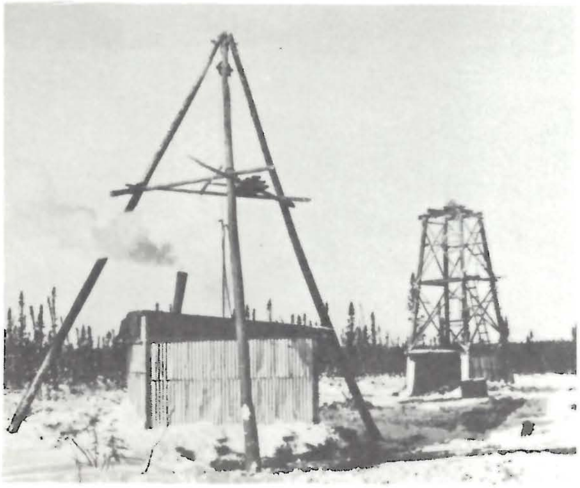


Photo 55. EL Mine, Sherritt Gordon Mines Limited, Early Development (MRD).

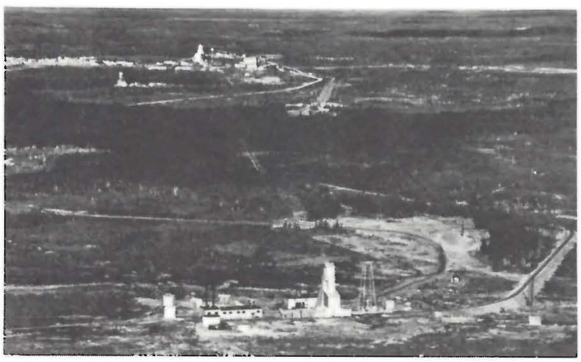


Photo 56. Relative Locations of the Mines at Lynn Lake, Sherritt Gordon Mines Limited. Foreground to background: EL Mine, Farley Mine, and "A" Mine (MED).

Photo 57. Tractor Train Hauling a Building from Sherridon to Lynn Lake (ca. 1951) (SGM).

concentrator, mining plant, homes, and other worthwhile portable property were moved from Sherridon by tractor train to Lynn Lake, a distance of 160 km to the north. In the same year, erection of the concentrator was begun at Lynn Lake and extension of the CNR rail line to it. Meanwhile, underground development and exploration continued. Ore reserves in 1951 were placed at 12 649 500 tonnes grading 1.223% nickel and 0.618% copper.

In a departure from the conventional method of processing nickel sulphide ores, Sherritt Gordon planned to refine the nickel concentrate by the ammonia-leaching process (developed by Professor F.A. Forward), a feature of which was the elimination of the intermediate step of smelting. Accordingly, construction of the refinery was commenced in 1952 at Fort Saskatchewan, Alberta, and the first nickel was produced in July 1954.

Photo 58. "Driving the Last Spike," Sherridon to Lynn Lake Railway Spur (ca. 1954) (MED).

Photo 59. Loading Concentrates for Shipment at the "A" Mine Terminal Building, Sherritt Gordon Mines Limited, Lynn Lake (MED).

Production began at the "A" Mine in 1953 and the first shipment of nickel concentrate to Fort Saskatchewan was made in January 1954. During May of the same year, the EL Mine came into production. Ore from the EL was transported via a 3.2 km small gauge railroad to the concentrator at Lynn Lake. Until 1961, all production came from these two mines. In 1961, the Farley Mine, located 1.6 km east of the "A," came into production.

The concentrator at Lynn Lake served the "A," EL and Farley Mines, milling 3 150 tonnes per day to produce nickel

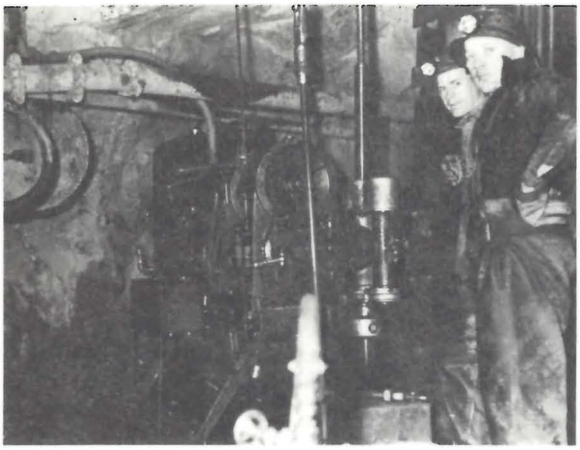


Photo 60. Underground Diamond Drill Set-Up at a Lynn Lake Mine, Sherritt Gordon Mines Limited (SGM).

Photo 61. Drilling "Uppers" at a Lynn Lake Mine, Sherritt Gordon Mines Limited (SGM).

and copper concentrates. The nickel concentrate was refined at Sherritt Gordon's refinery at Fort Saskatchewan. The copper concentrate was custom treated at the Flin Flon smelter and refined at the Canadian Copper refinery in Montreal.

The EL Mine orebody was exhausted in 1963 and the mine was closed down during the following year. In 1969, production at the "A" Mine came to an end, leaving the Farley as Sherritt Gordon's only nickel producer. The Farley, in its turn, was exhausted and closed down in June 1976. Consequently, the Lynn Lake concentrator suspended operations during the same year and was placed on standby basis for possible future needs. During their life, these three mines produced a total of 1 617 240 tonnes of nickel concentrate containing 166 088 269 kg of nickel, and 219 318 tonnes

Photo 62. Surface Plant, EL Mine, Sherritt Gordon Mines Limited, Lynn Lake Area. The circle to the left of the headframe marks the stope break-through to surface (MED).

Photo 63. EL Mine Stope Break-through to Surface, Sherritt Gordon Mines Limited (SGM).

of copper concentrate containing 94 835 880 kg of copper. In addition, the concentrates contained 1 656 053 kg of cobalt, 14,377 oz. of gold, and 290,076 oz. of silver.

With the closure of the Farley mine, Sherritt Gordon has had to look elsewhere for its nickel supplies with which to maintain operations at the Fort Saskatchewan refinery at optimum capacity. According to a report appearing in The Financial Post, May 20, 1978, Sherritt Gordon has entered into a long-term agreement to buy nickel feed material from Inco Metals Company to satisfy this need. At the same time, Sherritt is continuing exploration activities in the area surrounding its operating mines and in the vicinity of Lynn Lake.

During 1967 and 1968, Sherritt Gordon commenced underground development and construction of a concentrator at what is today the Fox Mine, approximately 48 km southwest of Lynn Lake. Production began in 1970. Twenty-seven hundred tonnes of ore per day are milled to produce COPPER and ZINC concentrates. The concentrates are trucked to the Company's load-out facilities in Lynn Lake for rail shipment to Flin Flon for processing.

Ore reserves at the Fox Mine as of December 31, 1978, were reported to be 5 699 700 tonnes grading 1.79% copper and 2.22% zinc.

During 1970, Sherritt Gordon commenced development of what is now the Ruttan Mine, approximately 96 km southeast of Lynn Lake. This is a combined open pit and underground mining operation, producing approximately 9 000 tonnes per day of copper-zinc ore.

Photo 64. Ruttan Open Pit and Concentrator, Sherritt Gordon Mines Limited, Leaf Rapids Area (MED).

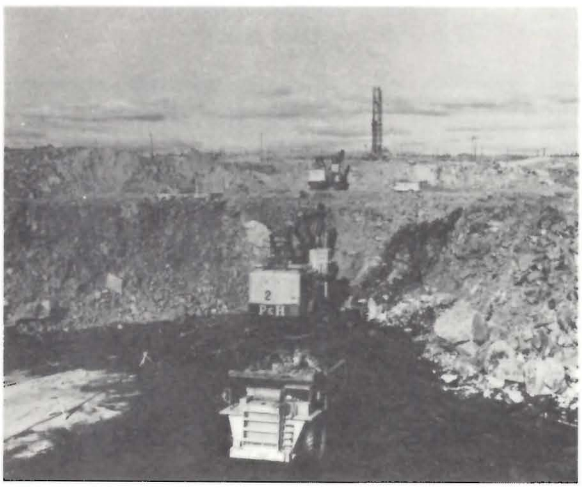


Photo 65. Ruttan Open Pit, Sherritt Gordon Mines Limited, Leaf Rapids Area (MED).

The years 1970-1972 saw the initial development of the open pit, construction of the plant, and 130 km of road. During the same period, the town of Leaf Rapids was built, 9 km west of the mine on Highway 391, to house the mine's employees and their families. At latest report, the population of Leaf Rapids is approximately 2 400 people.

On April 9, 1973, the Ruttan concentrator came on stream, and on April 21 the first shipment of concentrate was trucked to Lynn Lake.

As originally planned, the open pit was to provide all of the mill feed until 1979, when underground production was planned to begin. As the underground mine winds up to the 9 000 tonnes per day rate, the open pit will wind down correspondingly. Accordingly, underground development commenced in 1974 with the driving of two declines, one to serve as the main access and the other to house the conveying system for transporting ore and waste to surface. By year-end 1978, six levels were established with the deepest at the 1,400 foot (427 m) horizon. Initial production from underground began in 1979 and accounted for 20% of total production during that year. It is expected that the open pit operation will be phased out in 1980 and the underground mine will have reached full production at 9 000 tonnes per day.

Ore reserves as of December 31, 1978, were 25 893 900 tonnes averaging 1.79% copper and 1.20% zinc above the 2,000 foot (610 m) horizon. The ore zone is reported to be open at depth.

Copper and zinc concentrates from Ruttan are trucked to Lynn Lake for rail shipment. Noranda Mines Limited has contracted for all the copper concentrate produced during the first 10 years of operation. These are treated at Flin Flon as capacity permits, with the balance going to Noranda, Quebec. Zinc production was contracted to Mitsubishi Metal Mining Co. Ltd. of Japan but, through a subsequent arrangement, zinc concentrates are treated at Flin Flon.

NICKEL-COPPER

Simultaneously with Sherritt Gordon's exploration activities in the Lynn Lake area, shortly after the Second World War, The International Nickel Company of Canada, Limited (now Inco Limited)*, was actively engaged in the Mystery-Moak Lakes area, some 240 km to the southeast. Commencing in 1946, Inco began 10 years of extensive and intensive exploration which culminated in the company's announcement in 1956 of its discoveries at Thompson. These discoveries are now recognized as occurring in one of the world's foremost nickel belts and resulted in the creation of the western world's second largest nickel producing centre. The company's and district's first potential producer was the Moak Lake Mine, located approximately 3.2 km north of the lake of the same name and approximately 27 km to the northeast of what is now the City of Thompson. Sinking of

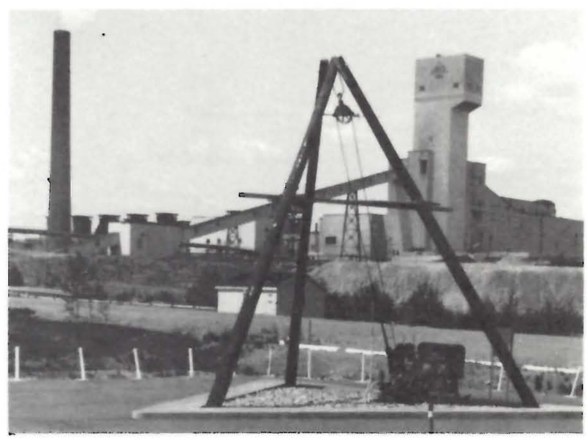


Photo 66. Commemorative Marker of the Diamond Drill Set-Up on the Site of the Discovery Hole of the Thompson Mine Orebody, Inco Metals Company, Thompson. The T-1 surface plant is shown in the background (MRD).

the exploration shaft commenced in 1955 and 3 000 m of lateral work was carried out on three levels. This underground exploration work outlined probable ore reserves of 450 000 tonnes grading 0.75% nickel, as well as tens of millions of tonnes of marginal grade ore. Sinking of the production shaft commenced in 1957 but was suspended indefinitely in 1958 when diamond drilling struck what is now the Thompson Mine orebody. This deposit was higher in grade and larger in size than the one at Moak. When it became evident that the Thompson deposit could alone support a mill, all work at Moak was suspended and remains so to this day. The property continues to be held by Inco. As originally planned, the main mine and town were to be at Moak Lake. However, with the discovery of the Thompson deposit, the

* The Manitoba Division operates under the name of Inco Metals Company.

Photo 67. Aerial View, City of Thompson. The Birchtree Mine headframe Inco Metals Company, may be seen in the right background (INCO).

plans were changed and the Thompson Mine and the City of Thompson came into being.

