Gale and Conley (2000) concluded that "Upper Mississippi Valley-type (MVT) Pb-Zn mineralization may be widespread in the area west of Lake Winnipegosis", especially along the Superior Boundary Zone (shown in Figure 1 as the Churchill-Superior Boundary Zone) on the basis of a multi-year geochemical study of over 6000 drillcore samples from more than 60 stratigraphic coreholes. They also suggested that mineralization in the Pine Point mining district in the Northwest Territories (Figure 1, Location 5; Figure 2) could be a possible model for potential MVT mineralization in West-central Manitoba (Figure 3). At Pine Point, almost 5 million tonnes of zinc and over 2 million tonnes of lead worth almost \$2 billion (Can.) were produced from 36 orebodies between 1964 and 1988 by Pine Point Mines Ltd. (controlled and operated by Cominco Ltd.).

Figure 4 shows the comparative stratigraphy of the Pine Point, Project Wapa (Saskatchewan) and Lake Winnipegosis areas. Project Wapa (Figure 1, Location 1) is included because Canadian Occidental Petroleum Ltd. and Saskatchewan Mining Development Corporation analyzed 1600 core samples from 49 drillholes between 1976 and 1981 in an unsuccessful attempt to prove up a MVT deposit. The following information will show the results of recent investigations that have

been carried out in West-central Manitoba (Figure 3) by Klyne Exploration and the Manitoba Geological Survey. This work has confirmed the presence of MVT mineralization (Figures 5 to 7) in the Province. In addition, it will be shown that the Pine Point model can be used to develop an exploration strategy to uncover this "hidden treasure".



(Campeau and Kissin, 1988; Kent, 1976, 1996)

Whitemud Falls, Clearwater River

alena Occurrence, AB Middle Devonian Methy (Keg River) Formation Appears to be associated with faulting Minor saddle dolomite Visible galena, at surface

(Pana, 2003)

*Figure 1:* Precambrian structure of the Western Canada Sedimentary Basin with locations of known MVT occurrences, including Pine Point and index map to Figure 3 "West-central Manitoba" (after Burwash et al., 1994).

1300 m depth

Appears to be associated with Great Slave Shear Zone

(Rice, 2003; http://www.ags.gov.ab.ca/activities/minerals/mvt.pdf)

3.1% Zn, 0.05% Pb over 20.7 m including:

5.1 % Zn, 0.03% Pb over 10.8 m and

6.9 % Zn, 0.05% Pb over 2.6 m



**Solution** Pine Point Mining District, N.W.T.

Upper and Middle Devonian Watt Mountain Formation and Pine Point Group

Appears to be associated with Precambrian McDonald Fault and Great Slave Shear Zone

Over 87 Pb-Zn deposits, within interconnected paleokarst network 24 by 65 km area

Total Production - 64.3 million tonnes averaging 3.4% Pb and 7.0% Zn (Rhodes et al., 1984; Symons et al., 1993)

Figure 2: Schematic cross-section from south to north through the Pine Point mining district, N.W.T. (from Gale and Conley, 2000; Anderson and McQueen, 1982).





*Figure 3:* Geological setting of West-central Manitoba showing the location of the Pemmican Island M.V.T. occurrence and other possible M.V.T. Mineralization.

A M-9-79 Middle Devonian Winnipegosis Formation 200 ppm Pb over 0.3 m (Gale and Conley, 2000)

## **M-6-80**

Middle Devonian Winnipegosis Formation Visible sphalerite at depth of 113.0-113.1 m 21.0-21.3 m - 147 ppm Zn in Souris River Formation 113.0-113.1 m - 225 ppm Zn in Winnipegosis Formation (A.F. 92116; Bamburak and Klyne, 2004) 116.9-117.3 m - 160 ppm Cu in Winnipegosis Formation (Gale and Conley, 2000; Bamburak et al., 2000)

# **M-5-00**

Middle Devonian Winnipegosis Formation Visible sphalerite at depth of 114.2 m 115.0-116.0 m - 156 ppm Cu in Winnipegosis Formation 116.0-117.0 m - 410 ppm Cu in Winnipegosis Formation H S-7-75 (Bamburak et al., 2000)

