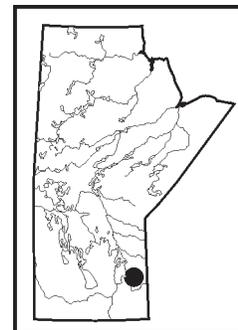


GS-21 Platinum group element investigations in the area of the Mayville igneous complex, Manitoba (NTS 52L12): exploiting palladium's mobility using humus samples
by P. Theyer



Theyer, P. 2004: Platinum group element investigations in the area of the Mayville igneous complex, Manitoba (NTS 52L12): exploiting palladium's mobility using humus samples; *in* Report of Activities 2004, Manitoba Industry, Economic Development and Mines, Manitoba Geological Survey, p. 232–235.

Summary

Thirty-three humus samples collected from the area of the Mayville igneous complex are being analyzed for Pd to investigate the distribution of platinum group element (PGE) mineralization known to occur in this igneous environment. The high mobility of Pd in aqueous surface environments, following local drainage pattern contrasts with its ready and tight adherence to organic matter, make it an ideal pathfinder element for areal surveys of sulphide-poor PGE prospects, especially in the wet and glacial-till-covered terrains that are so common to the Canadian Shield.

Introduction

The Mayville igneous complex, a mafic-ultramafic layered intrusion that is possibly part of the Bird River Sill (Trueman, 1980; Figure GS-21-1) has been explored for Ni, Cu, Cr and PGE for a number of years. Two Ni-Cu-PGE occurrences in this area, the Hititrite (Wright, 1932; Theyer, 1986) and the Mayville (Theyer, 1986; Figure GS-21-1), have been known for decades (Athayde, 1989).

Exploration for these commodities in the Mayville area, lately undertaken by Exploratus Limited and Maskwa Nickel Chrome Mines, traditionally relied on trenching and rock sampling of mineral occurrences; more recently on geophysical surveys followed by drilling; and, in the last few years, on areally extensive overburden stripping followed by channel sampling of the newly created exposures. Complementing these activities were two recently completed B.Sc. theses that investigated the petrology and PGE mineralization of the Mayville intrusion and the composition of chromite (Hiebert, 2003; Mackie, 2003). The area in which overburden is relatively shallow and stripping therefore feasible is restricted to a narrow (approx. 300 m wide) east-striking corridor. The balance of the area is generally covered by up to several metres of thick glacial till veneer and swamps. Geophysical surveys are not expected to be effective, since sulphides in the Mayville intrusion are generally disseminated, rarely exceeding 5 vol. %.

This intrusion is comparable to a number of other recently defined, sulphide-poor, gabbro-hosted PGE prospects that pose a severe exploration challenge. The most notable of these occurrences include the Lac des Isles (currently the only Pd producer in Canada) and associated deposits near Thunder Bay in northwestern Ontario (Sutcliffe, 1986; Sutcliffe et al., 1989; Lavigne and Michaud, 2001); the East Bull Lake suite and Nipissing gabbro suite in central Ontario (Peck et al., 2001; James et al., 2002); and certain layered complexes in the Baltic Shield (Schissel et al., 2002).

A detailed study of the behaviour and distribution patterns of Pd in aqueous surface environments (Wood et al., 1992; Wood, 2002), and its use as a potentially valuable exploration tool to define the location and distribution of PGE concentrations in the Lac des Isles area (Hattori and Cameron, 2004), provided the inspiration and incentive to try this method in the Mayville area.

Geology and PGE mineralization

The Mayville intrusion in the northern part of the of the Bird River Belt is a mafic-ultramafic body, at least 10 km long and 1.1 km thick, that intruded the contact of felsic-intermediate gneissic rocks to the north and mafic-intermediate volcanic rocks of the Lamprey Falls Formation to the south. The exact extent of the intrusion is unknown, since both upper and lower contacts are not exposed. Peck et al. (1999, 2002) subdivided the intrusion into an upper leucogabbro-anorthosite zone and a lower, 200 to 300 m thick heterolithic breccia zone. The heterolithic breccia zone is characterized by complexly interrelated angular and embayed anorthosite blocks, up to several metres thick, surrounded and in places invaded by pyroxenite, peridotite and chromiferous peridotite. Sulphide mineralization is exposed in the heterolithic breccia zone.