Concurrent with the exploration work in the Thompson-Moak area, Inco was also active in the Pipe Lake and Soab Lake areas, 32 and 64 km respectively, to the southwest of what is now the City of Thompson. This work resulted in the establishment of three underground mines (Pipe 1, Soab North, Soab South) and one open pit (Pipe 2). As a point of interest, development of the Pipe 2 Open Pit involved pumping out Upper Ospwagan Lake, which overlay the orebody, into Lower Ospwagan Lake using the same dredging equipment that had been used to pump out Steep Rock Lake at Atikokan, Ontario. 9 500 000 cu. m of overburden and 12 200 000 tonnes of waste rock had to be removed in preparing the site.

Photo 68. T-1 Mine Plant Area, Inco Metals Company, Thompson (INCO).

Development of the Thompson Mine and construction of the plant began in 1957. In October of the same year the rail spur to the plant site from Thicket Portage on The Pas-Churchill line was completed. The Thompson plant is a fully integrated nickel complex where mining, concentrating, smelting and refining are done in a single plant area designed to process 10 800 tonnes of ore per day. Production of electrolytic nickel began in 1961 and has continued without interruption since that time. Commencing in 1964, an expansion program covering 7 years began which culminated in bringing into production four additional underground mines and one open pit, all located along Highway 391 southwest of Thompson. Their location with respect to Thompson and the order in which they were brought into production are as follows:

Mine	Approx. Distance	Production Start
Soab North	64 km	1967
Soab South	67 km	1967
Birchtree	6 km	1969
Pipe 2 Open Pit	32 km	1970
Pipe 1	32 km	1970

The planned ultimate depth of Pipe 2 Open Pit is 720 feet (220 m). When this horizon is reached, mining of the orebody will be carried out from underground. Accordingly, sinking of the production shaft began in 1970 and was completed in 1973. Stations were cut at 300 foot (92 m) intervals and lateral development and exploratory drilling was carried out on the 1,500 (458 m) and 2,400 foot (732 m) levels. The latter work was completed in 1977. The workings are being maintained on a standby basis.

Ore from these outlying mines is transported to the Thompson Plant for processing, by truck from Birchtree, and by the Company's railway from Pipe and Soab.

Concurrent with expansion of mining operations, expansion of the plant at Thompson commenced in 1968 and was completed in 1970. This resulted in raising annual production to 45 000 kg, principally electrolytic nickel as a final product, and concentrates containing copper, cobalt and other elements which are shipped to the Company's other plants in Canada and abroad for refining.

In 1971, as a result of a world-wide nickel over-supply situation, Inco effected a curtailment of operations. In Manitoba, this resulted in suspending operations at the Pipe 1 Mine and the two Soab mines. World conditions began to improve in 1973, but by late 1975 a world-wide recession again created an oversupply of nickel. As a result, in 1977 production at the Birchtree Mine was suspended and production at the Pipe 2 Open Pit was reduced. In 1978, all operations at the Birchtree Mine were suspended and the mine was placed on a standby basis. This leaves only the Thompson Mine and Pipe 2 Open Pit in operation at the time of writing, with the other four mines being maintained on standby basis. As a result of the curtailment in the number of operating mines, the Thompson plant's rate of operations was reduced from 10 800 to 9 000 tonnes per day.

By year-end 1979, world inventories of nickel had been depleted to a point where supply and demand were in a near-balanced situation. In order to meet the projected demand for 1980-1985, reactivation of some idle capacity is expected.

As if by design, in anticipation of flux feed for the Thompson smelter, large deposits of gravel and one known quartzite deposit occur in close proximity to the sulphide orebodies. Gravel is mined by various contractors from pits within a 6.4 km radius of Thompson and at the Soab South site. Quartzite is quarried by a contractor, solely for Inco's use, near Manasan Rapids 19 km southwest of Thompson.

The history to date of the Thompson Nickel Belt would not be complete without mention of the activities of Falconbridge Nickel Mines, Limited. Between the years 1960 and 1967, this company carried out an exploration program in the Wabowden area, some 128 km to the southwest of Thompson, which resulted in the discovery of three nickel-copper deposits, namely, Manibridge, 32 km southeast of the town of Wabowden; Bowden, 0.8 km northwest of Wabowden; and Bucko, 3 km southeast of Wabowden.

Manibridge was a small high grade deposit estimated to contain 1 268 100 tonnes of ore grading 2.55% nickel and 0.27% copper to the 1,250 foot (381 m) horizon. Shaft sinking and construction of a mill commenced in 1969. In September 1971, the Manibridge Mine was brought into

Photo 69. T-1 Mine — Battery Locomotive Hauling a Trainload of Ore, Inco Metals Company, Thompson (INCO).

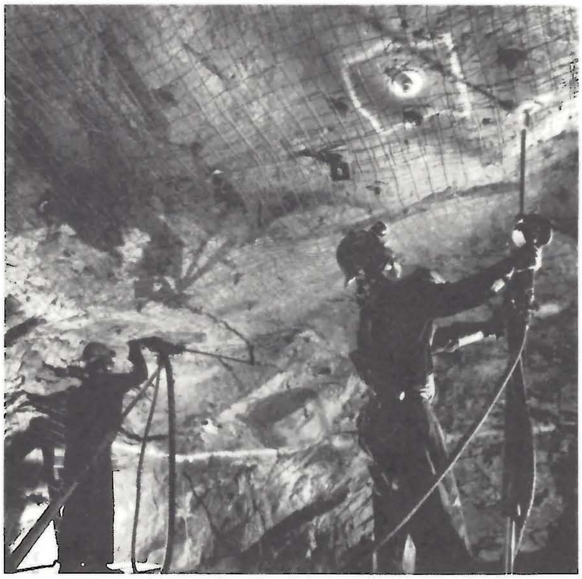


Photo 70. Roof Bolting. Photo illustrates the bolt-and-screen method of roof support. The miner at the right is roof bolting. The miner at the left is drilling the breast (INCO).

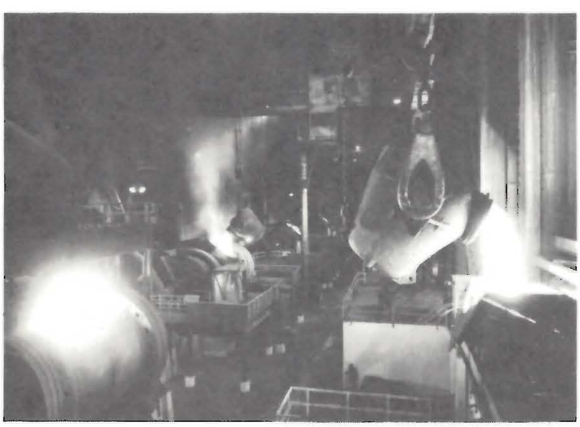


Photo 71. Thompson Smelter, Converter Aisle, Inco Metals Company. The converters are shown to the left in the photo and the reverberatory furnaces to the right (INCO).

Photo 72. Raise Boring Machine at an Inco Metals Company Mine, Thompson Area. The raise is bored to its full size to provide access from one level to another (INCO).

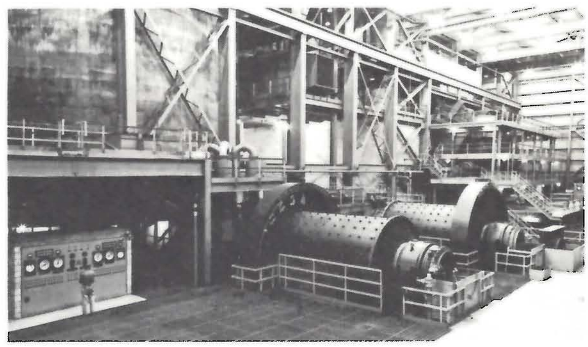


Photo 73. Thompson Concentrator, Grinding Section, Inco Metals Company (INCO).

Photo 74. Thompson Concentrator, Flotation Section, Inco Metals Company. The nickel and copper sulphide particles are separated from the gangue by floating them to the surface of the pulp by aeration, agitation, and the addition of chemicals. The gangue settles to the bottom of the flotation cells (INCO).

production with six years' ore reserves in sight. Throughout the life of the operation, the mill operated at one half of its design capacity of 900 tonnes per day. Operations were terminated in April 1977 due to depletion of recoverable ore. The surface plant and the Company's townsite at Clark Lake are being maintained on a caretaker basis.

In 1970, Bowden Lake Nickel Mines Limited, a company formed by Falconbridge, Consolidated Marbenor Mines Limited and Rio Tinto Canadian Exploration Limited, embarked on a shaft sinking program for the purpose of carrying out an underground diamond drilling program on the Bowden and Bucko deposits. The Bowden Lake Shaft was sunk to a depth of 347 feet (106 m) before the operation was suspended in 1971. The Bucko Lake Shaft was completed to a depth of 1,117 feet (341 m), and extensive lateral work and diamond drilling was carried out on the 1,000 foot (305 m) level. Operations were suspended in December 1972. No further work has been done at either property to date.

Pre-1971 estimates based on surface drilling are stated to indicate a potential of 27 000 000 tonnes of 0.78% nickel under Bucko Lake and 72 000 000 tonnes of 0.6% nickel under Bowden Lake.

Thus far, the section of this text dealing with metallic minerals has traced the history of mines in the northern part of the Province. It is not to be construed, however, that the same minerals have not been found and mined in southern Manitoba. Although these discoveries were made in similar times, they did not materialize as mines until much later than those in the north. In the pages that follow, it will be seen that southern Manitoba has its own storehouse of gold, nickel, copper and several other minerals not yet found in the North.

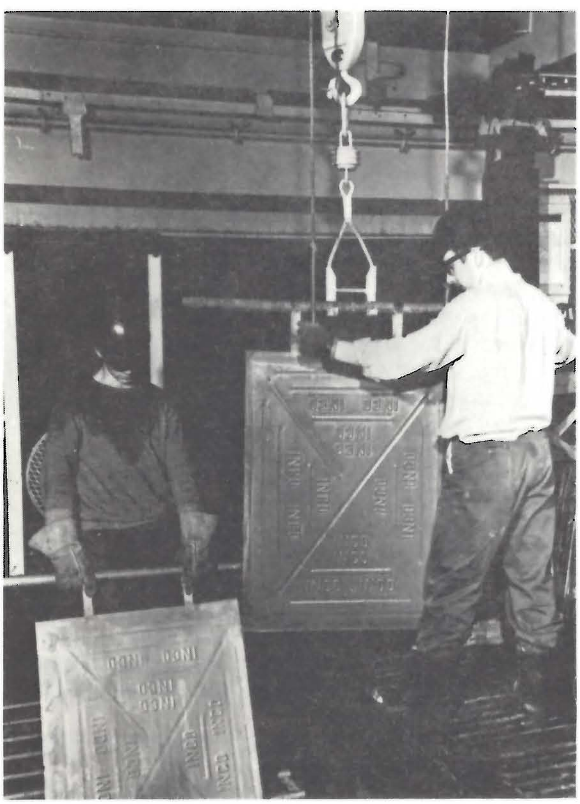


Photo 75. Thompson Refinery, Pulling Cathodes from Electrolytic Tank, Inco Metals Company. The final product (INCO).

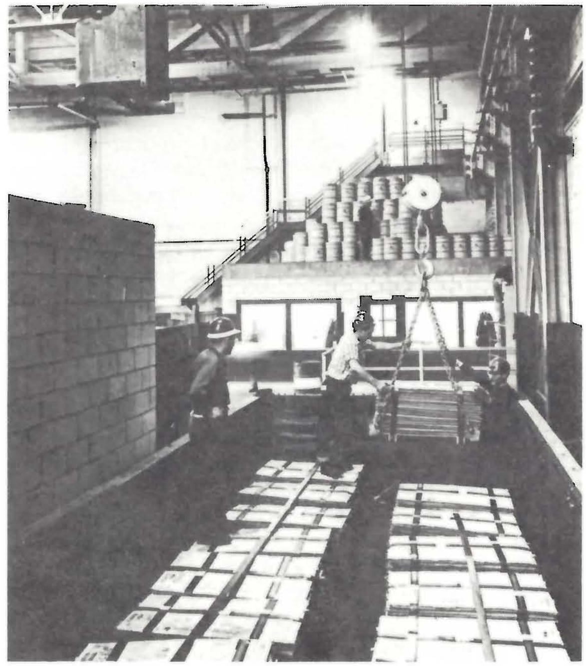


Photo 76. The Final Product — Electrolytic Nickel On Its Way to Markets (INCO).

