Nickel

Manitoba is home to world-class deposits and high mineral potential in extensive underexplored terrains.
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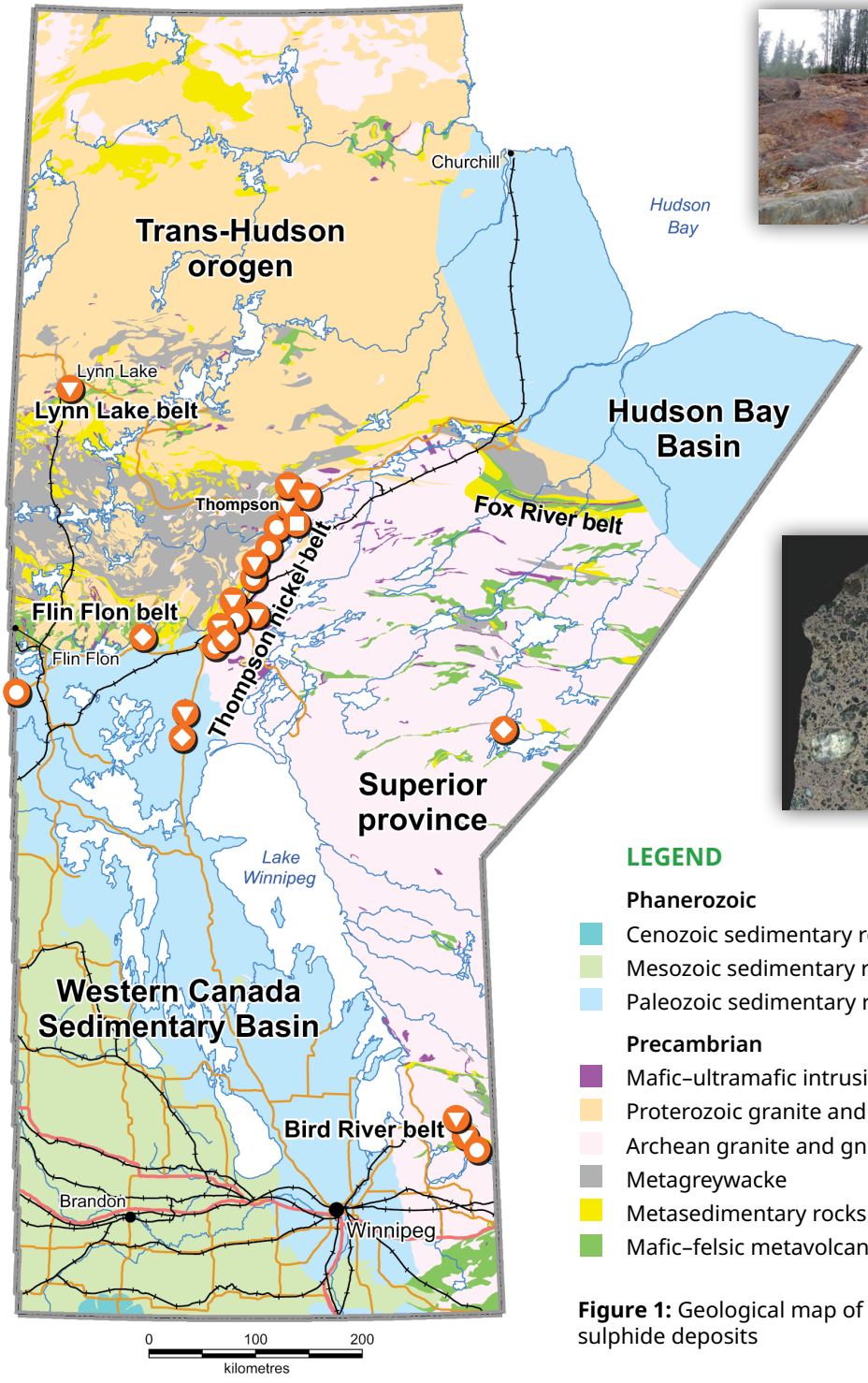
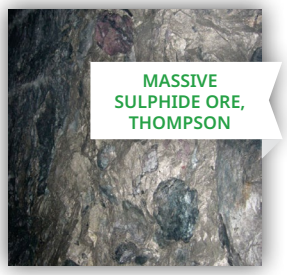
Manitoba

NICKEL EXPLORATION and mining in Manitoba date back to the first discovery of nickel sulphides in the Bird River area in the early 1920s and culminated with the discovery of the world-class Thompson deposit in 1956, which has been mined continuously for over 60 years.