Middle Devonian Dawson Bay Formation Possible visible sphalerite at depth of 72.8 m (Bamburak, 2006)



# **MVT Mineralization Indicators in West-central Manitoba**

### E 13-10-36-26W1 Ordovician Red River Formation Visible sphalerite at depth of 429 m 81 ppm Pb over 3 m in Silurian Interlake Group (A.F. 92116)

**F** 1-28-36-26W1 Middle Devonian Winnipegosis Formation 182 ppm Cu

G 15-32-36-26W1

Silurian Interlake Group 341.4-353.6 m - 297 ppm Cu and 294 ppm Zn, including: 347.5-350.5 - 721 ppm Cu and 690 ppm Zn (A.F. 92116; Bamburak and Klyne, 2004)

193 ppm Zn over 0.7 m in Middle Devonian Dawson Bay Formation **L** Ami Island Outcron 162 ppm Pb over 0.6 m in Middle Devonian Winnipegosis Formation Silurian Interlake Group (Gale and Conley, 2000)

**I** The Bluff Junction Outcrop Middle Devonian Dawson Bay Formation Goethitic carbonate sample 0.16 % (1600 ppm) Pb and 0.12% (1200 ppm) Zn from sample (A.F. 93877; Bamburak and Klyne, 2004)

J Rowan Island Outcrop Middle Devonian Winnipegosis Formation Carbonate sample 265 ppm Pb

(A.F. 93877; Bamburak and Klyne, 2004) K M-2-73

Middle Devonian Dawson Bay Formation 64 ppm Pb over 0.4 m (Gale and Conley, 2000)

Two samples - 724.1 ppm and 911 ppm Ni (Unpublished information)

<b>Point,</b> <b>N.T.</b> et al., 1984)	Project Wapa, Saskatchewan Kent (1976)	Lake Winnipegosis, Manitoba
	Pleistocene & Holocene	
	Manville Group	Swan River Fm.
er Fm.		
oint Fm. Shale		Souris River Fm.
untain Fm.		Dawson Bay Fm.
oint Fm. River Fm.)		Prairie Evaporite (dissolved)
ər Fm.	Winnipegosis Fm.	Winnipegosis Fm.
ga Fm.	Meadow Lake Fm.	Ashern Fm.
Point Fm.	Basal Red Bed	
		Interlake Group
		Stonewall Fm.
		Stony Mountain Fm
	Cambrio- Ordovician	Red River Fm.
rt Island		Winnipeg Fm.
TTTTTTTTT	111111111111111111111111111111111111111	

*Figure 4:* Comparative stratigraphy of Pine Point, N.W.T.; Project Wapa, Saskatchewan; and Lake Winnipegosis in West-central Manitoba (Modified from Rhodes et al., 1984; Kent, 1976, 1996).



*Figure 5:* Pemmican Island in the north basin of Lake Winnipegosis showing location of mineralized zone (with solid sulphide slabs and concretions), karst channel, magnetic and conductivity trend and drillhole locations (from Bamburak and Klyne, 2004).



Mildle Devonian Winnipegosis Formation or Silurian Interlake Group Maximum values obtained from analyses of slabs and concretions - 1.18% Ni, 0.76% Zn, 3670 ppm As, 1100 ppm Pb and 813 ppm Co, 62.2% Fe, 36.4% S It should be noted that the sample with 1100 ppm Pb also contained 1700 ppm Zn. (Bamburak et al., 2002)

*Figure 6:* Pemmican Island slabs and concretions.