GOLD (later developments)

Because the search for GOLD and, indeed, the interest in metallic minerals has been traditionally focussed on the northern part of the Province, it is easy to overlook the mineral history and potential of the southeastern part of the Province. Referring to the Geological Map of Manitoba (Page 49), it is seen that rocks of the Precambrian Shield which host the metal mines of the north extend to the southeastern part of the Province. From late in the 19th century to recent times, this area was thoroughly prospected for gold, culminating in the establishment of the gold mining centre at Bissett which, as mentioned previously, enjoyed a period of mining activity from 1927 to 1968. Gold was also discovered in the Star Lake-Falcon Lake area close to the Ontario border. One mine worth mentioning which resulted from prospecting done in this area was the Sunbeam Mine.

The Sunbeam deposit is located 1 km south of Star Lake and about 3 km north of the Trans-Canada Highway. The first known staking of the property took place in 1912. During the years that followed, a considerable amount of surface sampling was done on the Sunbeam and adjoining Waverley deposits, which culminated in the sinking of a shaft on the former in 1928, and diamond drilling during the early 1930's. There is no record of the depth of this shaft or the extent of the underground workings from it. In 1936, the Sunbeam and Waverley properties were assigned to Sunbeam Kirkland Gold Mines Limited. On the basis of favourable results of a diamond drilling program carried out during 1937, the Company proceeded to bring the Sunbeam property into production. Commencing in 1938, a shaft was sunk to a depth of 438 feet (134 m), with stations cut on four levels at intervals of 100 feet (31 m). In 1940, a bulk sample of 4 230 tonnes of gold ore, obtained from two stopes, was shipped to the mill at Kenricia. However, after a dispute between Sunbeam Kirkland and Kenricia on the amount of gold extracted, shipping was discontinued. The mine closed down during February 1940.

During its short life, the Sunbeam produced 4 408 tonnes of ore, yielding 794 oz. of gold and 182 oz. of silver.

Sunbeam Kirkland lost its option on the Sunbeam and Waverley properties in 1941. In 1943, both properties were assigned to Goldbeam Mines Limited. This Company embarked on an extensive diamond drilling program in 1944, which was completed in the following year. On the basis of the results obtained, sinking of a production shaft on the Waverly property commenced in 1945 and was completed in 1946. Three levels were established at 150 foot (46 m) intervals, with drifting and diamond drilling carried out from these workings. The 450 foot (137 m) level was driven a distance of 1,250 feet (381 m) toward the Sunbeam Shaft when, because of financial difficulties, operations were discontinued in late 1946.

Since the time of closure of the Waverley, mining interest in the Star Lake-Falcon Lake area has all but died, a probable reason being that it is embraced by what has become the most highly developed Provincial Government parkland, the Whiteshell. However, early in 1976, the Star Lake area enjoyed a brief period of mining exploration activity, namely, diamond drilling on the Sunbeam and Waverley deposits by Whiteshell Resources Limited. The drilling program was completed during the same year, and no further work was done on the properties.

In the south, as in the north, the search for gold uncovered the presence of other metals which at the time were not of commercial interest, but which today comprise the mining industry of the area encompassed by the Winnipeg, Bird, and Maskwa Rivers, approximately 48 km to the east of the town of Lac du Bonnet.

NICKEL-COPPER

The first NICKEL-COPPER discoveries in the southern part of the Province were staked about 1917 near the Maskwa River and in 1920 at the Bird River. During the 1930's, several thousand feet of diamond drilling was done on some sulphide deposits. Some of these deposits were again drilled by Maskwa Nickel Chrome Mines Limited (a subsidiary of Falconbridge Nickel Mines, Limited) in the 1950's, including what was later to become the Dumbarton Mine, located some 51 km east of Lac du Bonnet on the north shore of the Bird River. This was a small low grade orebody which in itself did not warrant the construction of a treatment plant. However, 40 km to the east at Werner Lake, Ontario, Consolidated Canadian Faraday Limited operated a nickel mine and a 900 tonne per day mill. In 1968, with exhaustion of Faraday's ore reserves in sight, Maskwa and Faraday entered into an agreement whereby Dumbarton Mines Limited was formed to mine the Dumbarton orebody and to deliver ore to the Werner Lake mill for treatment.

Production at Dumbarton commenced in September 1969 at 540 tonnes per day. Ore was hauled to Werner Lake by truck. The concentrate produced was trucked to Lac du Bonnet where it was transferred to railroad cars for shipment to Falconbridge, Ontario, for treatment. As mill feed from Faraday's mine decreased, the amount of Dumbarton ore milled increased progressively until the Faraday mine closed down in 1972. Thereafter, the mill remained in operation for the sole purpose of milling Dumbarton ore, delivery of which peaked at 1 125 tonnes per day.

Three orebodies were mined, namely, the Dumbarton, the Maskwa East Extension, and the Maskwa West Extension, in that order. The first two were mined by underground method from the Dumbarton workings, and the third by open pit. The underground workings extended to a depth of 600 feet (183 m) and the open pit to 150 feet (46 m). As a point of interest, the Dumbarton Mine was the first metal mine in Manitoba to employ a trackless decline as the main entry to the underground workings. Ore was conveyed to surface by means of a conveyor belt.

The Dumbarton orebody was exhausted in December 1974. During its life, 1 440 000 tonnes of ore were produced grading 0.81% nickel and 0.30% copper. The Maskwa East was mined out in May 1975 and the Maskwa West in December 1975, together having produced 448 200 tonnes grading 1.19% nickel and 0.25% copper. The last shipment of broken ore reserves to the Werner Lake mill was made in June 1976, and the last shipment of concentrates to Falconbridge was made in November of the same year. The Dumbarton, Maskwa East and Maskwa West are being maintained in good standing by Maskwa Nickel Chrome Mines Limited.

CHROMITE

In addition to nickel, copper, tantalum and lithium minerals, the Bird River area is known to contain large resources of CHROMITE. Notwithstanding these resources; and those in the Eastern Townships in Quebec, Canada has no production of chromite and must import all of its chromium requirements. The Bird River deposits are a continuous band of chromite mineralization, similar in type to the important chrome deposits in Rhodesia and the Republic of South Africa. However, these Canadian deposits are considered uneconomic because most of the mineralization is low-grade — 10 to 20% chromic oxide — and has a low chromium to iron ratio. The Ontario Research Foundation has in recent years developed a process for upgrading the Bird River chromite to a marketable product. Thus, the future of Manitoba's chromite looks more encouraging than in the past; however, metallurgical research has not yet been successful in developing a method for recovery of chromium at competitive cost.

TANTALUM-CESIUM-LITHIUM

The current TANTALUM mining operation at Bernic Lake owes its inception to the discovery in 1920 of a pegmatite deposit containing tin in the form of cassiterite. The initial exploration and underground development on the deposit was carried out by Jack Nutt Mines Limited during 1929 and 1930, TIN being the metal sought. By January 1930, the shaft (the present main ventilation shaft) had reached a depth of 165 feet (50 m) and a level had been established at the 125 foot (38 m) horizon, when a heavy inflow of water occurred in the shaft with which the pumping facilities could not cope. Operations were then suspended pending acquisition of a larger plant.

In addition to tin, a deeper level deposit was found containing BERYL, SPODUMENE, QUARTZ, FELDSPAR, MICA, TANTALITE and COLUMBITE. Jack Nutt Mines Limited changed its name to The Consolidated Tin Corporation Limited and made plans to mine the deposit, recover these minerals, and sell them as ore for the metals they contain. However, these plans were not pursued and the Company lost title to the ground.

This ended the first, or what may be called the tin chapter in the history of this unique deposit.

The property remained dormant for the next twenty-five years when, in 1955, in response to world demand for LITHIUM, it was again the focus of attention. In that year, Montgary Explorations Limited acquired title to the property

Photo 77. Jack Nutt Shaft and Power Plant, Jack Nutt Mines Limited, Bernic Lake (ca. 1930) (TANCO).

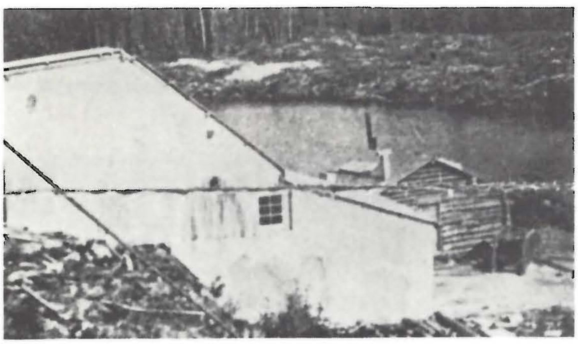


Photo 78. Test Mill and Assay Plant, Jack Nutt Mines Limited, Bernic Lake (ca. 1930) (TANCO).

Photo 79. Framing Jack Nutt Shaft Timber by Hand, Bernic Lake, 1928 (TANCO).

and, during 1955 and 1956, conducted an extensive drilling program to test the lithium content of the orebody. On the basis of the results obtained, SPODUMENE reserves were estimated to be 7 020 000 tonnes grading 1.85% lithium oxide. Late in 1956, sinking of the production shaft (the one currently used as such) commenced. Concurrently, in 1957, The American Metal Company of Canada (AMCO) took an option on the property from Montgary and conducted its own drilling program. The AMCO drilling not only confirmed and added to the Montgary estimated reserves, but also encountered massive POLLUCITE containing up to 35% CESIUM. In spite of these favourable results, AMCO did not exercise its option, deeming the market outlook for lithium and its derivatives to be unfavourable.

Suspension of the underground work followed in 1957. The shaft had been sunk through a narrow section of the main ore zone and reached a depth of 306 feet (93 m). The shaft was allowed to flood. At the time, an estimated 900 tonnes of ore was stockpiled on surface. Reserves were estimated to be in excess of 8 100 000 tonnes averaging 2.14% lithium oxides. Thus ended, for the time being, the lithium chapter of the property's history.

In 1959, Montgary pumped out the shaft and commenced drifting toward the pollucite deposit on the 285 foot (87 m) level. By June 1960, a stockpile of 2 041 tonnes of cesium ore averaging close to 27% cesium oxide was accumulated. By the end of the year, 2,900 feet (885 m) of lateral work and 7,000 feet (2135 m) of underground diamond drilling had been completed. Montgary changed its name to Chemalloy Minerals Limited. The mine remained open for two more years, but no further work was undertaken except for the removal of small quantities of QUARTZ and POLLUCITE from the underground workings. The mine was allowed to flood in 1962. During the next five years, Chemalloy sold POLLUCITE ore from the stockpile to the U.S.A.'s space industry, where cesium was used as a propellant in rocket engines. Thus, POLLUCITE can be said to be the Bernic Lake deposit's first cash product. While cesium has a growing number of uses in the chemical industry, the indications are that its main markets are in the future, namely, magnetohydrodynamic (MHD) power generation and space propulsion.

Unlike the preceding chapters in the history of the deposit, the cesium chapter is not closed, not even temporarily. Although not the main cash product, research activities in space propulsion and MHD continue to provide a potential market for the mine's POLLUCITE.

Concurrent with commencement of drifting toward the pollucite zone in 1959, the decision was made to examine a large body of aplitic albite for columbium-tantalum content. Although the presence of several million tonnes of aplitic albite had been known for years, the material had been previously assayed only for tin content. Assays of a 450 tonne bulk sample of albite removed from the shaft averaged 0.1% TANTALUM and 0.01% columbium. A composite sample representing a drift length of 211 feet (64 m) through the beryl-tantalite zone yielded an assay of 0.42% tantalum pentoxide.

As mentioned in the foregoing, the mine was closed in 1962. It was not until 1967 that examination of the tantalum content of the deposit was resumed. The mine was reopened and an underground exploration program undertaken, coupled with mill tests of samples, channel and bulk, taken from the mine. This work outlined approximately 1 800 000

Photo 80. Surface Plant, TANCO Mine, Bernic Lake (MED).

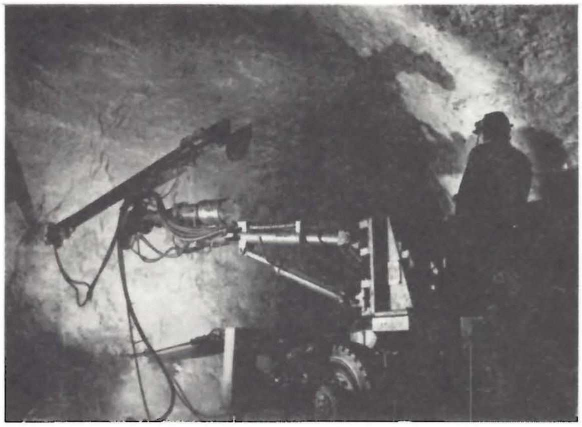


Photo 81. Drilling the Round, TANCO Mine, Bernic Lake (MED).