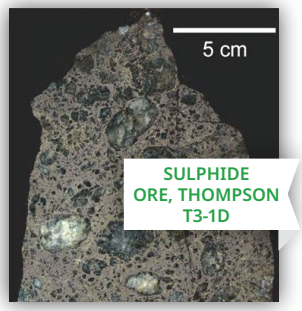
IN MANITOBA, nickel sulphide deposits are associated with mafic–ultramafic intrusions and ultramafic lava flows (komatiite), and can be generally classified as magmatic-type deposits. Major deposits of this type occur along the Paleoproterozoic rifted margin of the Superior province (defined in Manitoba by the Thompson nickel belt, Fox River belt, and Winnipegosis komatiite belt) and in greenstone belts of the Archean Superior province (Bird River and Island Lake belts) and Paleoproterozoic Trans-Hudson orogen (Lynn Lake and Flin Flon–Snow Lake belts). Continued exploration successes and favourable, yet underexplored, geology indicate high potential for new nickel discoveries.




SURFACE SHOWING, MAYVILLE


MASSIVE SULPHIDE ORE, THOMPSON


MASSIVE SULPHIDE, MAYVILLE



SULPHIDE ORE, THOMPSON T3-1D

SULPHIDE ORE, THOMPSON T1

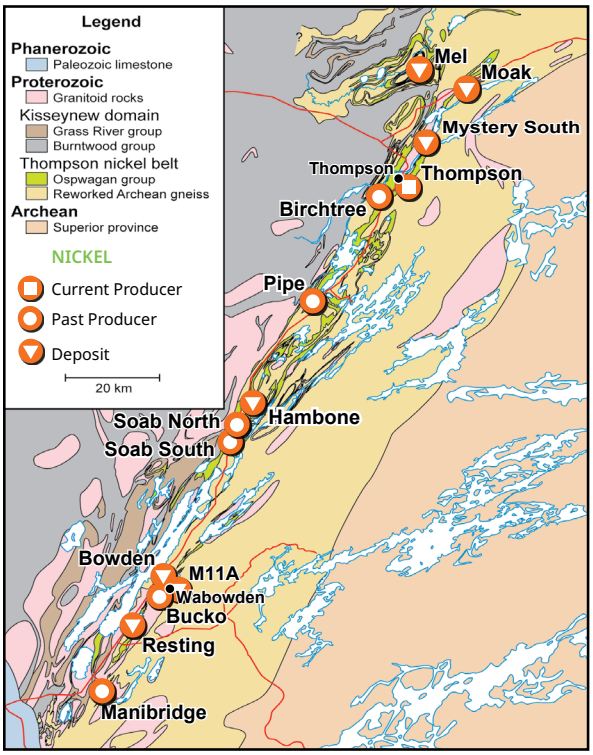
LEGEND

Phanerozoic
- Cenozoic sedimentary rocks
- Mesozoic sedimentary rocks
- Paleozoic sedimentary rocks

Precambrian
- Mafic–ultramafic intrusive rocks
- Proterozoic granite and gneiss
- Archean granite and gneiss
- Metagreywacke
- Metasedimentary rocks
- Mafic–felsic metavolcanic rocks

NICKEL
- Current Producer
- Past Producer
- Advanced Project
- Exploration Project

Figure 1: Geological map of Manitoba showing locations of selected nickel sulphide deposits



Thompson Nickel Belt (TNB)

The TNB is situated along the northwestern margin of the Archean Superior province. It contains several major nickel sulphide deposits, most notably the world-class Thompson deposit, associated with Paleoproterozoic (1.88 Ga) ultramafic intrusions and lava flows within platformal sedimentary rocks along the rifted margin of the Archean craton. High-grade massive to semimassive nickel sulphide ores occur in the ultramafic rocks or adjacent sulphidic sedimentary rocks and were subjected to amphibolite-facies metamorphism and multiphase folding during the Trans-Hudson orogeny, resulting in extensive modification of primary textures and ore-host relationships.

