



# Selected Manitoba Industrial Mineral Resources 2010

— aggregate, bentonite, coal, kaolin, lithium, rare earths and silica

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Industrial Minerals 2010

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# Selected Manitoba Industrial Mineral Resources 2010

- **Manitoba's Business Advantage**
- **Geological Setting**
- **Future property developments**
  - **Reactivation of former producers/commodities**
  - **New commodities**





# Manitoba's Business Advantage



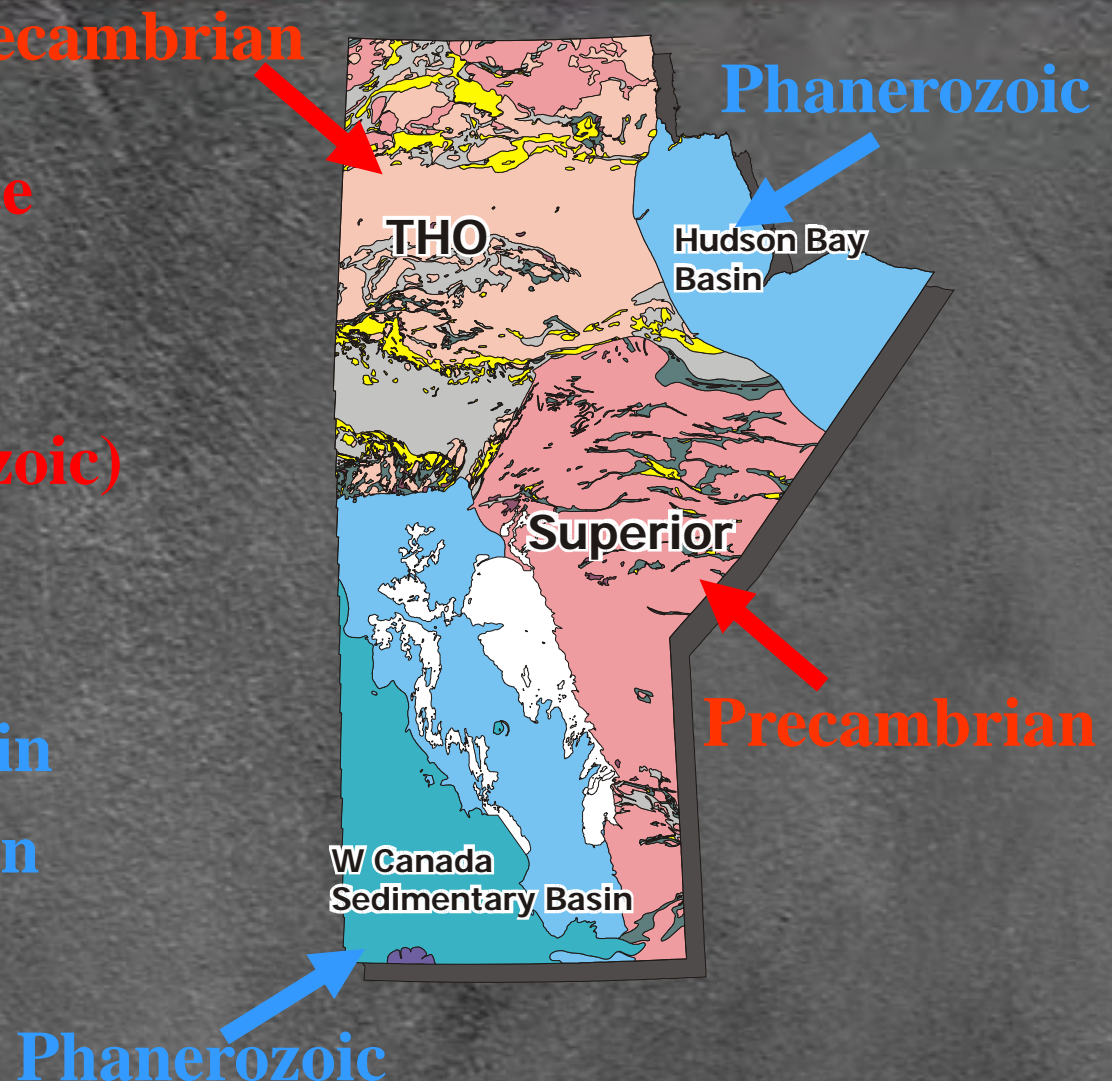
- **Strategic Central Location**
- **Mid-Continent Trade Corridor**
- **Maritime Province**
- **Near-Surface Geology ranging from Archean to Recent**
- **Diverse and Stable Economy**
- **Highly Competitive Business Costs**
- **Skilled Multicultural Workforce**
- **Well-developed Modern Infrastructure**
- **Abundant, Inexpensive Hydro-electric Power**





# Geological Setting

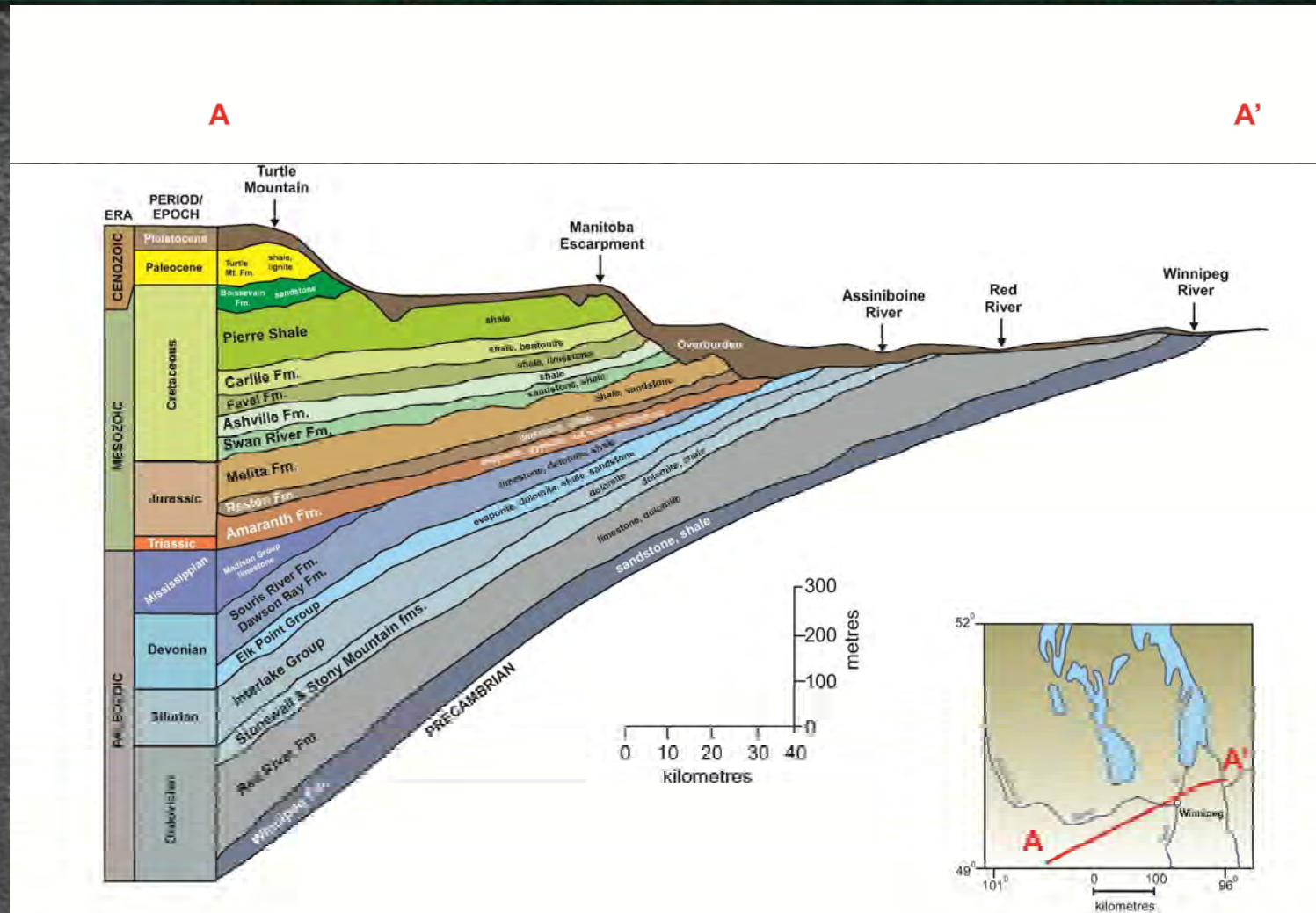
- **Precambrian**
  - Superior Province (Archean)
  - Trans-Hudson Orogen (Proterozoic)
- **Phanerozoic**
  - Western Canada Sedimentary Basin
  - Hudson Bay Basin