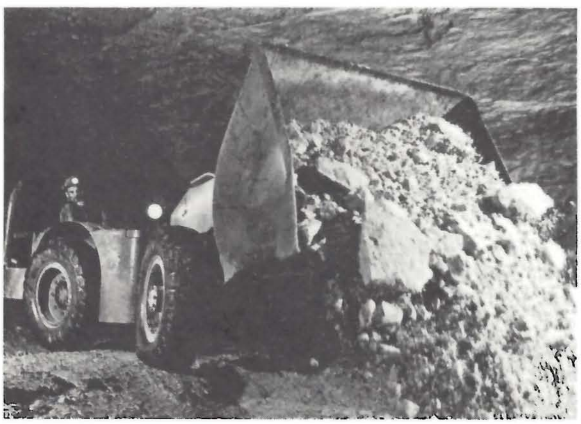


Photo 82. Dumping Muck at the Ore Pass, TANCO Mine, Bernic Lake (TANCO).

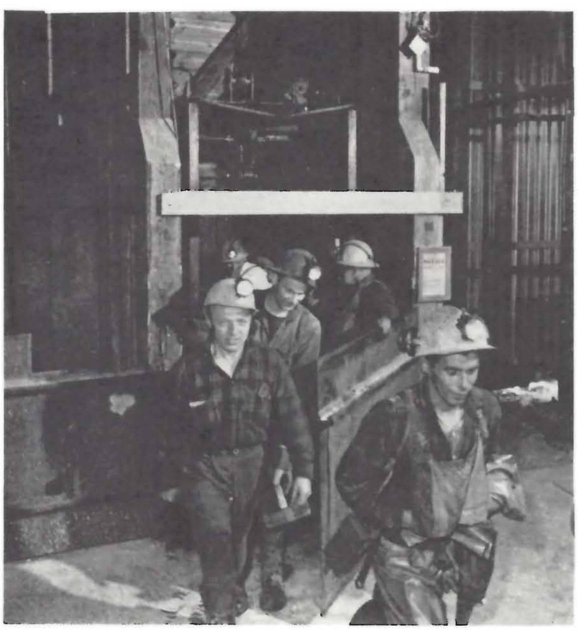


Photo 83. The End of the Shift, TANCO Mine, Bernic Lake, Miners disembarking from the cage at surface (TANCO).

Photo 84. TANCO Mill, Main Control Panel, Bernic Lake (MED).

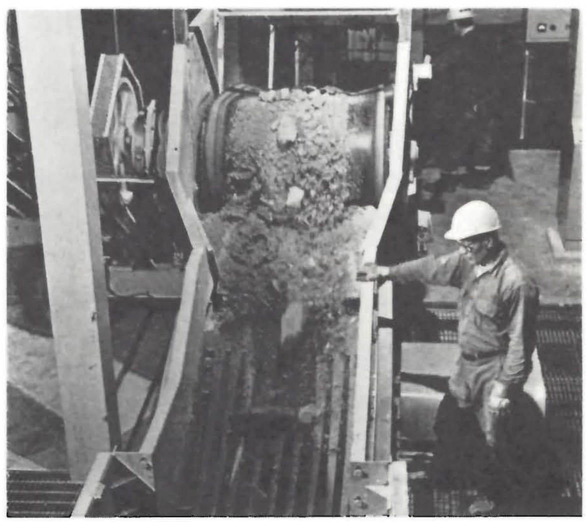


Photo 85. TANCO Mill, At the Primary Crusher, Bernic Lake. Crushing mine run — the first stage in the recovery of tantalite (MED).

Photo 86. TANCO Mill, Packaging the Final Product for Shipment — Tantalite Concentrate, Bernic Lake (MED).

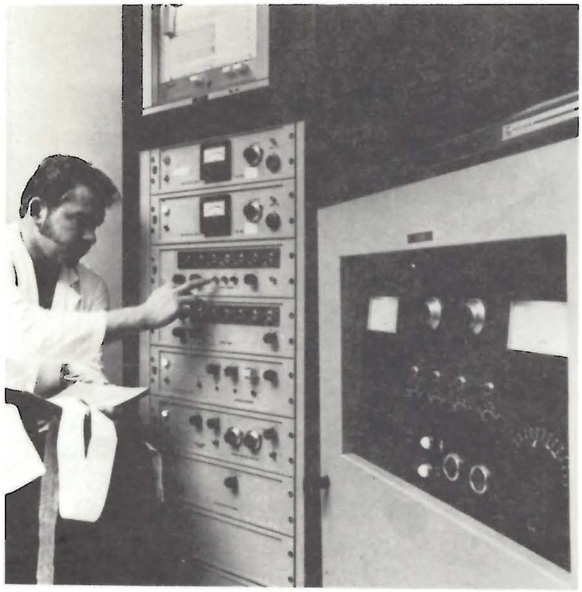


Photo 87. TANCO Mill, Assaying the Ore by X-ray Analysis, Bernic Lake (MED).

tonnes grading 0.23% tantalite (tantalum pentoxide). On this basis, a new company was formed, Tantalum Mining Corporation of Canada Limited (TANCO), the present operator of the mine. Construction of the mill and deepening of the shaft commenced. Production began in September 1969 and has continued since that time. A TANTALITE concentrate is produced and sold, principally to customers in the United States.

Late in 1979, the Company embarked on a mill expansion program designed to increase milling capacity to 900 tonnes per day, and to permit re-processing the tantalite tailings produced in previous years. Construction of the addition to the mill is scheduled for completion in June 1980.

Ore reserves as of January 1, 1980, were estimated as follows: tantalite — 1 100 000 tonnes grading 0.15%; spodumene (lithia) — 6 980 000 tonnes grading 2.76%; pollucite (cesium oxide) — 270 000 tonnes grading 23.0%. The tantalite and pollucite reserves are the largest of their kind in the world, and the spodumene body is the richest deposit of its size in the world.

The principal markets for the metal tantalum are in the manufacture of electrolytic capacitors, electronic equipment, cutting tools, dies, and chemical processing equipment. Other uses for the metal are also growing, notably in aerospace and nuclear power components.

As a background to the emergence of tantalite as the lifeblood of the mine, the Company has been working toward developing markets and production mechanics for extracting LITHIUM from the spodumene orebody. Spodumene pilot plant trials by TANCO at Bernic Lake and by Kawecki Berylco Industries in Boyertown, Pennsylvania, were successful in producing a high grade lithium oxide concentrate suitable for use in the glass-ceramics industry. Plans are in hand for the construction of a plant to produce lithium compounds in Manitoba. Lithium compounds have a wide variety of uses, examples of which are in the manufacture of pharmaceutical products, lubricants capable of use under extremes of temperature, and synthetic rubber. It is interesting to note that lithium hydroxide was used in canisters aboard the Apollo XI moon flight as the Environmental Control System to keep the air clean.

In summary, the history of the TANCO mine has been one of repeated starts, closings, and reopenings. It started as a hopeful tin producer. When that failed to materialize, lithium was the next hope, a hope which in turn had to be foresaken. Then followed cesium at the dawning of the space-MHD age, with the promise which this age holds for cesium in the future. Hitherto ignored among the vast family of exotic minerals which the deposit contains, tantalum finally emerged as the "family breadwinner," supporting the rest of the members while they find their place in the world's markets. Tin, lithium, cesium and tantalum are only some of the rare metals known to be contained in the Bernic Lake deposit. Beryllium, gallium, rubidium, to name a few of the others, are already finding uses in the aerospace, electronics and chemical industries. Hence, the term "space age minerals" is an apt label for the minerals of the deposit. The history of the TANCO mine is a classic example of "what may not be pay ore today may be pay ore tomorrow." Maybe this mine's history will turn full circle and TANCO may yet become a tin mine.

Besides TANCO and Dumbarton, three other mining operations, presently dormant, are worthy of mention, namely, the Diana-Gem Lake Mine, the Irgon Mining Claim, and the Eagle group. The first named was a GOLD producer, the second a LITHIUM development, and the third a COPPER-NICKEL development.

The Diana-Gem Lake property, at Kickley Lake approximately 128 km by road to the northeast of Lac du Bonnet, was first staked in 1926. In the same year, Gem Lake Gold Mining Company Limited was formed and took over the property. Two years later, this company merged with Boundary Mines, Limited to form Gem Lake Mines Limited. By 1932, a 45 tonne mill had been built, and production had commenced. The mine workings consist of a shaft 775 feet (236 m) deep with six levels at 125 foot (38 m) intervals, starting at the 125 foot (38 m) level. The same year, 1932, saw the liquidation of Gem Lake Mines Limited and acquisition of the holdings by Diana Gold Mines Limited. The latter, in turn, was liquidated in 1936 and Consolidated Diana Gold Mines Limited acquired the property. With the exception of the period of 1933-1934, the mine remained in production throughout these corporate changes until 1938, when it became inactive. Surface clean-up operations during 1940-1941 completed the production of gold. However, in response to the recent rise in the price of gold, interest in the property has revived. At present, the property is held by Rock Ore Exploration and Development Limited. During 1976, this Company carried out a sampling program on the Diana tailings pond to determine the feasibility of profitably recovering gold from the tailings. No further work on the property has been reported since that time. During its life, this mine produced 7,574 oz. of gold, and silver in the order of 425 oz.

The Irgon Mining Claim on the north shore of Cat Lake, approximately 80 km by road northeast of Lac du Bonnet, was staked in 1926. In 1938, The Lithium Corporation of Canada, Limited acquired the claim. During 1956-57, a shaft was sunk to a depth of 241 feet (74 m) and a level established at the 200 foot (61 m) horizon. Surface and underground exploration yielded indicated reserves of 1 083 150 tonnes of ore grading 1.5% lithium oxide. Work was suspended in 1957, awaiting a more favourable market for lithium oxide. The Lithium Corporation of Canada, Limited continues to hold the property.

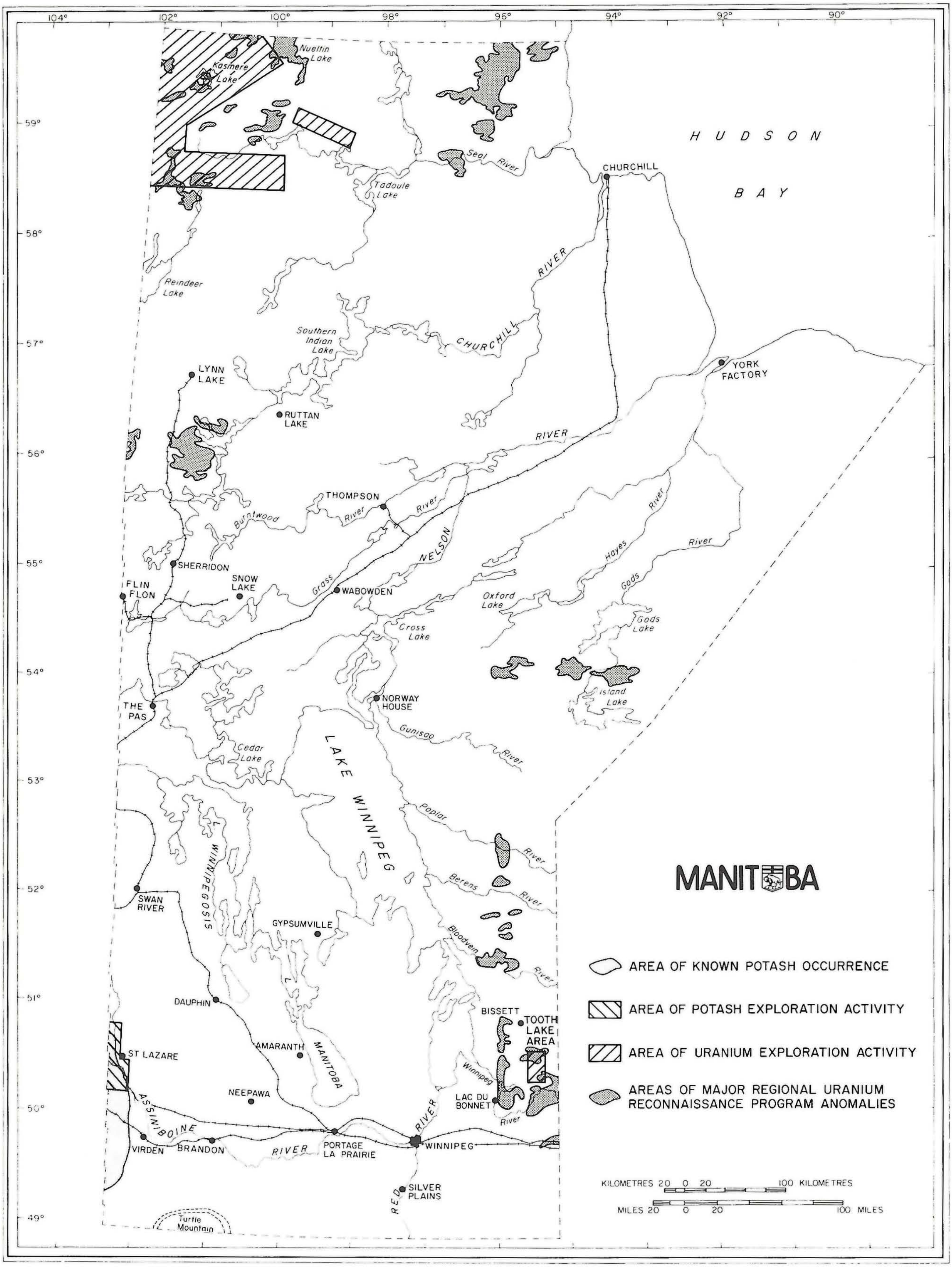


Figure 6. Areas of Uranium and Potash exploration.