NZ DDH Klyne No. 3 Silurian Interlake Group

6.5 m intersection averaging 0.61 % Zn from 17.5-23.9 m drill length, including: 15 cm intersection averaging 4.59 % Zn, 0.41% Pb, 0.014% Cu, 10.4% Fe and 14.05 % S (Bamburak and Klyne, 2004)

*Figure 7:* Mineralized core from DDH Klyne No. 3, drilled offshore

# West-central Manitoba

There are at least 10 indications of MVT mineralization, shown in Figure 3, present within West-central Manitoba, mainly to the west of Lake Winnipegosis. One of these indications on the east shore of Pemmican Island (Location M on Figure 3) comprises pebble to boulder-sized sulphide concretions and slabs within a mineralized zone (Figure 5). Maximum analytical values obtained from the concretions and slabs are: 62.2% Fe, 36.4% S, 1.18% Ni, 0.76% Zn, 3670 ppm As, 1100 ppm Pb and 813 ppm Co. It should be noted that the sample with 1100 ppm Pb also contained 1700 ppm Zn. The presence of these MVT indications supports the conclusion reached by Gale and Conley (2000) that "Upper Mississippi Valley-type (MVT) Pb-Zn mineralization may be widespread in the area west of Lake Winnipegosis" (i.e. West-central Manitoba, especially along the Superior Boundary Zone).

Confirmation of the presence of a potential MVT deposit in West-central Manitoba was found in DDH Klyne No. 3, the Discovery Hole (Figure 5), where a 6.5 m intersection averaging 0.61% Zn, was found in Silurian dolomite host rock. The intersection included a 15 cm interval grading 4.59% Zn, 0.41% Pb, 0.014% Cu, 10.4% Fe and 14.05% S (Figure 3, Location N; Figure 7).

# Northeastern Alberta

For relative comparison with MVT potential of northeastern Alberta, the above analytical results can be contrasted with the results of the 2002 study, by the Alberta Geological Survey, in which 26 sulphidebearing core samples were analyzed from four Middle and Upper Devonian carbonate formations (Rice and Zerbe, 2003). These samples were selected from 113 cores drilled in the Fort McMurray and Fort Vermilion-Harper Creek areas as part of a Contribution to the federal-provincial Carbonate-Hosted Pb-Zn (MVT) Targeted Geoscience Initiative. The target of the study was to find a deposit with the same geological controls as those occurring at Pine Point.

Examination of the cores revealed that only pyrite was present - no visible galena or sphalerite was observed. Further, Rice and Zerbe (2003) reported that "Trace element analyses returned a maximum Pb concentration of 246 ppm from pyrite-bearing Keg River Formation dolostone at 780 m in well GPD Noel et al Jean D'Or (15-27-109-07W5). The best Zn concentration is 75 ppm and came from the pyrite-bearing Waterways Formation limestone at 110 m in well Esso 90-12 Oslo OV (07-10-095-09W4)."

## Pine Point Model

As mentioned earlier, Gale and Conley (2000) also suggested that the Pine Point Mining District, in the Northwest Territories (Figure 1) could be a possible model for potential MVT mineralization in Manitoba. Within the Pine Point Mining District, over 87 Pb-Zn deposits, within paleokarst structures (Figure 2), were defined within a 24 by 65 km area. The special distribution of the 10+ MVT occurrences in Westcentral Manitoba, shown in Figure 3, suggests that numerous MVT deposits could be present within a 260 by 340 km area.

# **Stratigraphic Control**

At Pine Point, the MVT mineralization is situated within Devonian Pine Point Group and Watt Mountain Formation beds that lie beneath the Amco Shale (Figure 2). It should be noted that the Silurian is absent, as shown in Figure 4. However in West-central Manitoba, a relatively thick (~100 m), but eroded Silurian Interlake Group is present beneath the Devonian (Figure 4). Widespread and extensive pre-Middle Devonian paleokarst development is suspected beneath this unconformity. The unconformity would result in a truncation-type stratigraphic trap between the porous and karsted Interlake Group carbonate rock and the overlying Ashern Formation redbeds. These argillaceous redbeds would form a secondary caprock or seal to prevent upward movement of (hydrocarbon and/or hythrothemal?) fluids along the unconformity. Evidence for this was provided by Theiede and Cameron (1978), who showed that the highest concentrations of Cu, Pb and Zn within the Elk Point Evaporite sequence occurred in the green shale and red dolomitic shale of the Ashern Formation, below the massive nodular dolomite of the Winnipegosis Formation. They also concluded that large tonnages of Cu, Pb and Zn may be present within the Elk Point