# Cross-section across Southern Manitoba







# Selected Resources 2010

- **Aggregate**
- **Bentonite**
- **Coal**
- **Kaolin**
- **Lithium**
- **Rare Earths**
- **Silica**





## Aggregate

- Deposits ranging in age from **Precambrian** to **Phanerozoic (including Pleistocene)**.
- Wide range of lithologies from granitic, carbonate and shale bedrock to glacially reworked sand and gravel deposits.
- Over 400 producers (mostly in southern Manitoba) ranging in size from a few employees to 20 or more.
- Annual production of :
  - sand and gravel of over 10 million tonnes, worth almost \$60 million.
  - crushed stone about 5 million tonnes, worth about 25 million.





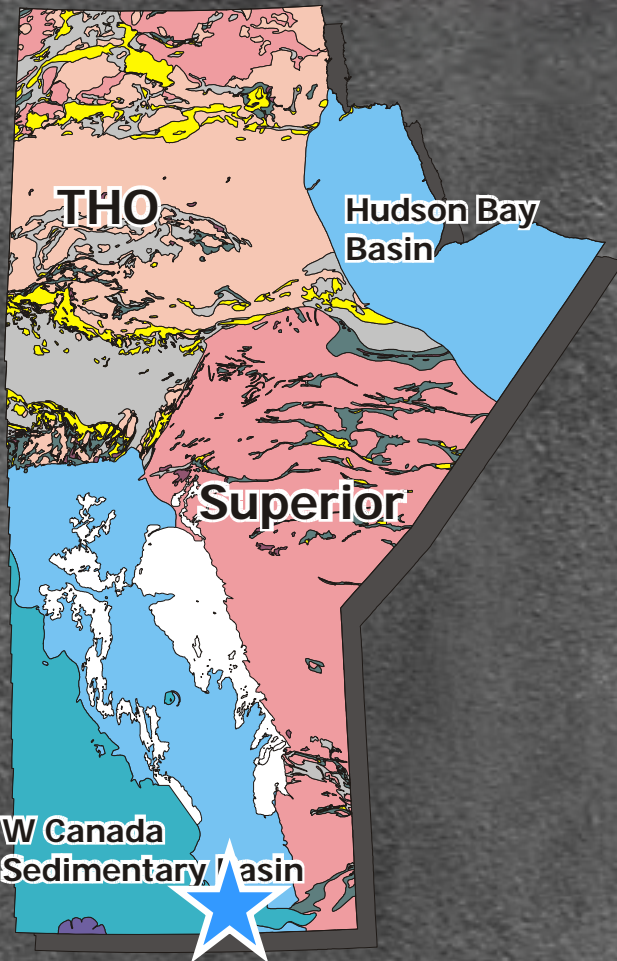
# Bentonite

- Altered volcanic ash (devitrification and weathering of glass particles)
- Two major types:
  - Swelling sodium bentonite (not found in Manitoba), major use in drilling mud by oil industry
  - Non-swelling calcium bentonite, major use as an adsorbant in clarifying oils





# Phanerozoic - Cretaceous Non-swelling calcium bentonite



- Quarried along the Manitoba Escarpment
- Only non-swelling calcium bentonite in Canada
- Pembina Mountain Clays Incorporated
  - produced from 1939 to 1990
  - former plants at Winnipeg and Morden







# Phanerozoic - Cretaceous

## Non-swelling calcium bentonite

- Non-swelling calcium bentonite is found interbedded with black shale in the **Cretaceous** Pembina Member of the Pierre Shale

ERA	PERIOD	SOUTHWEST MANITOBA		
MESOZOIC	CRETACEOUS	Boissevain Formation		
		Pierre Shale	Coulter Member	
			Odanah Member	
			Millwood Member	
			Pembina Member	
			Gammon Ferruginous Member	
			Boyne Member	
		Carlisle Formation	Morden Member	
			Assiniboine Member	
		Favel Formation	Keld Member	
			Belle Fourche Member	
		Ashville Formation	upper	Fish Scale Zone <small>Base of Fish Scale marker</small>
				Westgate Member
			lower	Newcastle Member
				Skull Creek Member
				Swan River Formation







# Phanerozoic - Cretaceous

## Bird River Mines Inc.

- Quarry is located 2 km east of Deerwood, and 8 km northwest of Miami, along the Manitoba Escarpment, in southern Manitoba



Nelson Shodine, Company President , on stockpile of calcium bentonite (2001)



Deerwood Quarry (2001)