The Eagle group of claims are located 2.4 km southwest of the westerly tip of Cat Lake, approximately 80 km by road from Lac du Bonnet. Although the claims were first staked in 1929, it was not until 1943 that copper-nickel sulphides were found on them. New Manitoba Gold Mines Limited optioned the property in 1955. Following completion of a surface exploration and diamond drilling program, shaft sinking was commenced in 1956 and was completed to a depth of 632 feet (193 m) in 1957. Four levels were established, the deepest being at the 600 foot (183 m) horizon. Construction of a 900 tonne concentrator begun but was not completed when operations were suspended in 1957. No further underground work has been done since that time. Also in 1957, the company's name was changed to New Manitoba Mining & Smelting Co., Limited. The property was later assigned to Manoka Mining & Smelting Co., Limited but remained dormant until 1971, when Manoka was re-organized as Cat Lake Mines Limited. This Company carried out a surface exploration and diamond drilling program during 1971-1972. The property has been dormant since that time. Ore reserves were estimated at 583 200 tonnes grading 0.24% nickel and 0.58% copper. The property is currently held by Eldorado Gold Mines Inc.

URANIUM & POTASH

Two minerals, not yet mined in Manitoba, but which deserve mention, are URANIUM and POTASH.

URANIUM

During the 1950's the demands of the United States Government for strategic stockpiles spurred exploration for uranium throughout the country. In Manitoba, the search was focussed in the southeastern part of the Province in the Tooth-Flintstone Lake area, some 64 to 80 km southeast of Bissett. No significant finds resulted and, with slackening of the world demand, uranium exploration in the Province all but ceased. The late 1960's saw a revival of interest in uranium, this time spurred on by the needs of the emerging nuclear energy field. The discovery of a rich deposit at Rabbit Lake in Saskatchewan, and the tracing of the Wollaston uranium belt into the northwest corner of Manitoba (Kasmere Lake area) focussed attention on this area of the Province as a target for uranium exploration activities. In 1971, the demand for uranium slackened again and, consequently, exploration for the mineral died down. However, developments on the Saskatchewan side of the border, where the Rabbit Lake find was brought into production, kept interest in Manitoba's northwest corner alive up to the late 1970's.

In response to the export restrictions placed on oil by the OPEC nations in recent years, the search for uranium has again gained momentum. In 1975, the Manitoba and Federal Governments launched a jointly funded mineral exploration program for the purpose of obtaining and publishing, for the public's use, an inventory of the Province's mineral potential. Publication of the first year's results was followed by an accelerated pace of uranium exploration by the private sector, principally in the northwest corner of the Province. However, the focus of uranium exploration has more recently been switched to Saskatchewan following the discovery of major deposits surrounding the Athabaska Basin. The map on page 34 shows where exploration activities are currently concentrated in Manitoba.

POTASH

In the previous pages, the point is made that the search for gold led to the discovery of the deposits which created the Province's base metal mining industry. It has also been mentioned that the Flin Flon mine's orebody straddles the Manitoba-Saskatchewan border. This situation has its parallel further south along the same common boundary. Here also, the search for one mineral, oil, led to the discovery of another mineral, potash — in beds also straddling the Manitoba-Saskatchewan border.

The first recorded find of potassium minerals in Manitoba was made in 1951 when the Calstan Daly well intersected a bed of potash 13 km west of Virden at a depth of approximately 3,800 feet (1 140 m) from surface. However, it was not until exploration on the Saskatchewan side of the border revealed large potash deposits that serious exploration for the mineral was undertaken in the adjacent area of Manitoba. Here, the original exploration for potash was undertaken in 1956. In that year, S.A.M. Exploration Limited commenced exploration in the St. Lazare area. In 1959, the S.A.M. property was optioned to Tombill Mines Limited (later Sylvite of Canada Limited) and further drilling was carried out. This work resulted in outlining 225 million tonnes of ore grading 23.6% K_2O in a bed 2 m thick, ranging in depth from 810 to 900 m from surface.

In 1966, Prairie Potash Mines Limited undertook an exploration program in the area south of the Sylvite of Canada property and, reportedly, outlined 50 year ore reserves grading 22.5% K_2O in a bed ranging from 840 to 960 m below surface. Because of the prevailing over-supply in the potash market at the time, (1975), development of the deposit was not pursued, and interest in Manitoba potash waned.

Renewed interest has resulted in the signing of a letter of intent, in April 1980, by the Manitoba Government and International Minerals and Chemical Corporation (Canada) Ltd. under which I.M.C. will carry out a $2 million exploration program on the Crown-owned potash rights in the area south and west of St. Lazare.

Geological data compiled to date indicate that the Manitoba potash zone is the southeastward extension of that in Saskatchewan which hosts that Province's potash mines. Drill data indicate that the Manitoba zone extends along the common border from Township 21 to Township 4, a distance in the order of 160 km. The northern and southern limits have not yet been defined. The eastern limit extends approximately 5 km to 29 km east of the border (at Virden).

It should be mentioned that the Manitoba potash deposits are among the "cleanest" in Western Canada.

Almost 95% of the world production of potash is used in fertilizers. However many other applications of potash are nevertheless very important. Most of these applications are of a chemical nature for which various salts of potassium are produced.

AGGREGATES

From the foregoing, the impression may be formed that the industrial and aggregate mineral mining industry of the Phanerozoic region of the Province is insignificant in comparison with the metal mining industry of the Precambrian Shield. Such is not the case. One has only to leave the outskirts of Winnipeg and drive on any highway throughout the extent of the southern Phanerozoic region to realize that the mining of sand, gravel and stone is "big business." The reason that attention has not focussed on this facet of the mining industry may be explained by the fact that, in contrast with the minerals of the Precambrian Shield, the aggregate deposits are relatively close to the markets, accessible by rail and road, and relatively easy to find. Indeed, it may be said that these deposits have not had to be "discovered." They have always been with us, so to speak. Hence, this industry has not been cloaked with the aura of glamour, adventure and achievement of man's ingenuity and perseverance against the obstacles which nature pits against the search, discovery and bringing into production the metallic mines of the Precambrian Shield. An appreciation of the importance of the industrial mineral sector to the Province may be gained from the fact that quarrying dispositions in any one year comprise a total in the order of 12 400 hectares, the number of active operators is in excess of 300, and the latest total value of production is in the order of $90.5* million. Of the latter figure, sand and gravel production accounted for $30.0 million and cement production $38.7 million.

* Preliminary estimate for 1979, Province of Manitoba, Department of Energy and Mines.

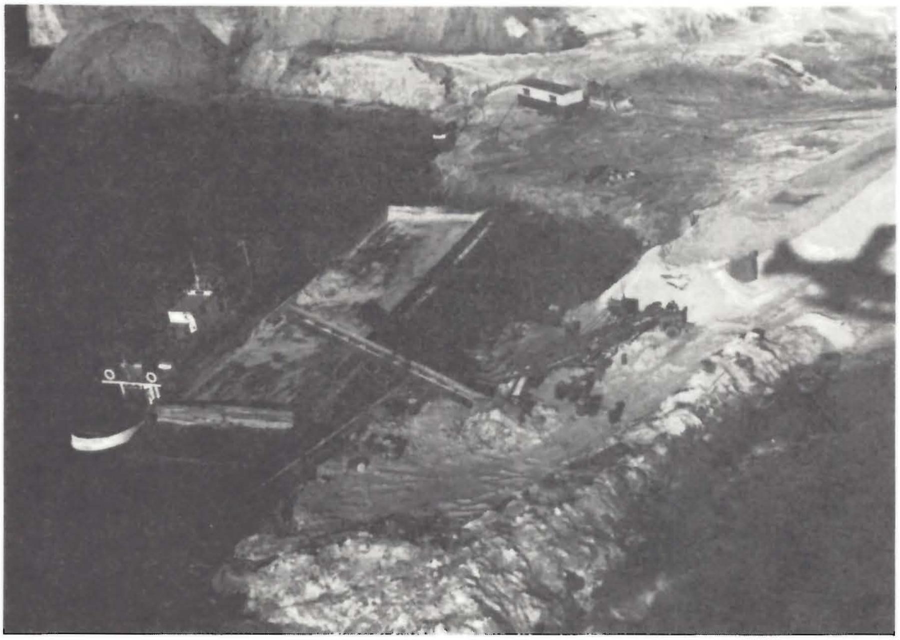


Photo 88.
Loading Silica Sand on Barge at Black Island, Lake Winnipeg, Steel Brothers Canada Ltd. (MED).

Photo 89.
Pumping Silica Sand to Stockpile, Alsip Brick, Tile & Lumber Co., Ltd., Beausejour (MRD).

SUMMARY

The history of mining in Manitoba commenced with the production of salt from brine wells and the mining of limestone, gypsum, clay and coal deposits during the early days of the Red River settlement, before the turn of the century. With the exceptions of salt and coal, the mining of these minerals continued uninterrupted and today, together with sand and gravel, support a flourishing industrial minerals industry.

Serious prospecting for metallic minerals, principally gold, dates from the years immediately preceding World War I. However, it was not until the late 1920's that sustained gold mining was established. The search for gold led to the discovery of the base metal deposits which today are the lifeblood of the Province's metal mining industry. Copper, nickel, and zinc are recovered from these deposits, as well as a host of by-products, including gold. Ironically, though the search for gold fathered the Province's metal mining industry, since 1968 there has not been one producing gold mine operating within its boundaries. As if to compensate for this loss the Province, during the same decade, has become the world's principal supplier of two "space age" minerals — tantalum and cesium — with the promise of a third — lithium — a foregone conclusion.

In addition to metals and industrial minerals, the Province shares a modest place in the country's petroleum industry. Although exploration for this mineral dates from the late 1800's, it was not until the early 1950's that oil was commercially produced.

This record is brought to a conclusion at this point on the hopeful note that three more minerals — uranium, potash and chromite — may well be added to the list of those which today are the mainstay of the Province's mining industry.