The Thompson, Birchtree and Pipe deposits have produced more than 150 Mt of nickel sulphide ore grading 2.32% Ni, 0.16% Cu, 0.046% Co and 0.83 g/t platinum-group elements (PGE). Continued success in near-mine exploration, as exemplified by the 'T3-1D' extension of the Thompson deposit, demonstrates the exceptional potential of the TNB. Ongoing exploration is targeting the spatial association of ultramafic intrusions and sulphidic metasedimentary rocks within macro-scale sites of structural thickening (fold hinges) or low mean stress (boudin necks).

Figure 2: Geological map of the Thompson nickel belt

Lynn Lake Greenstone Belt

Nickel deposits in the Lynn Lake district are hosted by 1.87 Ga gabbroic stocks that intrude 1.91–1.89 Ga arc volcanic rocks of the Lynn Lake belt in the Paleoproterozoic Trans-Hudson orogen. The Lynn Lake mine produced 22.2 Mt of ore averaging 1.02% Ni and 0.54% Cu during the period 1953–1976, making it the third largest nickel producer in Canada after Sudbury and Thompson, prior to being surpassed by the Voisey's Bay mine in 2005. The Lynn Lake nickel project contains a residual mineral resource of 16.3 Mt grading 0.72% Ni, 0.33% Cu and 0.033% Co.

Flin Flon–Snow Lake Greenstone Belts

The Paleoproterozoic Flin Flon belt is well known for its world-class volcanogenic massive sulphide deposits, but also contains several nickel sulphide occurrences associated with mafic–ultramafic intrusions. The Namew Lake deposit, hosted by a metamorphosed pyroxenite sill beneath a thin cover of Paleozoic sedimentary rocks south of Flin Flon, contained a pre-production reserve of 2.58 Mt grading 2.4% Ni, 0.9% Cu, 0.5 g/t Pd and 0.7 g/t Pt. The Rice Island deposit is hosted by a gabbronorite body that intruded greywacke turbidite deposits. The deposit contains an indicated resource of 4.29 Mt grading 0.74% Ni, 0.49% Cu, 0.03% Co, 0.06 g/t Au, 0.02 g/t Pt and 0.03 g/t Pd, and an inferred resource of 3.4 Mt grading 0.89% Ni equivalent. Nickel sulphide and PGE occurrences are also associated with the 1.88 Ga Mikanagan Lake gabbro sills in the Flin Flon arc assemblage and the Reed Lake layered mafic–ultramafic intrusion of the Elbow–Athapapuskow ocean-floor assemblage, indicating significant regional potential for nickel sulphide deposits.

Archean Greenstone Belts

The Archean Bird River belt of the western Superior province contains several significant deposits and occurrences of magmatic Ni-Cu-PGE and stratiform Cr-PGE. Major deposits are hosted by the Bird River sill and associated mafic–ultramafic intrusions, which were emplaced at ca. 2.74 Ga into MORB-like basalt flows near the base of the Bird River belt. The Bird River sill includes the past-producing Dumbarton and Maskwa West mines (2.7 Mt @ 1.02% Ni, combined), the active Makwa project (7.9 Mt @ 0.57% Ni and 0.13% Cu), and several undeveloped chromite deposits. The correlative Mayville intrusion, located on the northern arm of the belt, includes the active Mayville project (31.8 Mt @ 0.18% Ni and 0.45% Cu) and one undeveloped chromite deposit. The Nickel Island deposit of the Island Lake belt is hosted by komatiite and/or peridotite ultramafic rocks. An inferred mineral resource for the deposit consists of 8.48 Mt grading 0.82% Ni and 0.08% Cu.