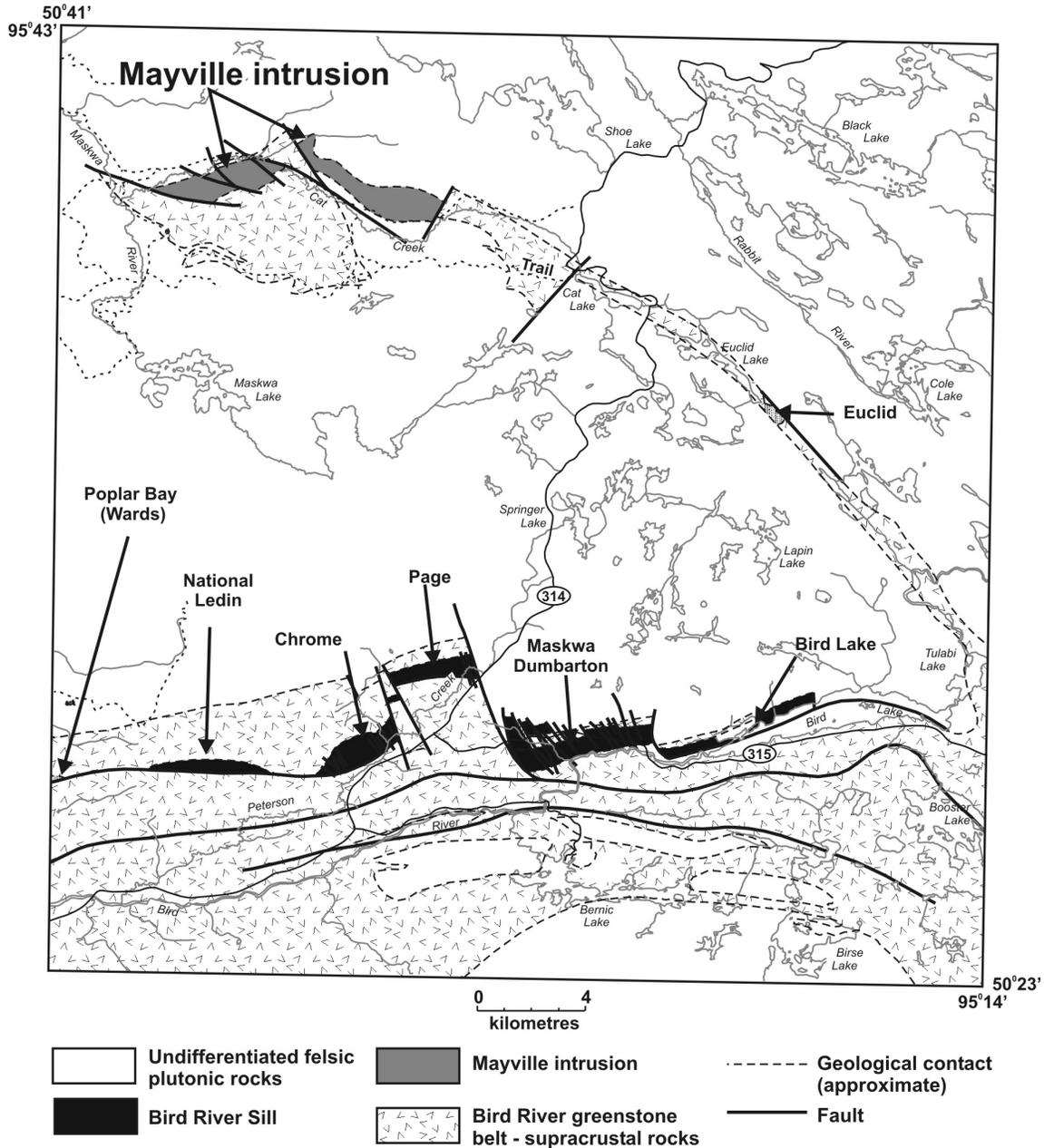


Figure GS-21-1: Simplified geology of the Bird River Belt, showing the location of the Bird River Sill and the Mayville intrusion.