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MINERAL PRODUCTION

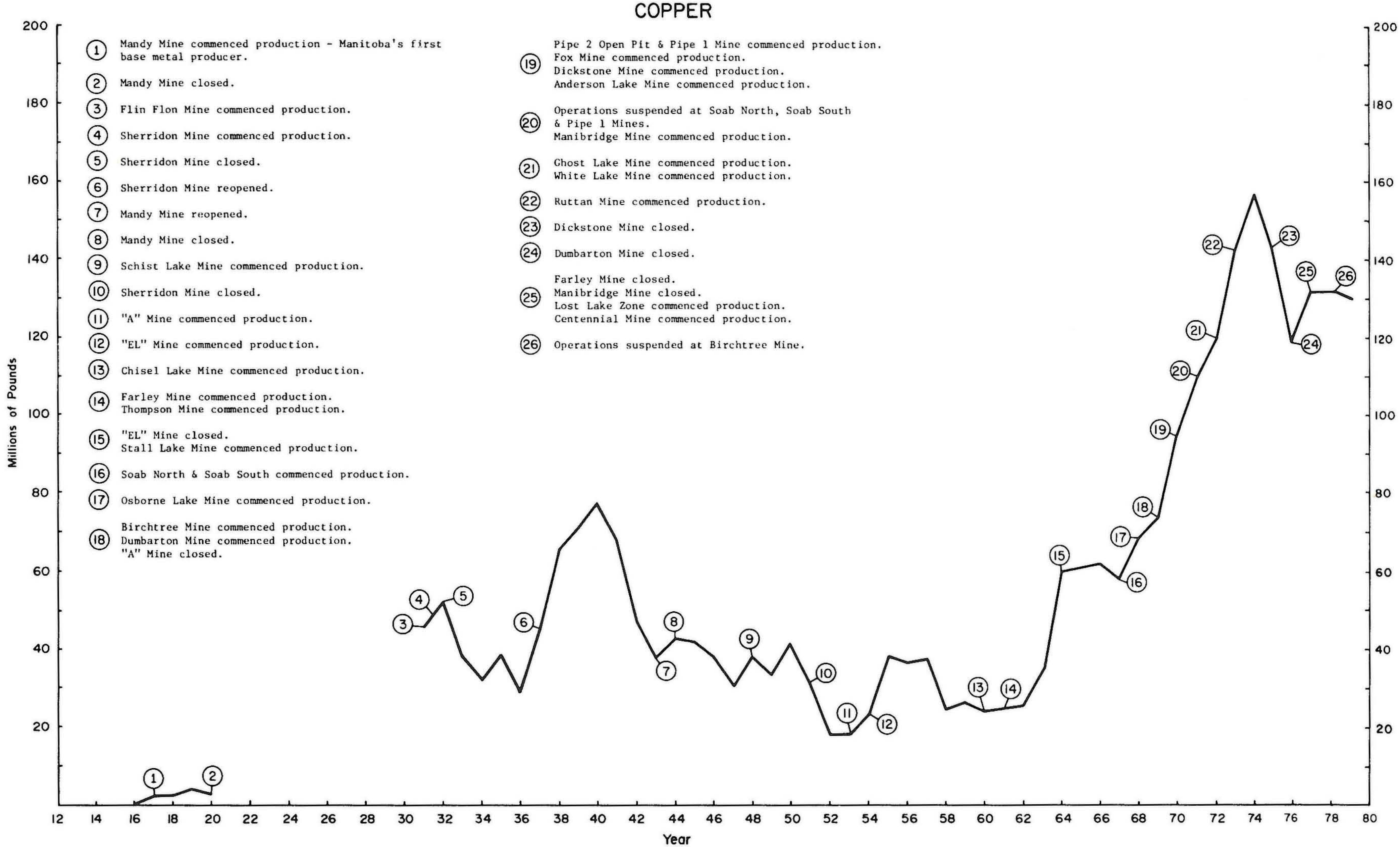
TABLE SHOWING MINERAL PRODUCTION OF MANITOBA BY PRODUCTS*

	Revised 1978			Estimated 1979		
METALS	Quantity		Value	Quantity		Value
Cadmium	56 291 kg	125,090 lbs	$ 349,627	60 300 kg	134,000 lbs	$ 434,000
Cobalt	324 173 kg	720,385 lbs	8,723,972	266 850 kg	593,000 lbs	14,814,000
Copper	59 761 651 kg	132,803,668 lbs	99,052,944	58 700 250 kg	130,445,000 lbs	139,288,000
Gold troy ozs		47,366	10,439,798		42,000	14,357,000
Lead	527 548 kg	1,172,329 lbs	431,687	304 650 kg	677,000 lbs	403,000
Nickel	34 364 137 kg	76,364,749 lbs	160,846,639	36 409 050 kg	80,909,000 lbs	221,918,000
Selenium	15 357 kg	34,127 lbs	583 913	16 200 kg	36,000 lbs	527,000
Silver troy ozs		923,978	5,701,868		861,000	10,221,000
Tantalum	157 519 kg	350,042 lbs	8,116,000	157 500 kg	350,000 lbs	14,521,000
Tellurium	2 858 kg	6,352 lbs	144,908	5 400 kg	12,000 lbs	274,000
Zinc	56 619 104 kg	125,820,229 lbs	43,731,337	45 891 900 kg	101,982,000 lbs	44,604,000
Total Metals			$338,122,693			$461,361,000
INDUSTRIAL MINERALS						
	(tonnes)	(tons)		(tonnes)	(tons)	
Clay Products	—	—	2,000,000	—	—	2,800,000
Cement	675 864	750,960	34,544,160	688 500	765,000	38,712,000
Gypsum	181 263	201,403	1,125,376	126 900	141,000	963,000
Lime	—	—	3,300,000	—	—	1,905,000
Peat Moss	32 534	36,149	3,952,855	33 300	37,000	4,103,000
Quartz	345 377	383,752	2,122,147	369 000	410,000	2,124,000
Salt	7 776	8,640	49,680	—	—	—
Sand & Gravel	13 076 011	14,528,901	27,973,743	13 500 000	15,000,000	30,000,000
Stone	2 657 099	2,952,332	8,628,186	2 880 000	3,200,000	9,920,000
Total Industrial Minerals			$83,696,147			$90,527,000
FUELS						
	(cubic metres)	(bbls)		(cubic metres)	(bbls)	
Petroleum, crude	598 354.0	3,765,364	$ 45,937,440	583 376.6	3,670,797	$ 48,275,000
GRAND TOTAL			$467,756,280			$600,163,000

Sources: Energy, Mines & Resources, Ottawa
Mineral Resources Division

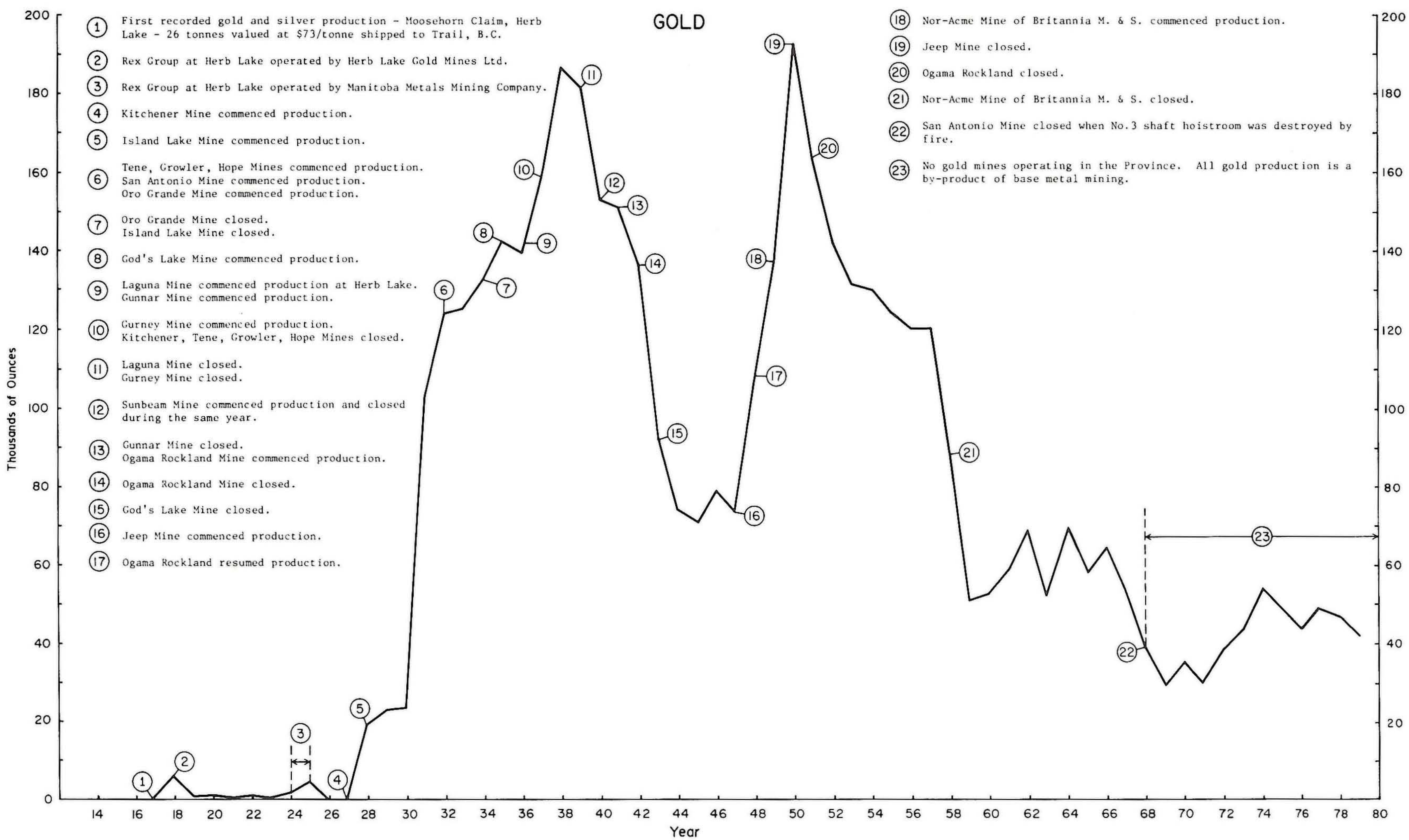
*Includes Tantalum quantity and value figures which were previously not available.
Conversion factors used: 0.45 kg equals 1 lb.
0.90 tonne equals 1 ton

COPPER



ANNUAL METALS PRODUCTION

MANITOBA



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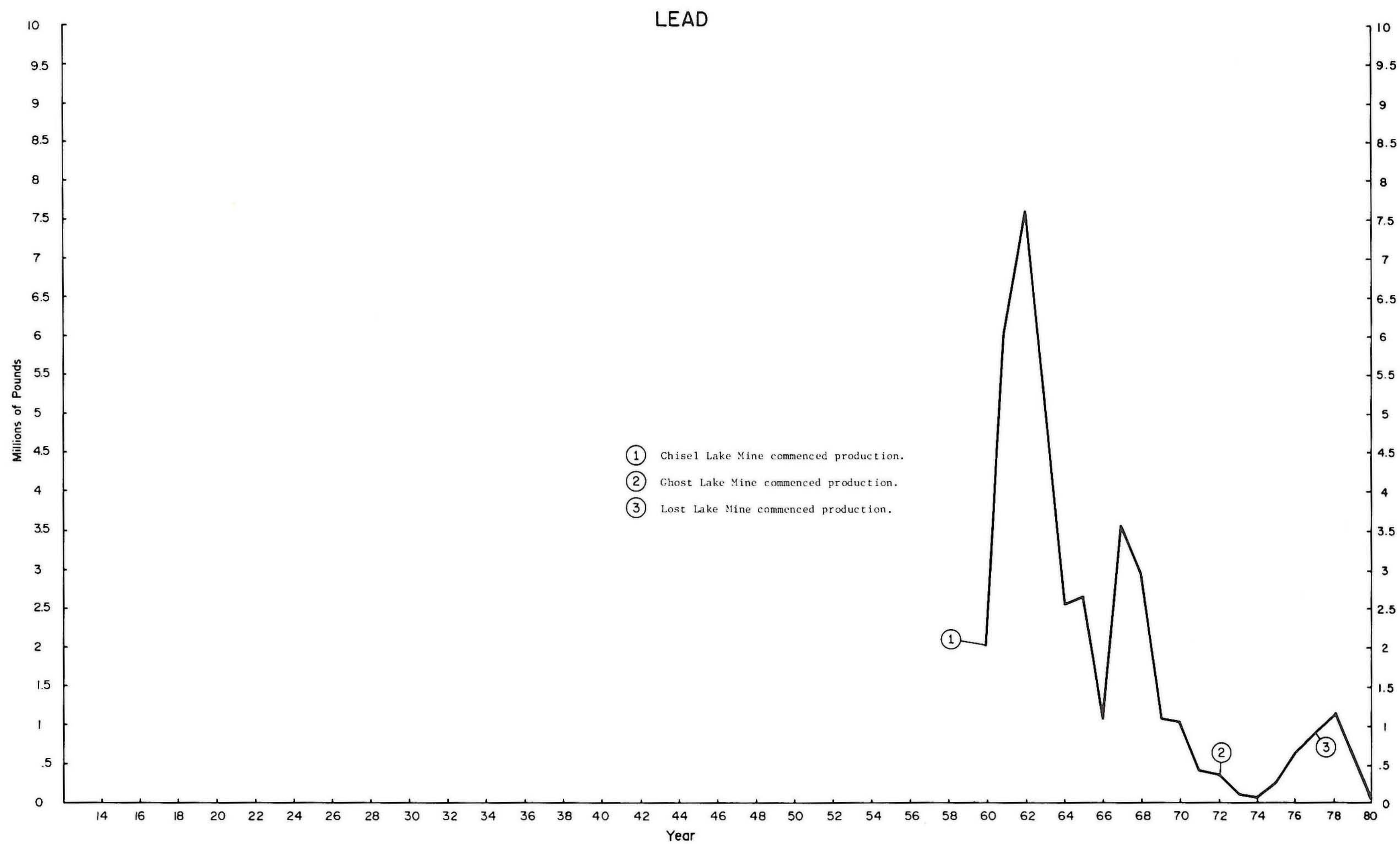

