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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• 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
Geology and mineral resources of Manitoba

Geological Setting

- **Precambrian**
  - Superior Province (Archean)
  - Trans-Hudson Orogen (Proterozoic)
- **Phanerozoic**
  - Western Canada Sedimentary Basin
  - Hudson Bay Basin
Selected Resources 2010

- Aggregate
- Bentonite
- Coal
- Kaolin
- Lithium
- Rare Earths
- Silica
• 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.
• 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
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)
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

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

Used oil reclamation test
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.
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.
• 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.
- **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

- **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
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

Exploration test pits, 1958

Auger drilling 1996-06-17
- 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
• 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.
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 4305,000 tonnes grading 1.30% Li$_2$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.
• 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.
Medallion Resources Ltd. and Rare Element Resources Ltd. joint venture

- Eden Lake Precambrian carbonate 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, carbonate dikes, fenitic selvages of the carbonate 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 quartzite produced from Manasan quarry, near Ospwagan Lake, southwest of Thompson, Manitoba.

- Grade is variable, but averages 80% SiO$_2$ with minor iron and alumina.
- Used as a fluxstone and converter flux in recovering nickel, copper and cobalt from ore by Vale.
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% SiO₂.

Silica sand underlying glacial till and gravel southwest of Seymourville.
Phanerozoic - Ordovician

Gossan Resources Silica Sand

- 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% SiO₂.
- 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.

Silica sand underlying silcrete and thin overburden, south of Seymourville, 2003-10-04
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$_2$
Manitoba Mining & Minerals Convention 2010

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On the Web
www.mineralsconvention.com