## **Basement Reactivation and Paleokarst Development**

Pana (2003) stated that based upon field observations and a preliminary review of published information, "all carbonate-hosted lead-zinc occurrences in the WCSB are strictly related to 'fault zone processes'." According to Wright et al. (1994), paleokarst development in the Pine Point area was related to basement re-activation that induced fracturing in the dolomite overlying the Great Slave Lake Shear Zone. Rhodes et al. (1984) noted that most Pine Point orebodies were deposited within a single interconnected paleokarst network where metallic sulphides precipitated from chloride-rich brines. According to White et al. (1993, 1994), in Manitoba the Archean Superior craton was uplifted during Precambrian time, relative to the SBZ, along a west-verging thrust fault. Maps produced by the Thompson Nickel Belt Geology Working Group (2001a, b and c) usually show a fault at the contact between the SBZ and the Superior Craton. Reactivation of the Precambrian basement along the SBZ during the Phanerozoic is believed to have produced vertical fractures, which penetrated upwards into the overlying Paleozoic rock (Gale and Conley, 2000). Evidence for basement reactivation was documented by Bezys (1996a) along the SBZ immediately to the north of West-central Manitoba, where sub-vertical fracturing was noted in Paleozoic core and in outcrop on the east shore of Reedy Lake. The fracturing occurs in the vicinity of the Reedy Lake Lineament, which is on strike with a 55 km long Precambrian basement shear zone (A.F. 94685). Holes M-5-95 and M-6-95, confirmed that the Reedy Lake Lineament is a fault (Macek, 1995 and Bezys, 1995). Further evidence for basement reactivation within West-central Manitoba was suggested by B. Powell and G. Wood in a geophysical report to Cominco Exploration in 1992 (A.F. 94640). One of their possible explanations for a gravity anomaly immediately west of Denbeigh Point "involves Archean being thrusted over Proterozoic and into Paleozoic cover with a concomitant downward displacement of the dolomites into the footwall." The position of this northward-trending fault corresponds to the orientation of the west shoreline of Denbeigh Point and the location of the eastern boundary of the SBZ.

The Ochre Lake structure, on the east shore of Ochre Lake (Twp. 50, Rge. 14, 15W1), 23 km northwest of Grand Rapids may also represent basement reactivation. The structure occurs in close proximity to the buried faulted eastern margin of the SBZ with the Superior craton. Bezys (1996b) concluded that although the Ochre Lake structure might represent an ancient brine spring vent; a tectonic event, possibly a fault-or diatreme, was implied by the presence of structurally disturbed in situ carbonate beds.

Basement reactivation may have also occurred within the Archean Superior Province in conjunction with movements along the SBZ. Pilkington and Thomas (2001) subdivided the Berens River Domain (Figure 3) into 4 subdomains mainly on the presence of distinctive linear magnetic features. They cautioned however, that the subdivisions may signify major faults/shear zones rather than boundaries between compositionally different blocks. Pemmican Island is situated almost at the T-intersection between the

faulted eastern margin of the buried Precambrian SBZ and two subdomains of the Archean Berens River Domain of the Superior craton as shown in Figure 3.

The vertical fractures into the Silurian Interlake Group along the T-intersection would have provided avenues for mineralized fluid migration from basement into the overlying sedimentary rock, where the right conditions of pressure and temperature would have resulted in deposition of metallic minerals, such as Cu, Ni, Pb and Zn (Bamburak and Klyne, 2004).

After deposition of the overlying Devonian stratigraphy across the Western Canada Sedimentary Basin (Figure 1), continued basement reactivation above basement faults, such as the McDonald and Stanley faults and faults within the SBZ resulted in:

1) basement and interformational fluids using the fractures as pathways, allowing the brines to dissolve out evaporite beds, such as the Prairie Evaporite (Figure 4);

2) collapse of the overlying stratigraphic units due to the removal of the evaporites; 3) continued migration of basement and interformational fluids, some possibly containing metallic sulphides, into fractured and brecciated carbonates; and

4) precipitation of metals in a trap below an unfractured shale aquitard, such as the Amco Shale at Pine Point or the First and Second red beds at the base of the Souris River and Dawson Bay formations in West-central Manitoba, respectively (Figure 2).