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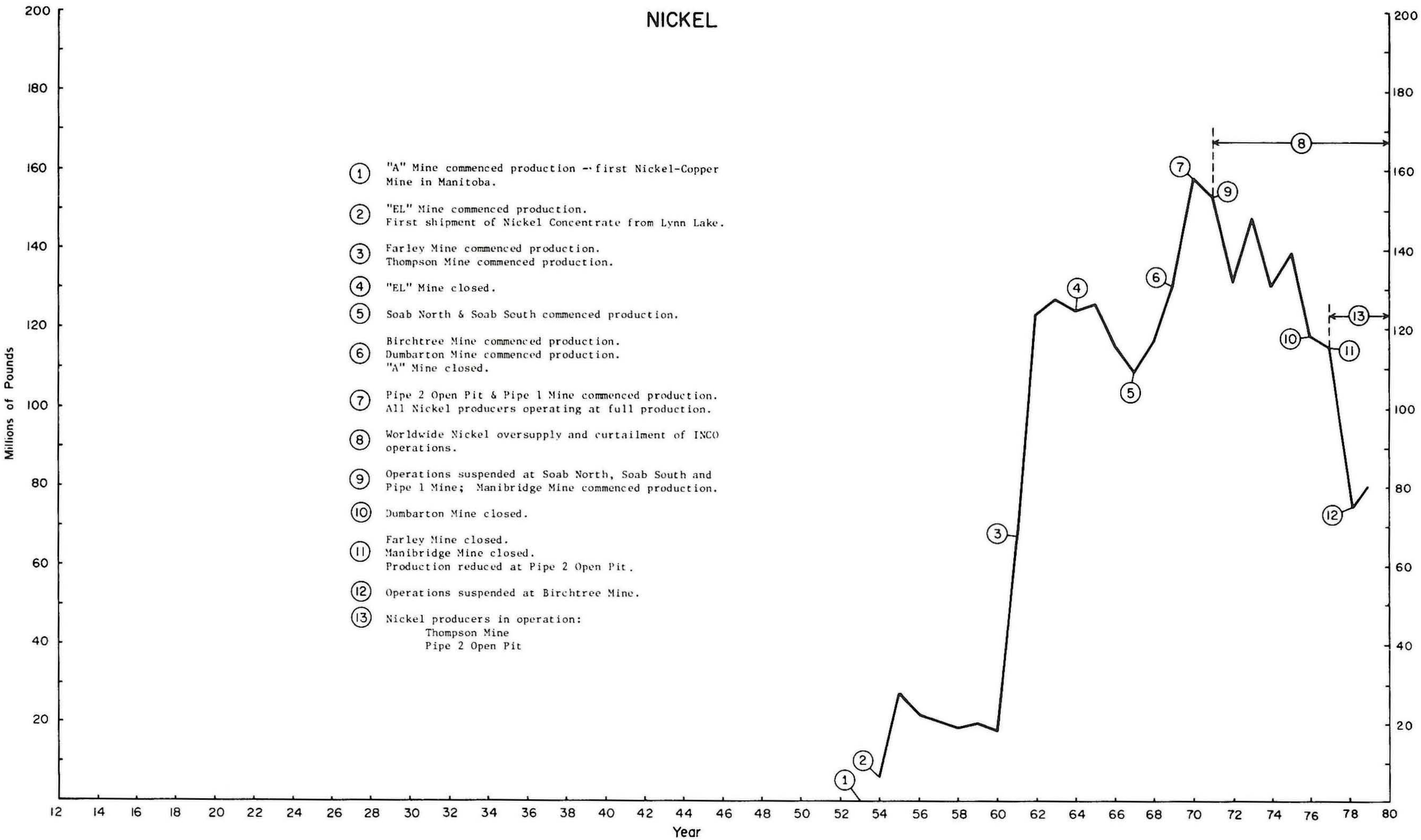

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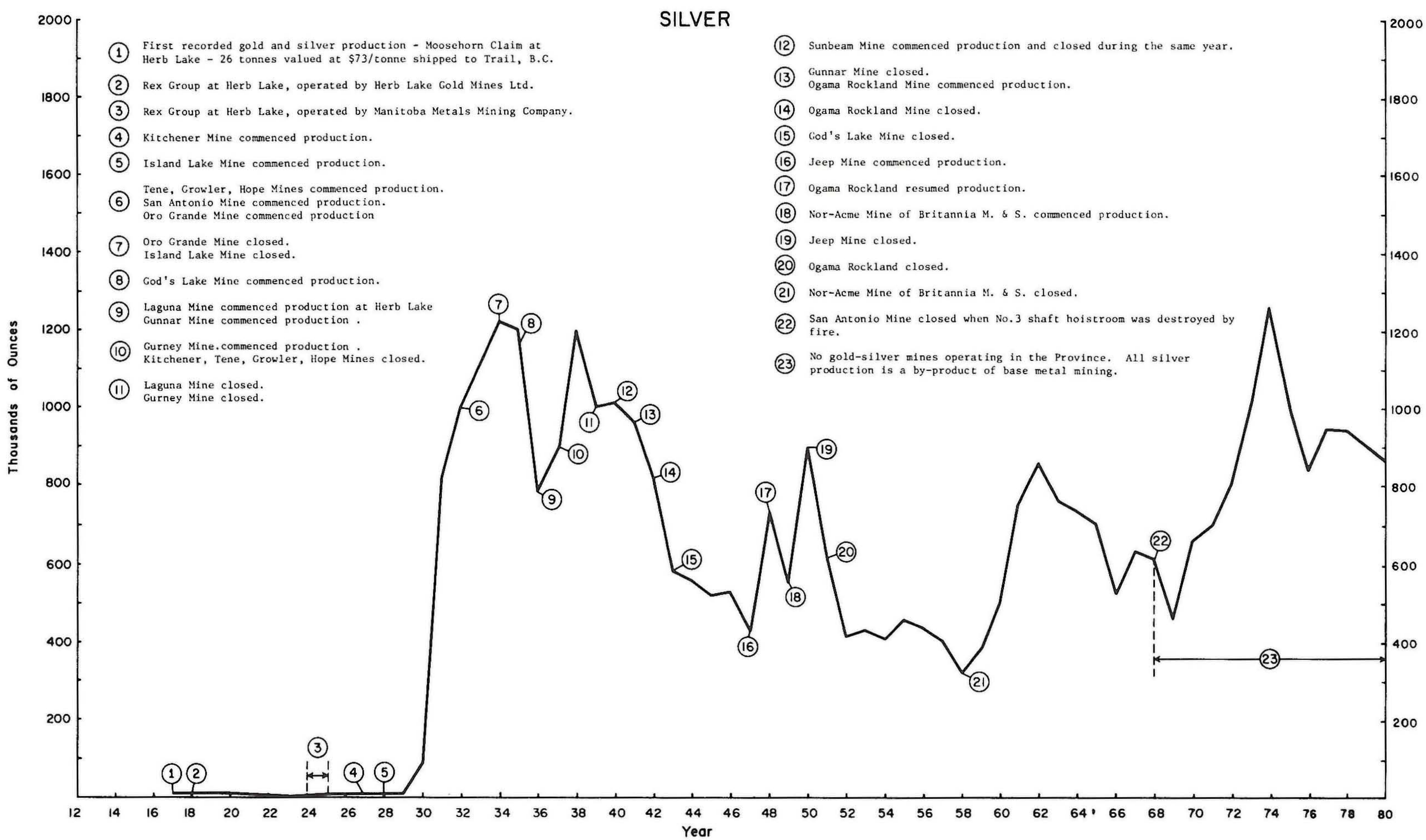

ANNUAL METALS PRODUCTION

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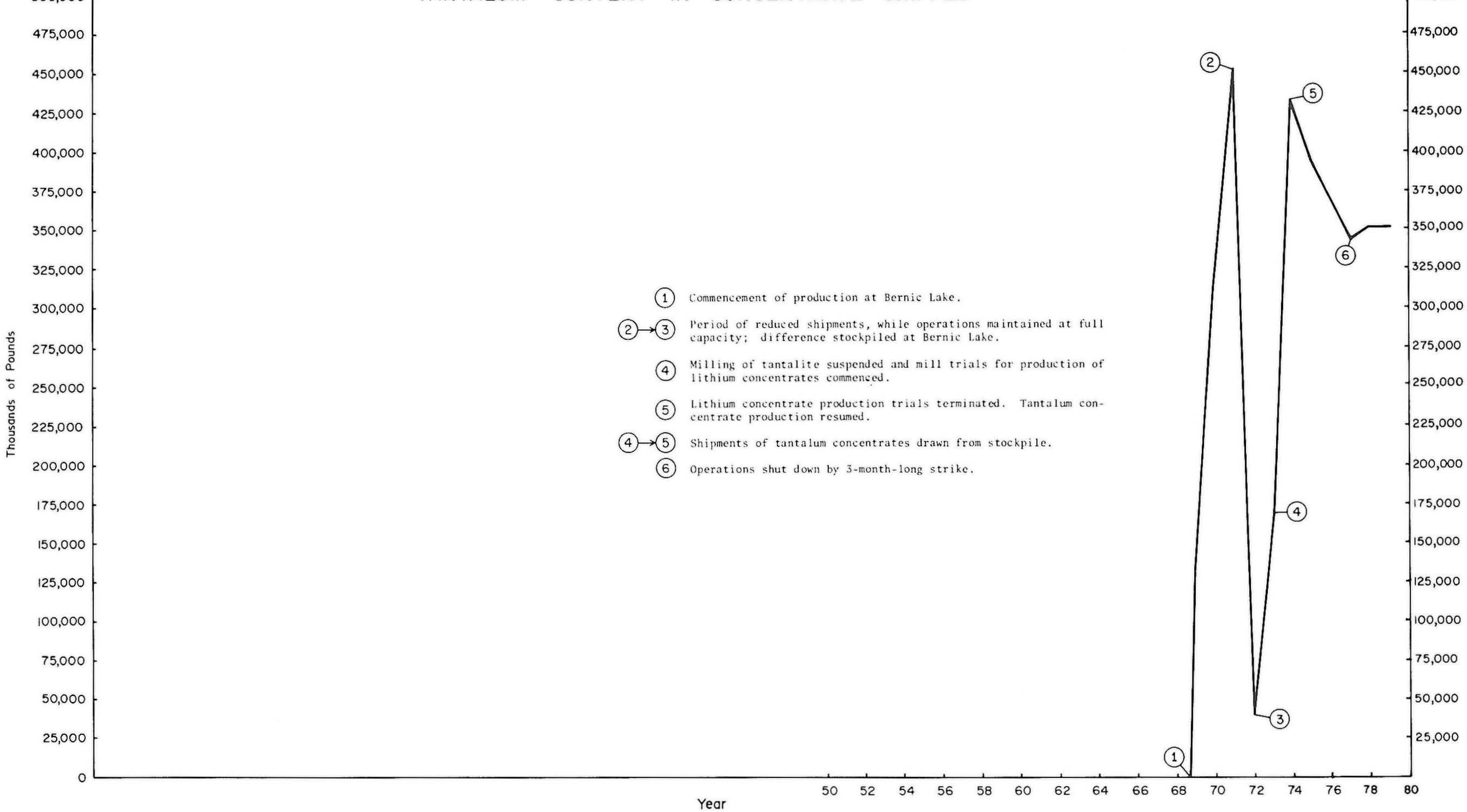
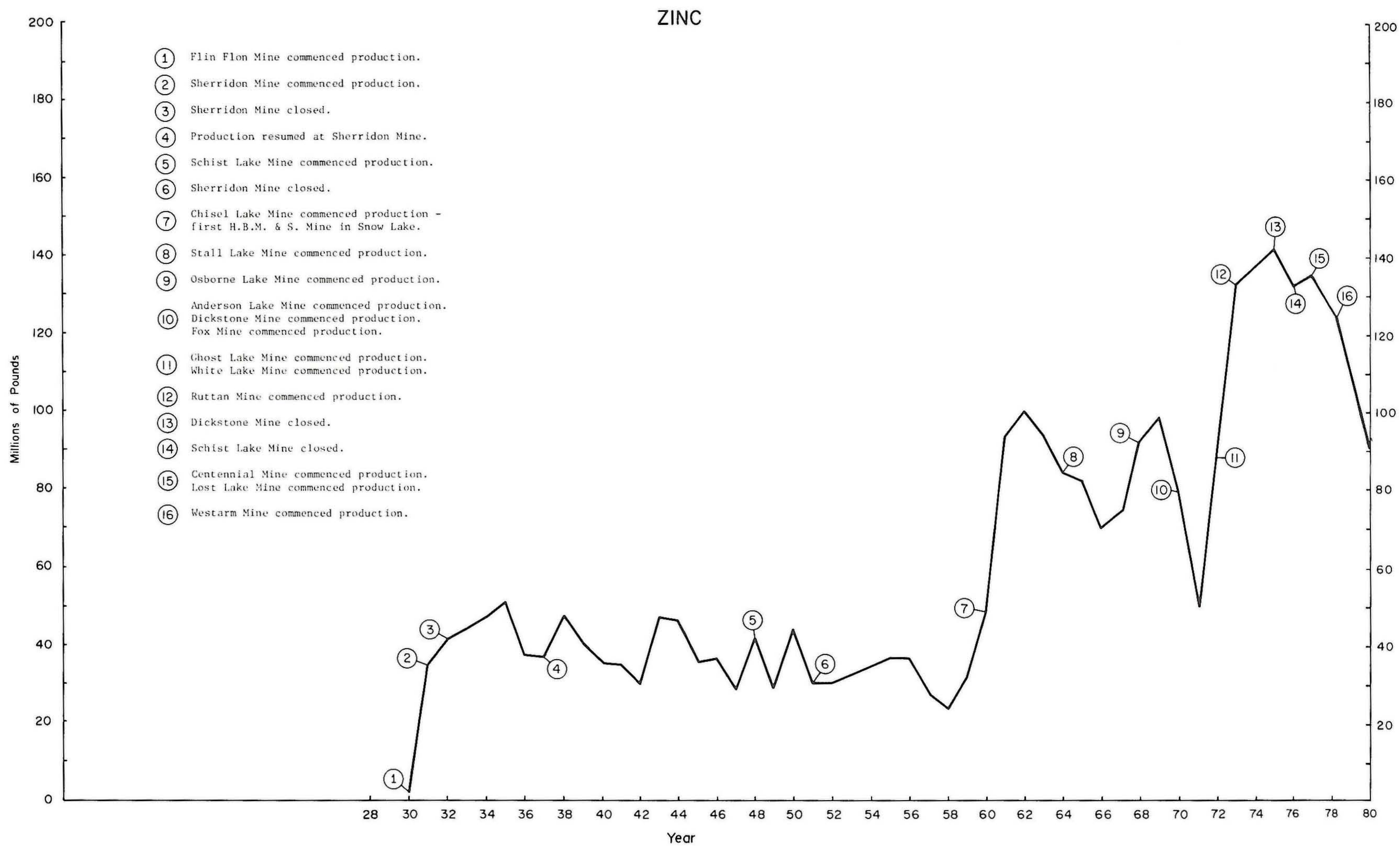
TANTALUM CONTENT IN CONCENTRATE SHIPPED