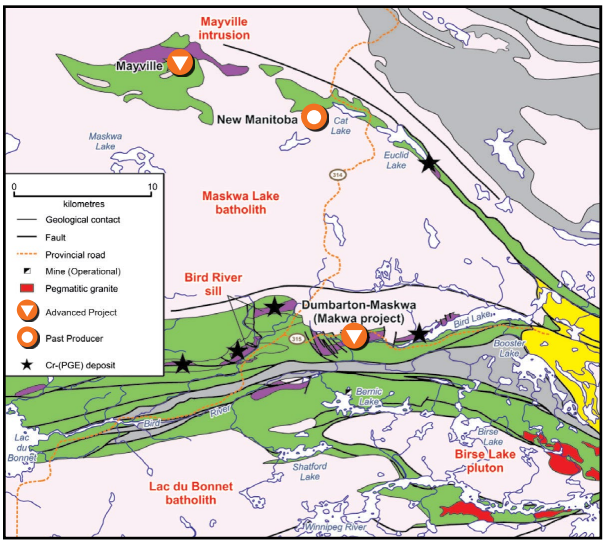


Figure 3: Geological map of the Bird River greenstone belt

Selected Nickel Deposits in Manitoba

Deposit	District	Ownership	Discovery	Production	Resource[1]		Resource Grade			
			(year)	(years)	Mt	%Ni	%Cu	%Co	g/t Pt	g/t Pd
Proterozoic Trans-Hudson orogen										
Thompson[2]	TNB	Vale Canada Ltd.	1956	1961–present	150	2.32				
Soab (North and South)	TNB	Vale Canada Ltd.	1953	1967–1971	0.9	1.5				
Moak Lake	TNB	Vale Canada Ltd.	1952		45	0.7				
Mystery Lake South	TNB	Vale Canada Ltd.	1927		227	0.6				
Hambone Lake	TNB	Vale Canada Ltd.	1956		3.3	0.81				
Hambone north	TNB	Vale Canada Ltd.	1956		1.1	1.1				
Bucko Lake	TNB	CaNickel Mining Ltd.	1964	2008–2012	11.3	1.39	0.11	0.023	0.153	0.363
Bowden Lake	TNB	CaNickel Mining Ltd.	1962		2	1.16				
M11A (Discovery)	TNB	CaNickel Mining Ltd.	1960		1.3	1.15				
Resting Lake	TNB	CanAlaska Uranium Ltd.	1966		90	0.3				
Mel	TNB	Victory Nickel Inc.	1961		4.3	0.88				
Minago	TNB	Flying Nickel Mining Corp.	1972		44	0.74				
Manibridge	TNB	CanAlaska Uranium Ltd./ Metal Energy Corp.	1963	1971–1977	1.3	2.25	0.27			
Lynn Lake	Lynn Lake	Corazon Mining Ltd.	1941	1953–1976	16.3	0.72	0.33	0.033		
Rice Island	Flin Flon	Wolfden Resources Corp.	1948		4.3	0.74	0.49	0.03	0.02	0.03
Namew Lake	Flin Flon	Hudbay Minerals Inc.	1984	1988–1993	2.6	2.44	0.9		0.651	0.479
Archean Superior province										
Dumbarton	Bird River	Grid Metals Corp.	1920	1969–1974	1.5	0.81				
Makwa (Maskwa)	Bird River	Grid Metals Corp.	1974	1975–1976	7.9	0.57	0.13	0.01	0.1	0.34
Mayville	Bird River	Grid Metals Corp.	1921		31.8	0.18	0.45		0.05	0.14
Nickel Island	Island Lake	Wolfden Resources Corporation	1952		8.5	0.82	0.08			

[1] Resource estimates include past-production, current reserves and resources as applicable; users should verify critical information
[2] Includes Thompson, Birchtree and Pipe deposits

Abbreviations: Mt, million tonnes; TNB, Thompson nickel belt

Current Producers

- **Thompson** (Vale Canada Ltd.): reserve (2017), 27.5 Mt grading 1.75% Ni; production (since 1961), 2.724 Mt of 99.9% pure nickel metal

Advanced Projects

- **Bucko** (CaNickel Mining Ltd.): resource (2008), 11.3 Mt grading 1.39% Ni
- **Lynn Lake** (Corazon Mining Ltd.): resource (2019), 16.3 Mt grading 0.72% Ni, 0.33% Cu and 0.033% Co
- **Makwa-Mayville** (Grid Metals Corp.): resource (2014), 39.7 Mt grading 0.26% Ni and 0.39% Cu
- **Minago** (Flying Nickel Mining Corp.): resource (2021), 44 Mt grading 0.74% Ni
- **Rice Island** (Wolfden Resources Corporation): resource (2021), 4.3 Mt grading

Mining, Oil and Gas Industry Overview

- $3.4 billion in estimated value of production, a 45% increase since 2021
- $1.7 billion in real value added, accounting for approximately 2.6 per cent of the province's real GDP and 4.3 per cent of all domestic merchandise exports
- Direct employment of approximately 3480 people, with an additional 2035 individuals employed by sector support activities
- 2023 estimated mineral exploration and deposit appraisal spending intentions at $163.8 million
- 225 new wells drilled in 2022

Source: Natural Resources Canada

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Photos courtesy of Vale Canada Ltd. and the Geological Survey of Canada.