# Phanerozoic - Cretaceous Bird River Mines Inc.

## Used oil reclamation test



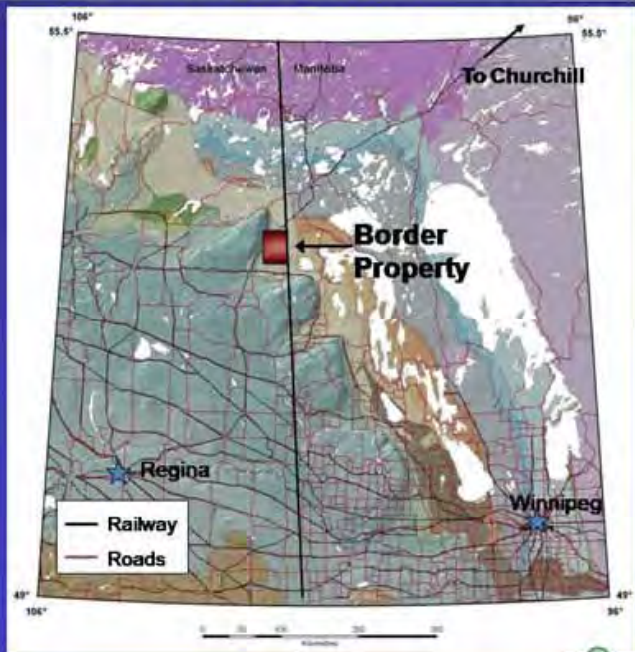
Results of cleaning of cracked dirty crank case oil (left) with:

- non-acid activated bentonite at 400°F (middle) and
- acid-activated (virgin sulphuric acid) bentonite at 400°F (right),

2003-07-09

- Uses for the calcium bentonite include:
  - Adsorbent of impurities
    - Decolouration of beverages, syrups, sugar and vinegar
    - Decolouration of animal, vegetable and petroleum oils, fats and waxes
    - Reclaiming of used oils
  - Cracking catalyst in the refining of crude oil
  - Detergents, cosmetics, water softener, filler, binder in cattle feed and for cleaning fur
  - Bonding agent for molding sand in foundries



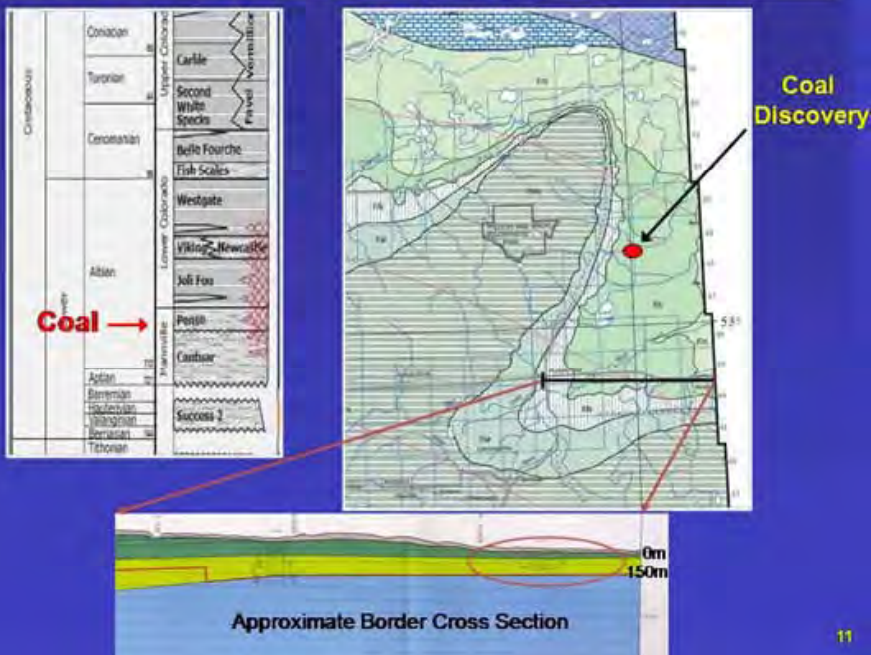


# Coal

## Saskatchewan Discovery

- Discovery of Durango Coal Seam in Pasquia River basin, Saskatchewan, April, 2008.
- Two coreholes, 1.6 km apart, intersected a flat-lying coal seam with clay partings in the **Cretaceous** Manville Formation, averaging 32.8 m thick, at average depth of 79 m.
- Results of 213 drillcore analyses confirmed good quality thermal coal ranging from **sub-bituminous C to bituminous C** in rank.
- Average calorific value stated to be generally higher than Alberta thermal coal fields and Powder River basin major producers.

## Border Geology – Flat Lying Strata







# Phanerozoic - Cretaceous

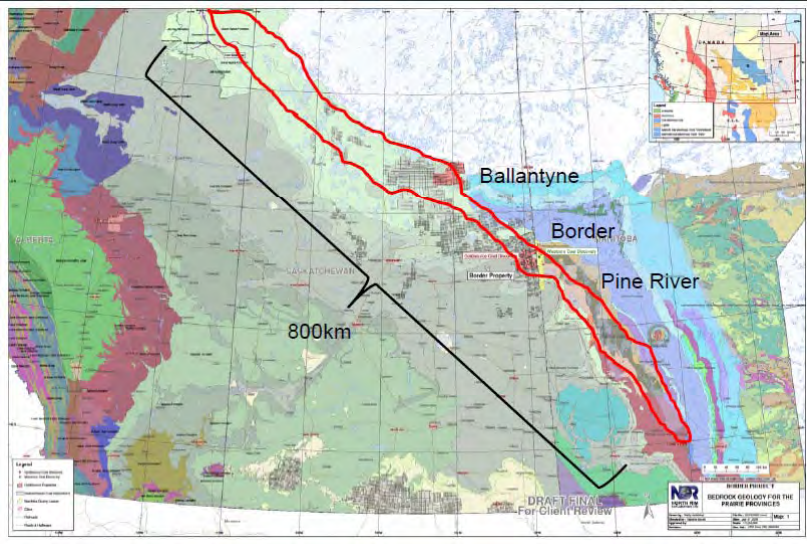
## Coal

### In Manitoba

- **Cretaceous** sub-bituminous coal resources extend eastward across the provincial boundary (as the Manville equivalent Swan River Formation).
- Quarry Exploration Permits were taken out by a number of parties in west-central Manitoba:
  - Jon R. MacNeill
  - Greencastle Resources Ltd.
  - Nucoal Energy Corp.
  - Minera Pacific Inc.
  - Silver Fields Resources Inc.
  - Westcan Uranium Corp.

ERA	PERIOD	SOUTHWEST MANITOBA		
MESOZOIC	CRETACEOUS	Boissevain Formation		
		Pierre Shale	Coulter Member	
			Odanah Member	
			Millwood Member	
			Pembina Member	
			Gammon Ferruginous Member	
		Cardie Formation	Boyne Member	
			Morden Member	
		Favel Formation	Assiniboine Member	
			Keld Member	
		Ashville Formation	upper	Belle Fourche Member
				Fish Scale Zone <small>Base of Fish Scale marker</small>
			lower	Westgate Member
				Newcastle Member
				Skull Creek Member
		Swan River Formation		





# Proterozoic - Cretaceous Goldsource Mines Inc.

- Eight properties acquired along Durango Trend.
- **Pine River Coal**
  - Two shallow shafts and test holes sunk into lignite occurrence on north bank of Pine River, 22 km northeast of the village of Pine River in 1937.
  - 9 m thick lignite seam was also reported in water well drilled near local school in the village of Pine River.
  - Eight holes drilled by Goldsource in winter of 2009/10 – two had intercepts ranging from 1-3 m.