ANNUAL METALS PRODUCTION

MANITOBA

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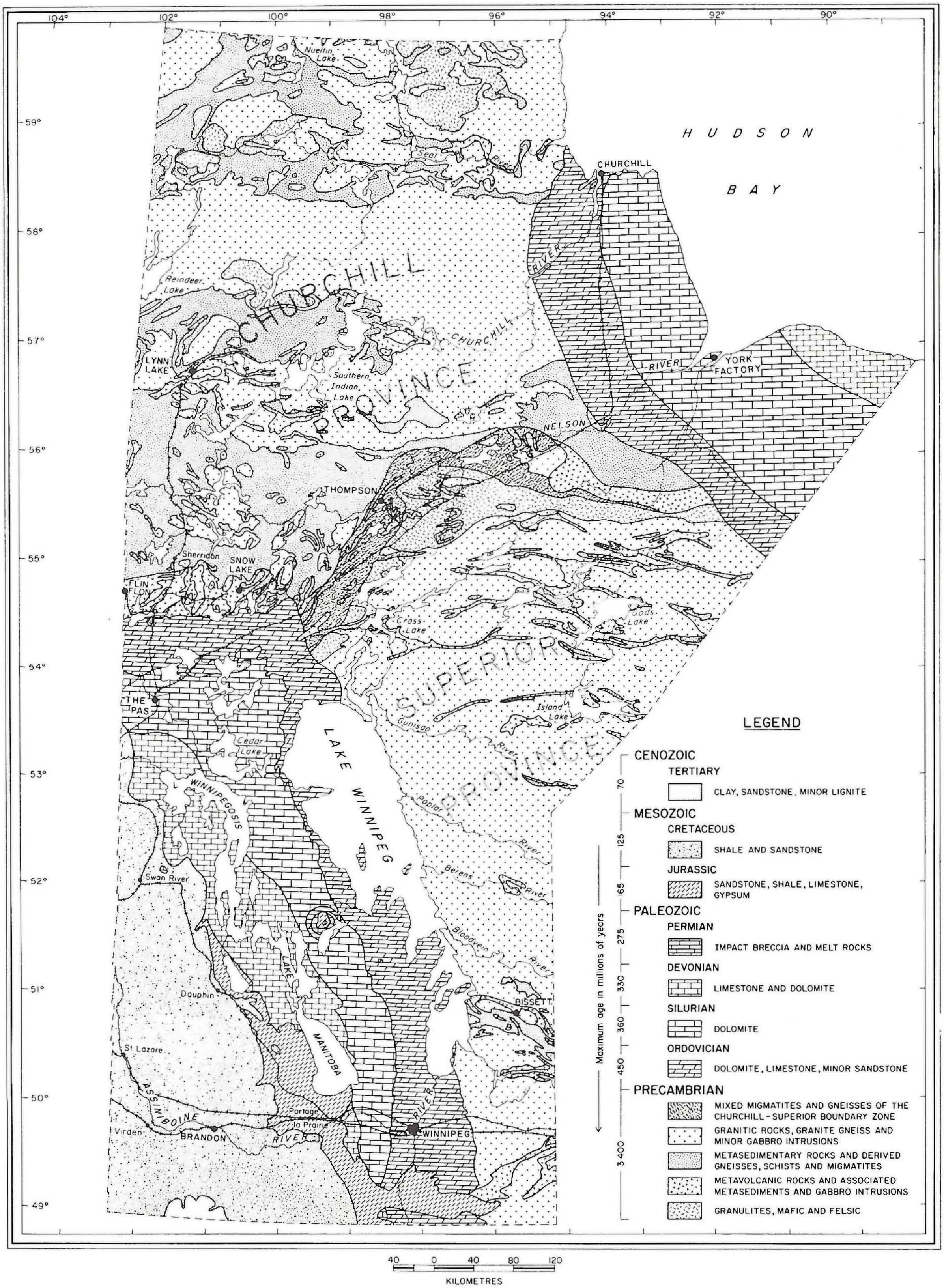

Figure 7. Generalized Geological Map of Manitoba.

ERA	PERIOD	EPOCH	FORMATION	MEMBER	MAX THICK (m)	BASIC LITHOLOGY
CENOZOIC	QUATERNARY	RECENT				TOP SOIL, DUNE SANDS
		PLEISTOCENE	GLACIAL DRIFT		140	CLAY, SAND, GRAVEL, BOULDERS, PEAT
	TERTIARY	PLIOCENE				
		MIOCENE				
		OLIGOCENE				
		EOCENE				
		PALEOCENE	TURTLE MTN.	PEACE GARDEN GOODLANDS	120	SHALE, CLAY AND SAND. LIGNITE BEDS LOCATED ONLY IN TURTLE MOUNTAIN
MESOZOIC	CRETACEOUS	UPPER CRETACEOUS	BOISSEVAIN		30	SAND AND SANDSTONE, GREENISH GREY, LOCATED ONLY IN TURTLE MOUNTAIN
			RIDING MTN.	COULTER ODANAH MILLWOOD	310	GREY SHALES—NON-CALC. LOCAL IRONSTONE BENTONITE NEAR BASE. GAS FOUND
			VERMILION RIVER	PEMBINA	155	SHALE DARK GREY CARBONACEOUS NON-CAL BENTONITE BANDS
				BOYNE		SHALE GREY SPECKLED CALC. BENTONITIC SLIGHTLY PETROLIFEROUS
				MORDEN		SHALE DARK GREY NON-CALC. CONCRETIONS LOCAL SAND AND SILT
			FAVEL		40	GREY SHALE WITH HEAVY CALCAREOUS SPECKS BANDS LIMESTONE AND BENTONITE
			ASHVILLE		115	SHALE, DARK GREY, NON-CALC. SILTY
		LOWER CRETACEOUS	ASHVILLE SAND			"SAND ZONE" 27m F.G. QTZ. S. OR SS.
			SWAN RIVER		75	SANDSTONE AND SAND, QTZ. PYRITIC SHALE—GREY, NON-CALC
	JURASSIC	UPPER JURASSIC	WASKADA		200	BANDED-GREEN SHALE AND CALC.SANDSTONE
			MELITA			BANDS OF LIMESTONE, VARI-COLORED SHALE
		MIDDLE JURASSIC	RESTON		45	LIMESTONE, BUFF, AND SHALES, GREY
			AMARANTH	UPPER: EVAPORITE	45	WHITE ANHYDRITE AND/OR GYPSUM AND BANDED DOLOMITE AND SHALE
				LOWER: RED BEDS	40	RED SHALE TO SILTSTONE-DOLOMITIC
	TRIASSIC	(?)	ST. MARTIN COMPLEX		300	CARBONATE BRECCIA, TRACHYANDESITE (CRYPTO-EXPLOSION STRUCTURE)
PALEOZOIC	PERMIAN					
	PENNSYLVANIAN					
	MISSISSIPPIAN		MADISON GROUP: CHARLES		20	MASSIVE ANHYDRITE AND DOLOMITE
			MADISON GROUP: MISSION CANYON	MC—5 MC—4 MC—3 MC—2 MC—1	120	LIMESTONE—LIGHT BUFF, OOLITIC, FOSS. FRAG., CHERTY, BANDS SHALE AND ANHYDRITE. OIL PRODUCTION
			MADISON GROUP: LODGEPOLE	FLOSSIE LAKE WHITEWATER LAKE VIRDEN SCALLION / ROUTLEDGE	185	LIMESTONE & ARG. LIMESTONE LIGHT BROWN AND REDDISH MOTTLED. ZONES OF SHALEY, OOLITIC, CRINOIDAL & CHERTY. OIL PRODUCTION
			BAKKEN	UPPER MIDDLE LOWER	20	2 BLACK SHALE ZONES — SEPARATED BY SILTSTONE OIL SHOW HIGH R.A. KICK.
	DEVONIAN		QU'APPELLE GROUP: LYLETON		35	RED SILTSTONE AND SHALE DOLOMITIC.
			SASK GROUP: NISKU		40	LIMESTONE & DOLOMITE, YELLOW-GREY FOSS. POROUS. SOME ANHYD.
			SASK GROUP: DUPEROW		170	LIMESTONE & DOLOMITE. ARG.& ANHYDRITIC IN PLACES
			MAN. GROUP: SOURIS RIVER 1-ST RED		120	CYCLICAL SHALE, LIMESTONE & DOLOMITE. ANHYDRITE
			MAN. GROUP: DAWSON BAY 2-ND RED		65	LIMESTONE & DOLOMITE, POROUS, ANHYDRITE—LOCAL SHALE RED & GREEN
			ELK POINT G.: PRAIRIE EVAP		120	SALT POTASH & ANHYDRITE, DOLOMITE INTER-BEDDED.
			ELK POINT G.: WINNIPEGOSIS		75	DOLOMITE, LIGHT YELLOWISH BROWN REEFY.
			ELK POINT G.: ELM POINT			LIMESTONE—FOSS, HIGH CALCIUM
			ELK POINT G.: ASHERN		12	DOLOMITE AND SHALE—BRICK RED
	SILURIAN		INTERLAKE GROUP		135	DOLOMITE YELLOWISH—ORANGE TO GREYISH—YELLOW FOSS. SILTY ZONES
	ORDOVICIAN		STONEWALL		15	DOLOSTONE, GREYISH YELLOW, BEDDED.
			STONY MOUNTAIN	WILLIAMS GUNTON PENITENTIARY	30	DOLOMITE—YELLOWISH—GREY SHALEY DOLOMITE—DUSKY—YELLOW FOSS.
				GUNN	20	SHALE RED-GREEN FOSS. LIMESTONE BANDS
			RED RIVER	FORT GARRY SELKIRK CAT HEAD DOG HEAD	170	DOLOMITIC LIMESTONE, MOTTLED AND DOLOMITE
			WINNIPEG	UPPER UNIT	60	SHALE, GREEN, WAXY, SANDSTONE INTERBEDDED.
				SANDSTONE		SAND, SANDSTONE, QUARTZOSE.
	CAMBRIAN		DEADWOOD		60	SAND, BLACK TO GREEN-GREY WAXY, GLAUCONITIC SILTSTONE & SHALE, GREEN-GREY TO BLACK. VERY EDGE OF S.W. MANITOBA ONLY.
PRECAMBRIAN						ACID & BASIC CRYSTALLINES & METAMORPHICS

Figure 8. Chart of Geological Formations in Manitoba.