### **Ore-forming Fluid Temperatures and Composition**

According to Roedder (1968) and Rhodes et al. (1984), ore-forming fluids at Pine Point were exceedingly saline brines (free of solid particles) that ranged in temperature from about 50° to 100° C. Numerous saline springs are flowing in West-central Manitoba and maximum salinities range from 45 000 to almost 53 000 mg/l. Higher salinities may have occurred in the past when hydrothermal conditions may have present, as suggested by conodont studies and solution chimney structures (lined with siderite-rich rind and siliceous sinters) found in the Mafeking quarries (Fedikow et al., 2004). Warm basement temperatures are also indicated by the presence of non-kimberlitic accretionary lapilli in core from an inclined Cominco Limited drillhole (RP-96-21), 7.5 km south of Easterville (Bezys et al., 1996). It was estimated that the lapilli originated, from a volcanic vent within or adjacent to the SBZ, not more than 20 km from the drillhole.

### **Relationship of Small Gravity Highs and Orebodies**

Small Bouguer gravity highs have been noted over several Pine Point orebodies, as noted by Seigel et al. (1968) and as shown in Figure 8 from Lajoie and Klein (1979). A singular gravity high (Figure 9) has been detected near Pickerel Lake, just east of the north basin of Lake Winnipegosis. The small circular gravity high is also situated at the northern end of the Camperville Gravity Low (Figure 3). Many more small gravity highs may be present in West-central Manitoba than is shown in Figure 9, but they could have been missed due to the wide spacing of gravity stations.



Interlake Group.

**Selected References** Survey, p. 246-252.

Manitoba Geological Survey, p. 266-278. 131-143.

Research Council, p. 49-56.

Geoscientific Report GR2004-1, 76 p. 14, p. 141-152.



Figure 8: Bouguer gravity data over Pine Point orebody A (from Lajoie and Klein, 1979).

*Figure 9:* Bouguer gravity in the vicinity of the north basin of Lake Winnipegosis showing relative density of gravity stations and the location of the Pickerel Lake gravity high, situated 25 k, southeast of Pemmican Island (from Website: http://gdr.nrcan.gc.ca/gravity/index e.php.).

Considering all of the above, it is now possible to conclude that:

# **1. YES, another "Pine Point Mining District"**

# is hiding in West-central Manitoba.

# And YES, more work is required to prove that it does. **Do you have the determination to "Make It So"?**

To give you a head start on your new grassroots MVT exploration program in Manitoba, Figure 10 depicts what this hypothetical mining district might look like in cross-section from Swan River to Pemmican Island.



Anderson, G.M. and Macqueen, R.W., 1982. Ore Deposit Models - 6. Mississippi Valley-type lead-zinc deposits; Geoscience Canada, Vol. 9, No. 2, p. 108-117. Bamburak, J.D. 2006: Manitoba Geological Survey's stratigraphic corehole drilling program; in

Report of Activities 2006, Manitoba Science, Technology, Energy and Mines, Manitoba Geological

Bamburak, J.D. and Klyne, K. 2004: A possible new Mississippi Valley-type mineral occurrence near Pemmican Island in the north basin of Lake Winnipegosis, Manitoba (NTS 63B12 and 13, 63C9 and 16), Manitoba; in Report of Activities 2004, Manitoba Industry, Economic Development and Mines.

Bamburak, J.D., Hosain, I.T. and Klyne, K. 2002: Phanerozoic solid-sulphide occurrence containing Devonian dolomite breccia clasts, Pemmican Island, Lake Winnipegosis (NTS 63B12NW), Manitoba: in Report of Activities 2002, Manitoba Industry, Trade and Mines, Manitoba Geological Survey, p.

Bamburak, J.D., Hosain, I.T., Fedikow, M.A.F. and Dobrzanski, E. 2000: Investigations on the Camperville gravity low (parts of NTS 62N/E and 63C/E); in Report of Activities 2000, Manitoba Industry, Trade and Mines, Manitoba Geological Survey, p. 202-209.