Humus samples

Hattori and Cameron (2004) emphasized that, owing to the high mobility of Pd in aqueous solutions, the effectiveness of a Pd-in-humus sample program is dependent on correctly sited sample locations, which in turn depend on a good understanding of the local topography and recognition of drainage patterns. Sample locations and numbers, the topography and inferred water-drainage paths of the terrain underlain by the Mayville intrusion are depicted in Figure GS-21-2. The area is drained by two streams: Cat Creek, which meanders in a westerly direction near the northern edge of the map, and Maskwa Creek, a north-flowing subsidiary of Cat Creek at the western edge of the map. Drainage of the large waterlogged terrain south of Cat Creek is constrained by a prominent east-striking ridge, up to 30 m high, underlain by anorthosite and leucogabbro. The ridge is breached near its eastern end by a drainage channel in which sample 14 was taken.

Water-borne metals from the Mayville mineral occurrence and its surroundings are expected to drain into Cat

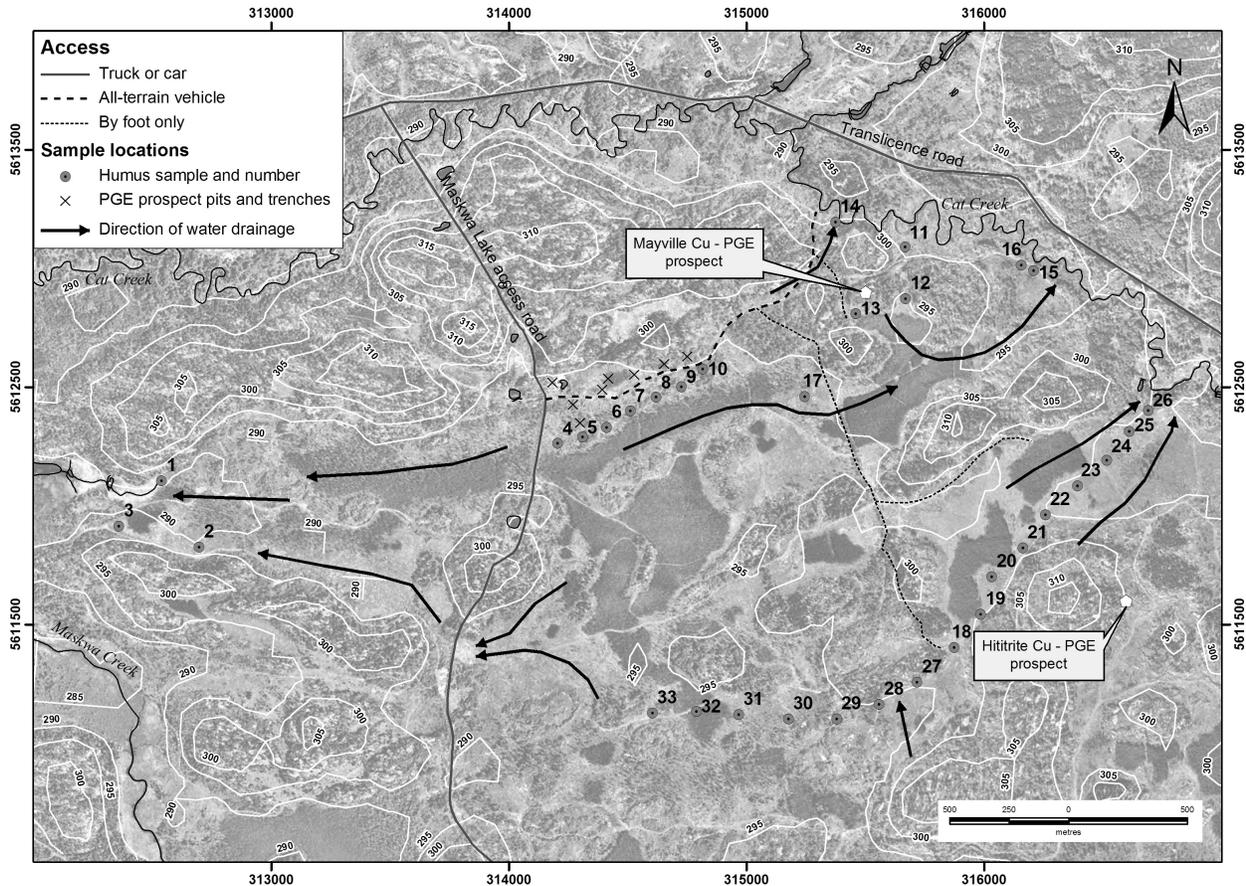


Figure GS-21-2: Topography, surficial-water flow patterns, access, and sample locations and numbers, Mayville area.

Creek in the vicinity of samples 11, 12, 15 and 16. Samples 4, 5, 6, 7, 8, 9, and 10 were collected to further investigate the extent of the mineralization uncovered by Exploratus. Sample 17 was taken to combine the effect of the previous sample series. The sample series 18 to 33 was collected to detect the occurrence of mineralization draining from the northwestern side of the ridge