2000



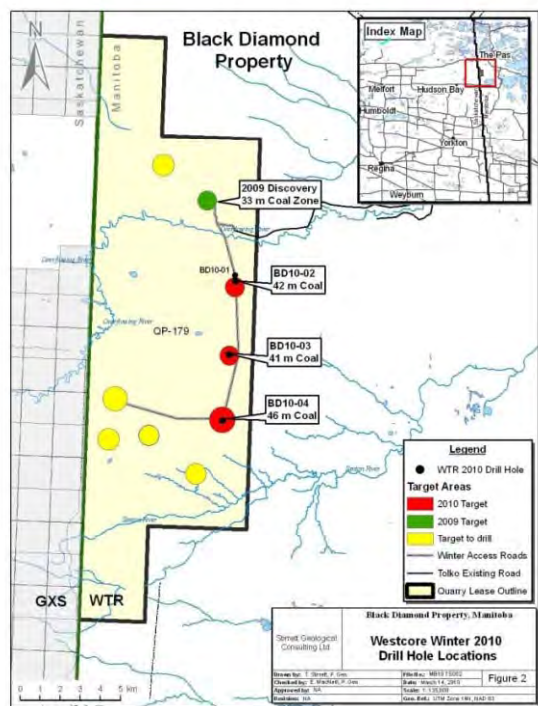
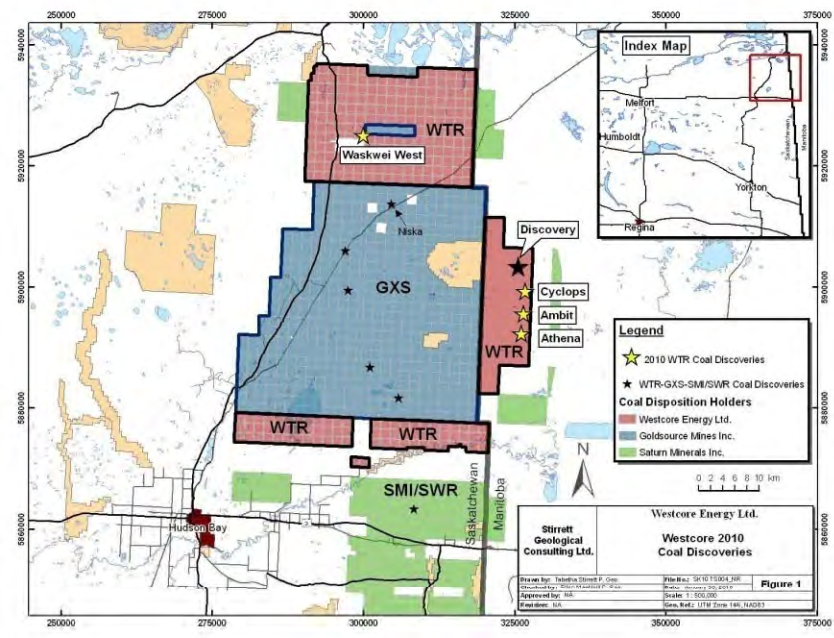


# Proterozoic - Cretaceous Westcore Energy Ltd.

## • Black Diamond Property

- Cyclops deposit – Hole BD10-02: 38.05 m composite coal interval with calorific value of 18 196 kJ/kg and 32.81% ash.
- Ambit deposit – Hole BD10-03: 41.60 m continuous coal interval with calorific value of 21 978 kJ/kg and 19.28% ash.
- Athena deposit – Hole BD10-04: 55.12 m coal interval, including minor partings with calorific value of 19 132 kJ/kg and 30.88% ash.

- Coal samples ranged from Lignite A to Sub-bituminous C in rank.







# Phanerozoic - Cretaceous

## Kaolin and kaolinitic clay

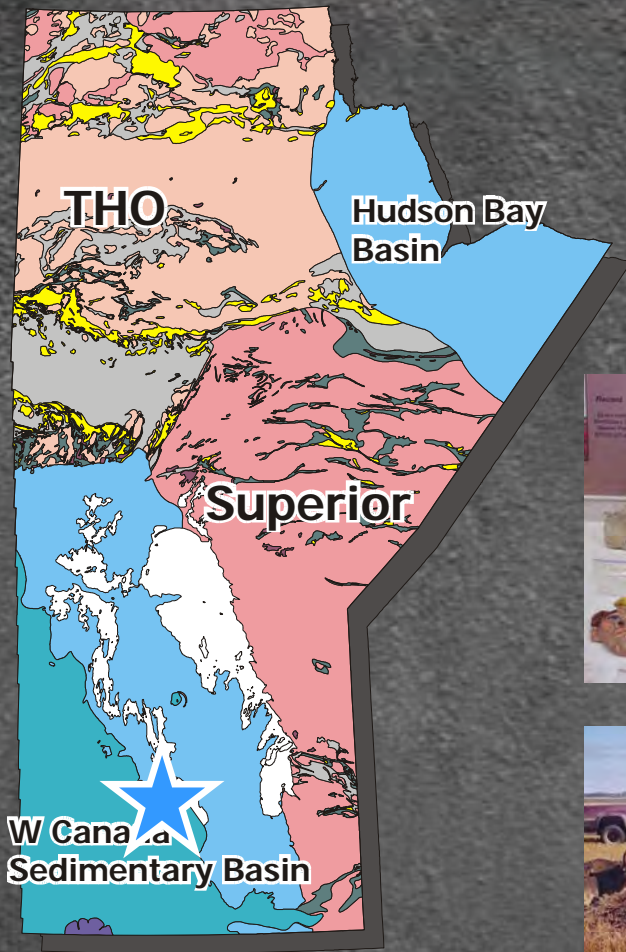
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			Gammon Ferruginous Member	
			Boyne Member	
		Cairfile Formation	Morden Member	
			Assiniboine Member	
		Favel Formation	Keld Member	
			Belle Fourche Member	
		Ashville Formation	upper	Fish Scale Zone <small>Base of Fish Scale marker</small>
				Westgate Member
			lower	Newcastle Member
				Skull Creek Member
				Swan River Formation

- **Cretaceous** Swan River Formation
- The formation is found:
  - within the sub-surface southwest of Manitoba
  - within its outcrop belt, and
  - as discrete outliers.
- Ste. Rose deposit
- Arborg deposit of Dawson Resources Ltd.