Bezys, R.K. 1995: Stratigraphic mapping (NTS 62I and 63G) and corehole program 1995; in Report of Activities 1995, Manitoba Energy and Mines, p. 99-108. Bezys, R.K. 1996a: Sub-Paleozoic structure in Manitoba's northern Interlake along the Churchill-

Superior Boundary Zone: A detailed investigation of the Falconbridge William Lake study area; Manitoba Energy and Mines, Open File Report OF 94-3, 32p. *Bezys, R.K. 1996b:* Stratigraphic mapping (NTS 63G) and corehole drilling program 1996; in Report

of Activities 1996, Manitoba Energy and Mines, Geological Services, p. 96-102. Bezys, R.K., Fedikow, M.A.F. and Kjarsgaard, B.A. 1996: Evidence of Cretaceous(?) volcanism along the Churchill-Superior boundary zone, Manitoba (NTS 63G/4); in Report of Activities, 1996,

Manitoba Energy and Mines, Geological Services, p. 122-126. Burwash, R.A., McGregor, C.R. and Wilson, J. 1994: Precambrian basement beneath the Western Canada Sedimentary Basin; in Geological Atlas of the Western Canada Sedimentary Basin, G.D. Mossop and I. Shetsen (comps). Calgary, Canadian Society of Petroleum Geologists and Alberta

Campeau, R.M. and Kissin, S.A. 1988: Project Wapa: Evaluation of a lead-zinc occurrence in Middle Devonian carbonates on northern Saskatchewan; Geoscience Canada, vol. 15, no. 2, p. 106-108. Fedikow, M.A.F., Bezys, R.K., Bamburak, J.D., Hosain, I.T. and Abercrombie, H.J. 2004: Prairie-type microdisseminated mineralization in the Dawson Bay area, west-central Manitoba (NTS 63C14 and 15); Manitoba Industry, Economic Development and Mines, Manitoba Geological Survey,

Gale, G.H. and Conley, G.G. 2000: Metal contents of selected Phanerozoic drill cores and the potential for carbonate-hosted Mississippi Valley-type deposits in Manitoba; Manitoba Industry, Trade and Mines, Geological Survey, Open File Report OF2000-3, 126 p. *Kent, D.M. 1976:* Geology of the Project WAPA area; Unpublished report, Canadian Occidental

Petroleum Ltd., Minerals Division, Toronto, Ontario, 25 p. Kent, D.M. 1996: Mississippi Valley-type mineralization in Lower Devonian Lower Elk Point strata,

south La Ronge area, central Saskatchewan: A case history; in Minexop'96 Symposium - Advances in Saskatchewan geology and mineral exploration, Saskatchewan Geological Society, Special Paper No.

Lajoie, J.J. and Klein, J. 1979: Geophysical exploration at the Pine Point Mine Ltd. zinc-lead property, Northwest Territories, Canada in Geophysics and Geochemistry in the Search for Metallic Ores; Peter J. Hood, editor; Geological Survey of Canada, Economic Geology Report 31, p. 653-664.

*Macek, J.J. 1995:* Precambrian drilling along the sub-Paleozoic eastern boundary of the Thompson Nickel Belt in Report of Activities 1995, Manitoba Energy and Mines, Minerals Division, p. 93-96. Pana, D.I. 2003: Structural control of lead-zinc mineralization in carbonate sequences of northern Alberta: A contribution to the carbonate-hosted Pb-Zn (MVT) Targeted Geoscience Initiative; Alberta Energy and Utilities Board, EUB/AGS, Geo-Note 2002-15, 32 p.

*Pilkington, M. and Thomas, M.D. 2001:* Magnetic and gravity maps with interpreted Precambrian basement, Manitoba; Geological Survey of Canada, Open File 3739, 4 map sheets at 1:1 500 000 scale. Rhodes, D., Lantos, E.A., Lantos, J.A., Webb, R.J. and Owens, D.C. 1984: Pine Point orebodies and their relationship to the stratigraphy, structure, dolomitization, and karstification of the Middle Devonian barrier complex; Economic Geology, vol. 79, p. 991-1055.