hosting the Hititrite Cu-PGE prospect, and samples 1, 2, and 3 were collected to probe the possibility that as-yet unknown PGE mineralization is contained in rocks within the catchment area draining into Maskwa Creek (i.e., west of the watershed located in the area between the hill hosting the Hititrite mineral prospect and the ridge underlying the Maskwa Lake access road).

After air drying, all samples will be sieved to -80 mesh and a 15 g subsample will be digested by aqua regia and analyzed by inductively coupled plasma-mass spectrometry (ICP-MS). Analytical results will be published separately, since they were not yet available at the time this report was written.

Economic considerations

The aim of this study is to define and delineate the extent of PGE mineralization in an area underlain by a mafic-ultramafic intrusive body known to contain, in places, significant quantities of PGE. This method relies, on the one hand, on the high solubility of Pd in aqueous surface environments facilitating widespread distribution following drainage patterns and, on the other hand, on the strong adherence of Pd to humus. Humus samples collected in or near drainage channels will reflect Pd concentrations in the catchment area, thus allowing the explorationist to decide on further exploration of the investigated area. The Mayville PGE prospect may be part of the Bird River Sill, a group of Archean intrusions in southeastern Manitoba that has recently seen a revival of exploration for Ni, Cu and PGE.

Acknowledgments

The author thanks Mark Pacey and Bonnie Lenton for producing the graphics in this report.