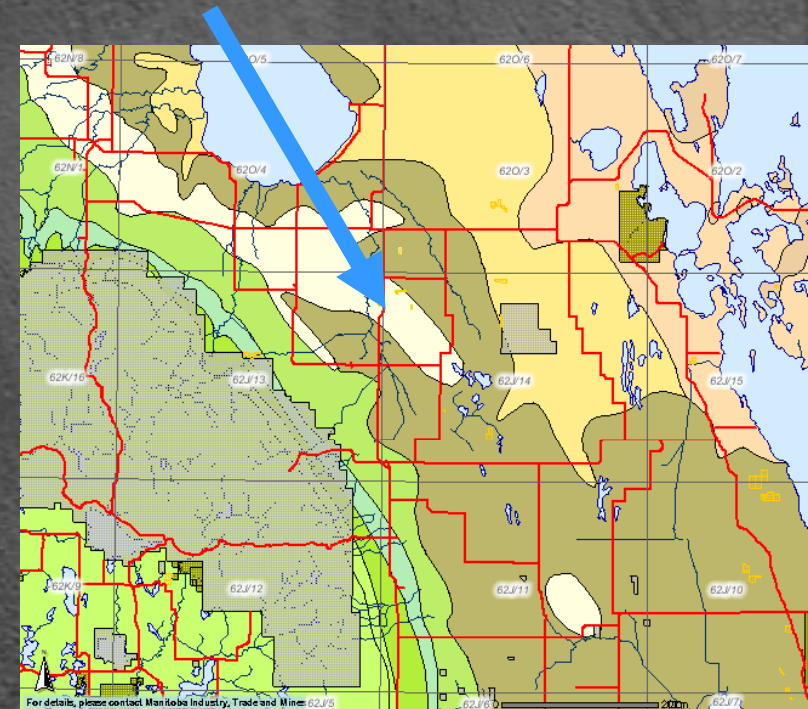




# Phanerozoic Cretaceous/Jurassic Ste. Rose Deposit



- **Cretaceous** outcrop belt, south of Ste. Rose du Lac.
- Farm of Maurice Maquet

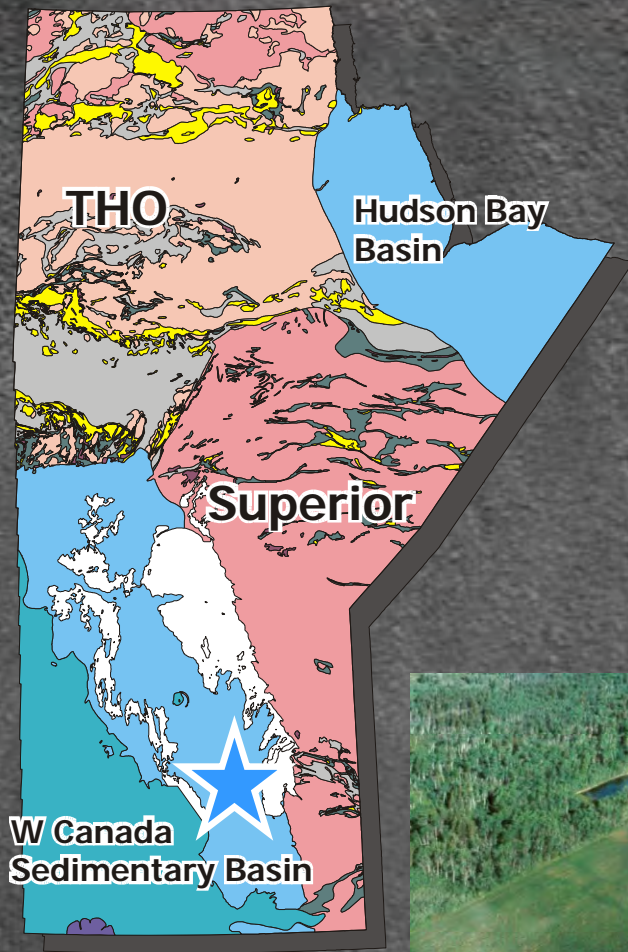


Backhoe digging stoneware clay (next to former brick clay pit of Red River Brick and Tile), 2003-09-03





# Phanerozoic - Cretaceous Dawson Resources Ltd.



Exploration test pits, 1958

## Arborg Deposit

- **Cretaceous** outlier, 120 km north of Winnipeg
- Could yield approximately 23 tonnes of premium grade kaolin and 60 tonnes of container glass sand for each 100 tonnes of raw ore mined