*Rice, R.J. 2003:* The carbonate-hosted Pb-Zn (MVT) project for northern Alberta - Background and year one summary: A contribution to the carbonate-hosted Pb-Zn (MVT) Targeted Geoscience Initiative; Alberta Energy and Utilities Board, EUB/AGS, Geo-Note 2002-19, 7 p.

Rice, R.J. and Zerbe, T.A. 2003: Carbonate-hosted Pb-Zn (MVT) in northeastern Alberta - 2002 core program: A contribution to the carbonate-hosted Pb-Zn (MVT) Targeted Geoscience Initiative; Alberta Energy and Utilities Board, EUB/AGS, Geo-Note 2003-02, 12 p., plus appendices. *Roedder, E. 1968:* Temperature, salinity, and origin of the ore-forming fluids at Pine Point, Northwest

Territories, Canada, from fluid inclusion studies; Economic Geology; vol. 63, p 439-450. Seigel, H.O., Hill, H.L. and Baird, J.G. 1968: Discovery case history of the Pyramid ore bodies Pine Point, Northwest Territories, Canada; Geophysics, vol. 33, no. 4, p. 645-656.

Symons, D.T.A., Pan, P., Sangster, D.F. and Jowett, E.C. 1993: Paleomagnetism of the Pine Point Zn-Pb deposits; Canadian Journal of Earth Sciences, vol. 30, p. 1028-1036. Theide, D.S. and Cameron, E.N. 1978: Concentration of heavy metals in the Elk Point evaporite

sequence, Saskatchewan; Economic Geology, vol. 73, p. 405-415. Thompson Nickel Belt Geology Working Group 2001a: Geology of Perch Lake (63G/5), Eating Point (63G/06), Howell Point (63G/11 and Bracken Lake (63G/12) areas; Manitoba Industry, Trade and

Mines, Manitoba Geological Survey, Preliminary Map 2001FS-1, scale 1:100 000. Thompson Nickel Belt Geology Working Group 2001b: Geology of Kokookahoo Island (63F/8) and Lamb Lake (63F/9) areas; Manitoba Industry, Trade and Mines, Manitoba Geological Survey, Preliminary Map 2001FS-2, scale 1:100 000.

Thompson Nickel Belt Geology Working Group 2001c: Geology of the Hargrave River (63J/6), Hill Lake (63J/7), Muhigan Lake (63J/10) and Tyrell (63J/11) areas; Manitoba Industry, Trade and Mines, Manitoba Geological Survey, Preliminary Map 2001FS-1, scale 1:100 000.

White, D.J., Lucas, S.B., Hajnal, Z., Green, A.G., Lewry, J.F., Weber, W., Bailes, A.H., Syme, E.C. and Ashton, K.E: 1994: Paleo-Proterozoic thick-skinned tectonics : Lithoprobe seismic reflection results from the eastern Trans-Hudson Orogen; National Research Council of Canada, Canadian Journal of Earth Sciences = Journal Canadien des Sciences de la Terre, vol. 31, no. 3, p. 458-469. White, D.J., Lucas, S.B., Hajnal, Z., Green, A.G., Lewry, J.F., Weber, W., Zwanzig, H.V., Bailes, A.H.,

Syme, E.C., Macek, J., Ashton, K.E: and Thomas, D.J. 1993: Lithoprobe seismic refection results from the eastern Trans-Hudson Orogen; in Lithoprobe : Trans-Hudson Orogen Transect : report of third transect meeting, ed(s). Hajnal, Z. Lewry, J.F.; [University of British Columbia, Lithoprobe Secretariat [for the] Canadian Lithoprobe Program], Third transect meeting on Trans-Hudson Orogen Transect, Regina, SK, April 1-2, 1993, Lithoprobe Report 34, p. 13-19.

Wright, G.N., McMechan, M.E. and Potter, D.E.G. 1994: Structure and architecture of the Western Canada Sedimentary Basin; in Geological Atlas of the Western Canada Sedimentary Basin, G.D. Mossop and I. Shetsen (comps). Calgary, Canadian Society of Petroleum Geologists and Alberta Research Council, p. 25-

Author(s): J. D. Bamburak and K. Klyne **MVT Mineralization - Is There Another "Pine Point** Mining District" Hiding In West-central Manitoba?