References

- Athayde, P. 1989: Platinum-group metals in Manitoba; Manitoba Energy and Mines, Minerals Division, Open File Report OFR89-5, 47 p. plus 5 microfiche.
- Hattori, K.H. and Cameron, E.M. 2004: Using the high mobility of palladium in surface media in exploration for platinum group element deposits: evidence from the Lac des Isles region, northwestern Ontario; *Economic Geology*, v. 99, p. 157–171.
- Hiebert, R. 2003: Composition and genesis of chromite in the Mayville Intrusion: southeastern Manitoba; B.Sc. thesis, University of Manitoba, Winnipeg, Manitoba, 96 p.
- James, R.S., Jobin-Bevans, S., Easton, R.M., Wood, P., Hrominchuck, J.L., Keays, R.R. and Peck, D.C. 2002: Platinum-group element mineralization in Paleoproterozoic basic intrusions in central and northeastern Ontario, Canada; *in* The Geology, Geochemistry, Mineralogy and Mineral Beneficiation of Platinum-Group Elements, L.J. Cabri (ed.), Canadian Institute of Mining and Metallurgy, Special Volume 54, p. 339-365
- Lavigne, M.J. and Michaud, M.J. 2001: Geology of North American Palladium Ltd.'s Roby zone deposit, Lac des Isles; *Exploration and Mining Geology*, v. 10, no. 1-2, p. 1-17.
- Mackie, R. 2003: Emplacement history and PGE-enriched sulphide mineralization of the heterolithic breccia zone in the Mayville Intrusion; B.Sc. thesis, University of Manitoba, Winnipeg, Manitoba, 135 p.
- Peck, D.C., Halden, N.M., Jobin-Bevans L.S., Cameron, H.D.M. and Theyer, P. 1999: Summary of metallogenetic and petrogenetic features of Archean anorthosites and associated mafic and ultramafic rocks in the Superior Province, Manitoba (parts of NTS 63I, 63J, 63P and 64A); *in* Report of Activities 1999, Manitoba Industry, Trade and Mines, Geological Services, p. 94–96.
- Peck, D.C., Keays, R.R., James, R.S., Chubb, P.T. and Reeves, S.J. 2001: Controls on the formation of contact-type platinum group mineralization in the East Bull Lake intrusion; *Economic Geology*, v. 96, p. 559–581.
- Peck, D.C., Scoates, R.F.J., Theyer, P., Desharnais, G., Hulbert, L.J. and Huminicki, M.A.E. 2002: Stratiform and contact-type PGE-Cu-Ni mineralization in the Fox River Sill and the Bird River Belt, Manitoba; *in* The geology, geochemistry, mineralogy and mineral beneficiation of platinum-group elements, ed(s). Cabri, Louis J.; Canadian Institute of Mining and Metallurgy, Special Volume 54, p. 367-387.
- Schissel, D., Tsvetkov, A.A., Mitrofanov, F.P. and Korchagin, A.U. 2002: Basal platinum-group element mineralization in the Federov Pansky layered mafic intrusion, Kola Peninsula, Russia; *Economic Geology*, v. 97, p. 1657-1677.
- Sutcliffe, R.H. 1986: Regional geology of the Lac des Isles area, District of Thunder Bay; Ontario Geological Survey, Miscellaneous Paper 132, p. 70–75.
- Sutcliffe, R.H., Sweeny, J.M. and Edgar, A.D. 1989: The Lac des Isles complex, Ontario: petrology and platinum group elements mineralization in an Archean mafic intrusion; *Canadian Journal of Earth Sciences*, v. 26, p. 1408–1427.
- Theyer, P. 1986: Platinum group elements in southeastern Manitoba; *in* Report of Field Activities 1986, Manitoba Energy and Mines, Minerals Division, p. 125–130.
- Trueman, D.L. 1980: Stratigraphy, structure, and metamorphic petrology of the Archean greenstone belt at Bird River, Manitoba; Ph.D. thesis, University of Manitoba, 150 p.
- Wood, S.A. 2002: The aqueous geochemistry of the platinum group elements with applications to ore deposits; *in* The Geology, Geochemistry, Mineralogy and Mineral Beneficiation of Platinum-Group Elements, L.J. Cabri (ed.), Canadian Institute of Mining and Metallurgy, Special Volume 54, p. 955–982.
- Wood, S.A., Mountain, B.W. and Pan, P. 1992: The aqueous geochemistry of platinum, palladium and gold: recent experimental constraints and a reevaluation of theoretical predictions; *Canadian Mineralogist*, v. 30, p. 955–982.
- Wright, J.F. 1932: Geology and mineral deposits of a part of southeastern Manitoba; Geological Survey of Canada, Memoir 169, 150 p. (includes Map 280A).