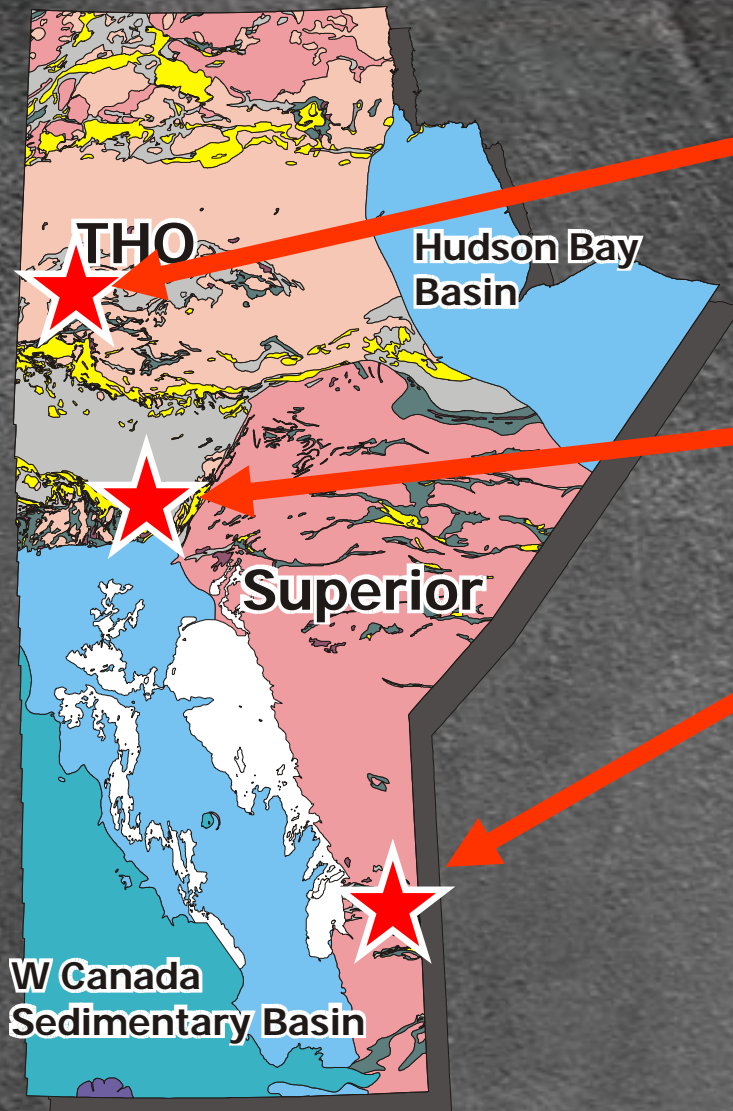
Auger drilling  
1996-06-17







# Precambrian Lithium



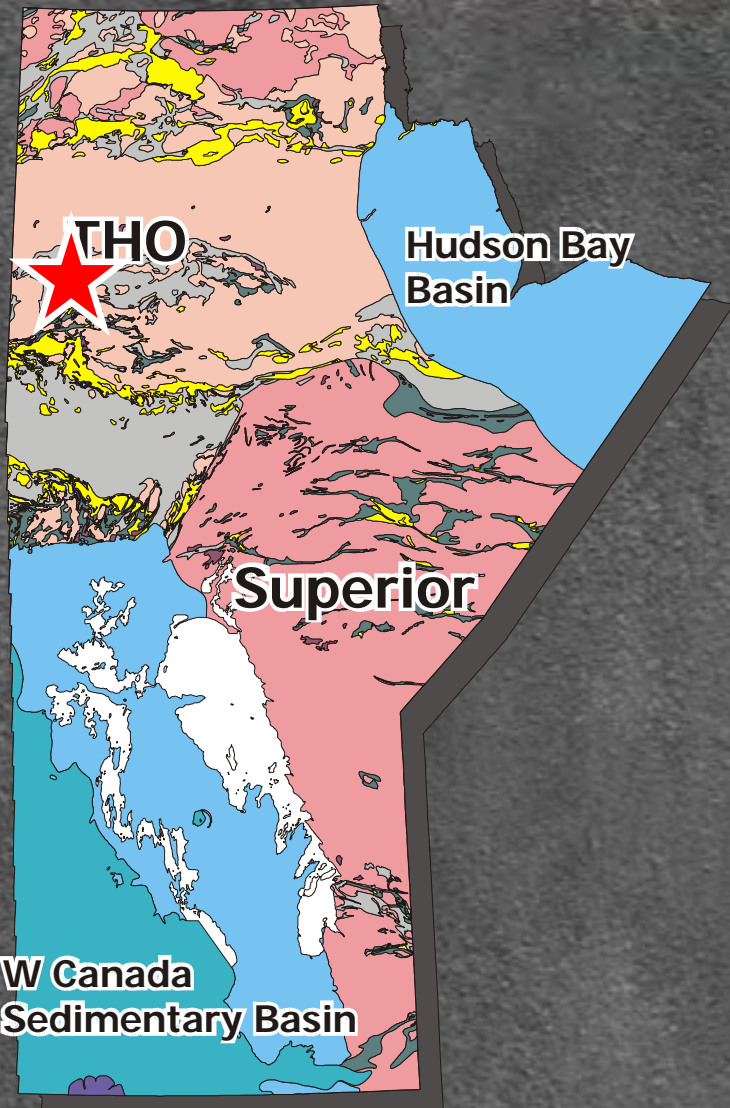
- Wapus Li-Cs-Ta-type rare metal pegmatite – VMS Ventures Ltd.
- Strider Lithium Project – Rodinia Minerals Inc.
- Tanco Mine – Tantalum Mining Corporation of Canada Limited





# Precambrian - THO VMS Ventures Inc.

- Wapus Li-Cs-Ta-type rare metal pegmatite



- In 2004, Dr. H. Mumin P.Eng and M. Trott of Brandon University discovered the Wapus **Precambrian** rare metal pegmatite field, 60 km northeast of Leaf Rapids (NTS 64B11NE) in northwest Manitoba .
- The discovery of lithium cesium tantalum (Li-Cs-Ta) subtype zoned pegmatites was made during field reconnaissance of the South Bay Ni-Cu-Co PGE property.
- The pegmatites are well exposed along 5 to 6 km of the South Indian Lake road.





# Precambrian - THO Rodinia Minerals Inc.

## • Strider Lithium Project

- Located east of Wekusko Lake, 20 km east of Snow Lake in north-central Manitoba.
- Previous drilling on the **Precambrian** spodumene dike indicated a historical non-NI 43-101-compliant deposit tonnage of 4 305 000 tonnes grading 1.30%  $\text{Li}_2\text{O}$ , over a weighted average true width of 9.99 m.
- Iron content is too high for ceramics, but okay for lithium carbonate used in glass, chemical, pharmaceutical industries and battery industries.







# Precambrian - Superior Tanco



Underground at Tanco



- Operating mine of Tantalum Mining Corporation of Canada Limited (Tanco)

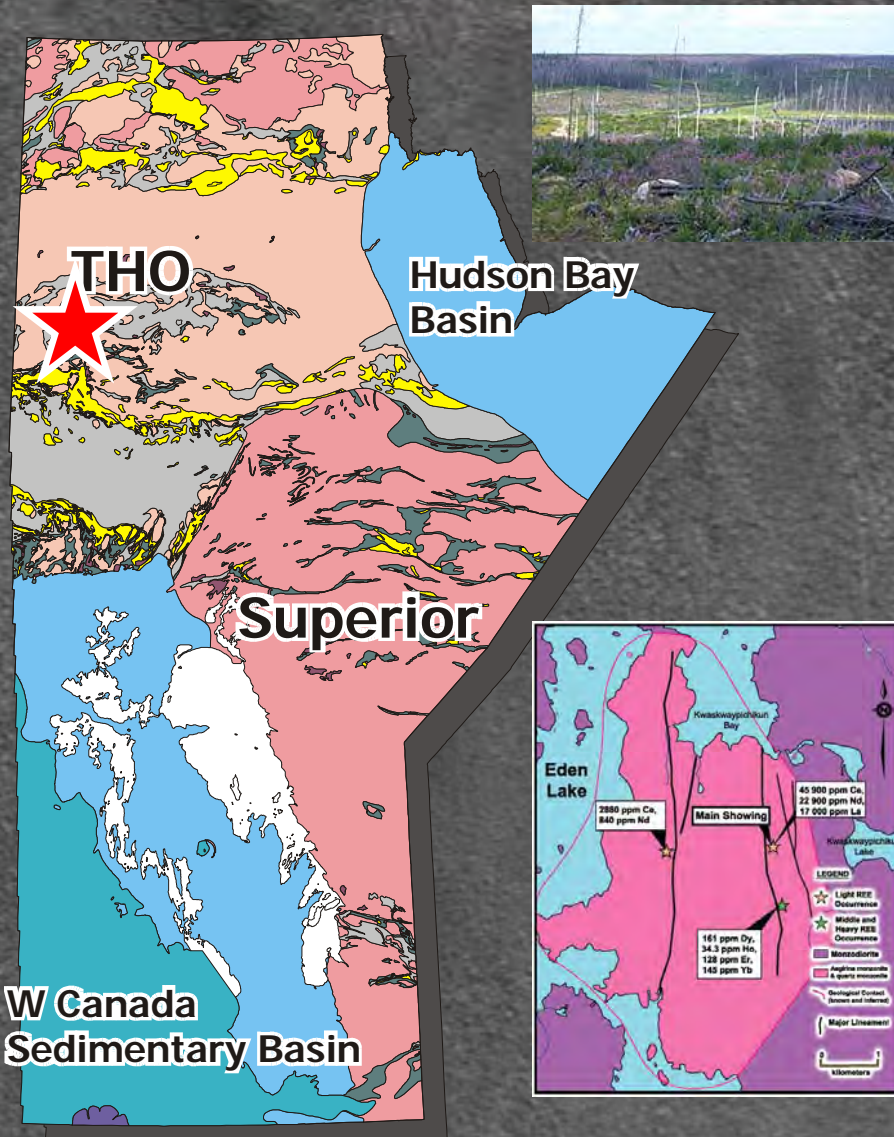
- 1986 – Tanco commenced commercial production of ceramic grade spodumene concentrate.

- 2009/10 – Tanco ceased producing spodumene concentrate, but is now considering resuming production.





## Precambrian - THO Rare Earths

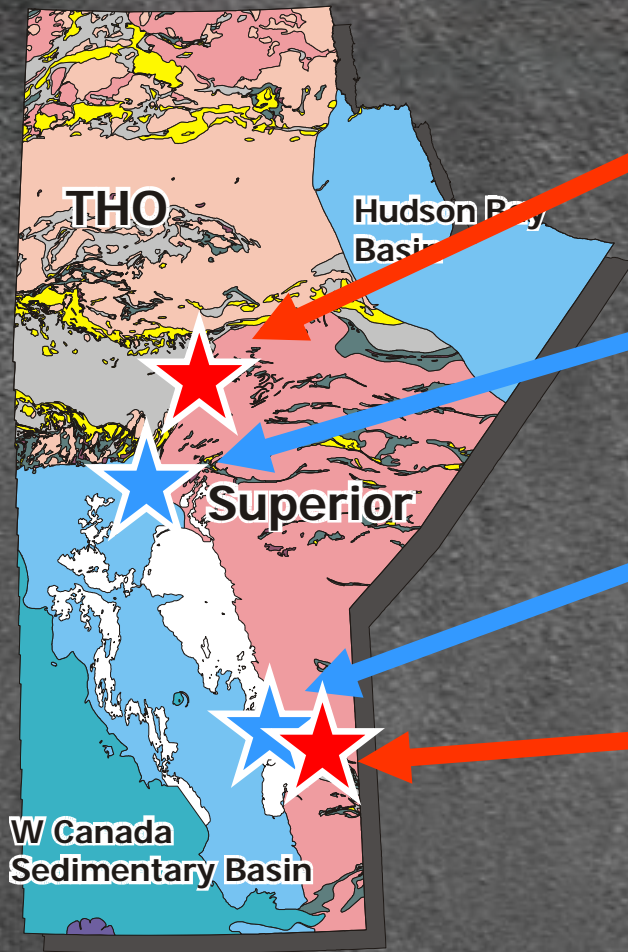


- Medallion Resources Ltd. and Rare Element Resources Ltd. joint venture
  - Eden Lake **Precambrian** carbonatite complex, 35 km northwest of Leaf Rapids in northern Manitoba.
  - Britholite ore mapped along 1 km long lineament. Test on 8% britholite sample produced 9.2% cerium, 5.3% neodymium and 3.3% lanthanum concentrate.
  - High-grade veins, carbonatite dikes, fenitic selvages of the carbonatite dikes, and altered syenite identified.
  - The highest **REE** concentrations are in the dikes (up to 1.6% total REE, 9764 ppm Sr and 745 ppm Y) and in hydrothermal REE-rich veins (up to 13.8% total REE, 5307 ppm Y and 5465 ppm Th + U).





# Silica

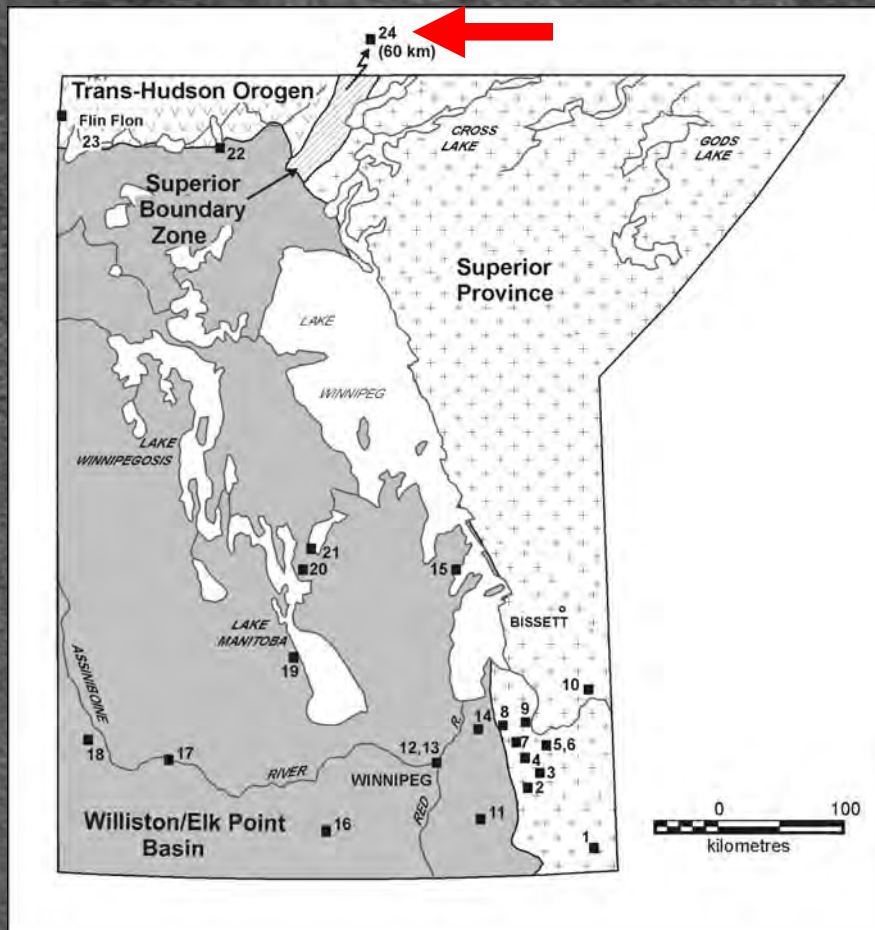


- **Precambrian** Quartzite –  
Ospwagan Lake
- **Ordovician** Silica sand –  
Minago River area
- **Ordovician** Silica sand –  
Seymourville area
- **Precambrian** Quartz –  
Seller's Mountain Quartz





## Precambrian - SBZ Vale



- **Precambrian** quartzite produced from Manasan quarry, near Oswagan Lake, southwest of Thompson, Manitoba
- Grade is variable, but averages 80%  $\text{SiO}_2$  with minor iron and alumina.
- Used as a fluxstone and converter flux in recovering nickel, copper and cobalt from ore by Vale.

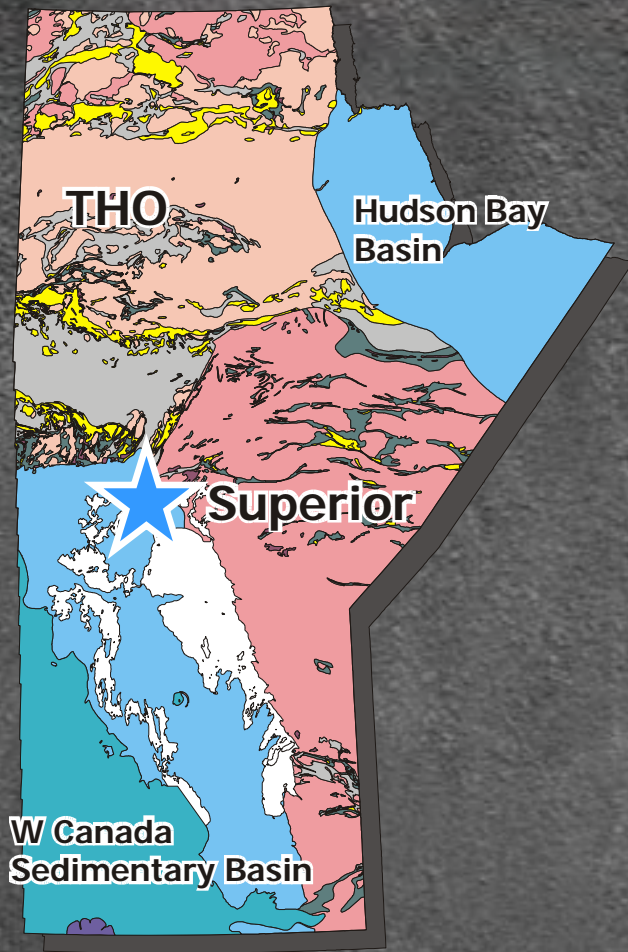
Thompson mine site and plant (City of Thompson in background) – 1980







# Phanerozoic - Ordovician Victory Nickel Silica Sand



A (NI 43-101-compliant) indicated resource of 15 million tonnes of **Ordovician** Winnipeg Formation silica sand (containing 84% marketable frac sand) was drilled off in Sept. 2009.

The sand is situated above Victory Nickel's Minago Nose nickel deposit, south of Thompson. The sand, which forms part of the overburden, must be removed before the nickel can be open-pit mined.

As of September 2010, 23 additional holes, passing through the sand, had been drilled, and another 60 holes are planned for completion by the end of May 2011.





# Phanerozoic - Ordovician Seymourville Silica Sand



- 15 quarry leases on the east shore of the south basin of Lake Winnipeg, issued to:
  - Gossan Resources Limited
  - Char Crete Ltd.
- Occurrence was estimated to be 15 m thick and containing a potential 45 million tonnes of silica sand in the **Ordovician** Winnipeg Formation.
- The sand is exposed at surface or occurs beneath thin overburden
- After washing, a similar Ordovician silica sand from the former Black Island Quarry, a few kilometers to the west across a narrow strait of water, was marketed as being over 99.5%  $\text{SiO}_2$

Silica sand underlying glacial till and gravel southwest of Seymourville





# Phanerozoic - Ordovician Gossan Resources Silica Sand



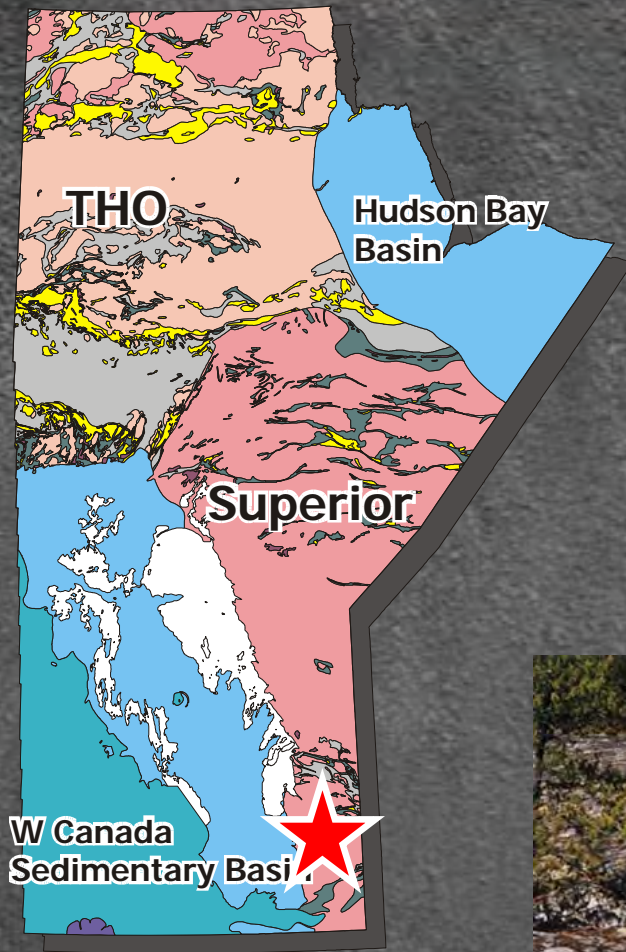
**Silica sand underlying silcrete and thin overburden, south of Seymourville, 2003-10-04**

- Two zones outlined as of May 2008. The zones extend for over 400 and 600 m in length and have thicknesses exceeding 5 m.
- An analysis of 9 washed and scrubbed samples returned a silica content of 99.0%  $\text{SiO}_2$ .
- In May 2010, a series of proppant tests indicated the sand exceeds all of the minimum oil and gas industry frac sand standards.
- A recently completed marketing study concluded that the silica sand meets the specifications for fibreglass, recreation, metallurgical, construction, filtration and well pack markets, in addition to frac sand proppant.





# Precambrian - Superior Quartz



## Seller's (Quartz) Mountain

- 2 km south of Long Lake in SE MB
- Held by Fred Sellers
- High purity quartz core of the main zone is 310 m long, 20 m wide and 20 m thick at south end
- Composite surface sample from the southern end contained 98.9% SiO<sub>2</sub>





Geology and mineral resources of Manitoba

Manitoba



# Manitoba Mining & Minerals Convention 2010

*Winnipeg, Manitoba  
November 18-20, 2010*

On the Web

[www.mineralsconvention.com](http://www.mineralsconvention.com)