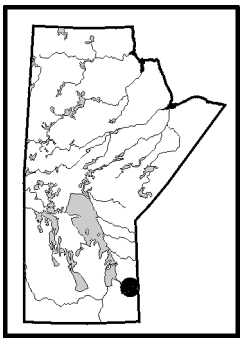
GS-28 PLATINUM GROUP ELEMENT INVESTIGATIONS IN THE PETERSON BLOCK OF THE BIRD RIVER SILL (NTS 52L5NE), MANITOBA

by P. Theyer



Theyer, P. 2002: Platinum group element investigations in the Peterson Block of the Bird River Sill (NTS 52L5NE), Manitoba; *in* Report of Activities 2002, Manitoba Industry, Trade and Mines, Manitoba Geological Survey, p. 250–254.

SUMMARY

The Bird River Sill, a repository of significant chromite resources, supported two nickel-copper mines and, in the past decade, has been explored for platinum group elements (PGE). In the southern part of the sill, exploration concentrated on the Chrome property and, to a lesser degree, on the Page property. Significant PGE concentrations discovered in 2001 brought the 'Peterson Block', which is located between the Chrome and Page properties, to the attention of explorationists. In the Peterson Block, the Lamprey Falls Formation consists of massive and pillowed basalt interlayered with and crosscut by abundant coarse-grained synvolcanic 'gabbroic' sills and dikes. The formation is locally characterized by abundant fracture-bound pyrrhotite. Sulphide minerals exposed in a number of pits and trenches are, in places, associated with strong silicification and have locally attracted intense exploration. Because exploration records indicate that samples collected from these trenches were not analyzed for PGE, a number of rock samples were collected from mineralized zones and are currently being analyzed for Pt, Pd and Au.

INTRODUCTION

Approximately two weeks were spent investigating the Peterson Block of the Bird River Sill (Fig. GS-28-1). Substantial concentrations of Pt and Pd were discovered in a drillhole that intersected mineralized peridotite (K. McMurren, pers. comm., 2001). Core logging in 2001 showed that the PGE were associated with massive pyrrhotite and minor chalcopyrite accumulations in fractures. This work also determined that all four holes intersected lithologically different peridotite. Field inspections showed that peridotite occurs adjacent to the stratigraphic base of the Bird River Sill and is associated with feldspathic peridotite of the 'Contact Zone'. This lowermost unit of the sill is in contact with basalt and gabbro of the stratigraphically underlying Lamprey Falls Formation (Scoates, 1983).

The Lamprey Falls Formation consists principally of mafic volcanic rocks interlayered with and crosscut by hypabyssal coarse-grained gabbroic intrusions. Abundant brittle fractures are mineralized with silica and/or sulphide minerals. The most prominent of these mineralized fracture zones strikes east-southeast and has been traced for more than 150 m, in a number of pits and trenches. Trees growing in some of these exploration workings are more than 60 years old. This and several other mineralized zones in the Lamprey Falls Formation were sampled in 2002 and are currently being analyzed for PGE. The most recent geological investigation of this area was by Falconbridge Ltd. in 1981 (Assessment File 92649, Manitoba Industry, Trade and Mines, Winnipeg). Samples were not analyzed for PGE at that time, and it is assumed that prospectors active prior to 1981 would also have not analyzed for these elements.

GALAXY PGE OCCURRENCE

The Galaxy occurrence is partly exposed in an east-southeast-striking trench, measuring approximately 17 m long by 1 m wide by 0.5 m deep, that is underlain by grey-green–weathering serpentinized peridotite. The host peridotite is intensely sheared, with a vertically dipping fabric that strikes approximately 120°. Four holes were drilled in 2000 and 2001.

Drillhole G1

This hole, oriented 335°/45°, is 20.5 m long. From the collar to a depth of 12 m, it intersected dunite consisting of subrounded, densely packed, millimetre-size olivine crystals. Pyrrhotite occurs, in places, as pseudomorphs after olivine and as fracture coatings. A pebble-shaped chromitite agglomeration, measuring approximately 2 cm in diameter, was intersected at approximately 9.7 m. Pyroxene concentration increases gradually from trace amounts to more than 20% at about 11 m. The highest concentration of sulphide minerals intersected, at a depth of 13 m, consists of a 10 cm long interval containing approximately 8% pyrrhotite, in places associated with wispy traces of coarse-grained clusters and fracture-filling chalcopyrite.

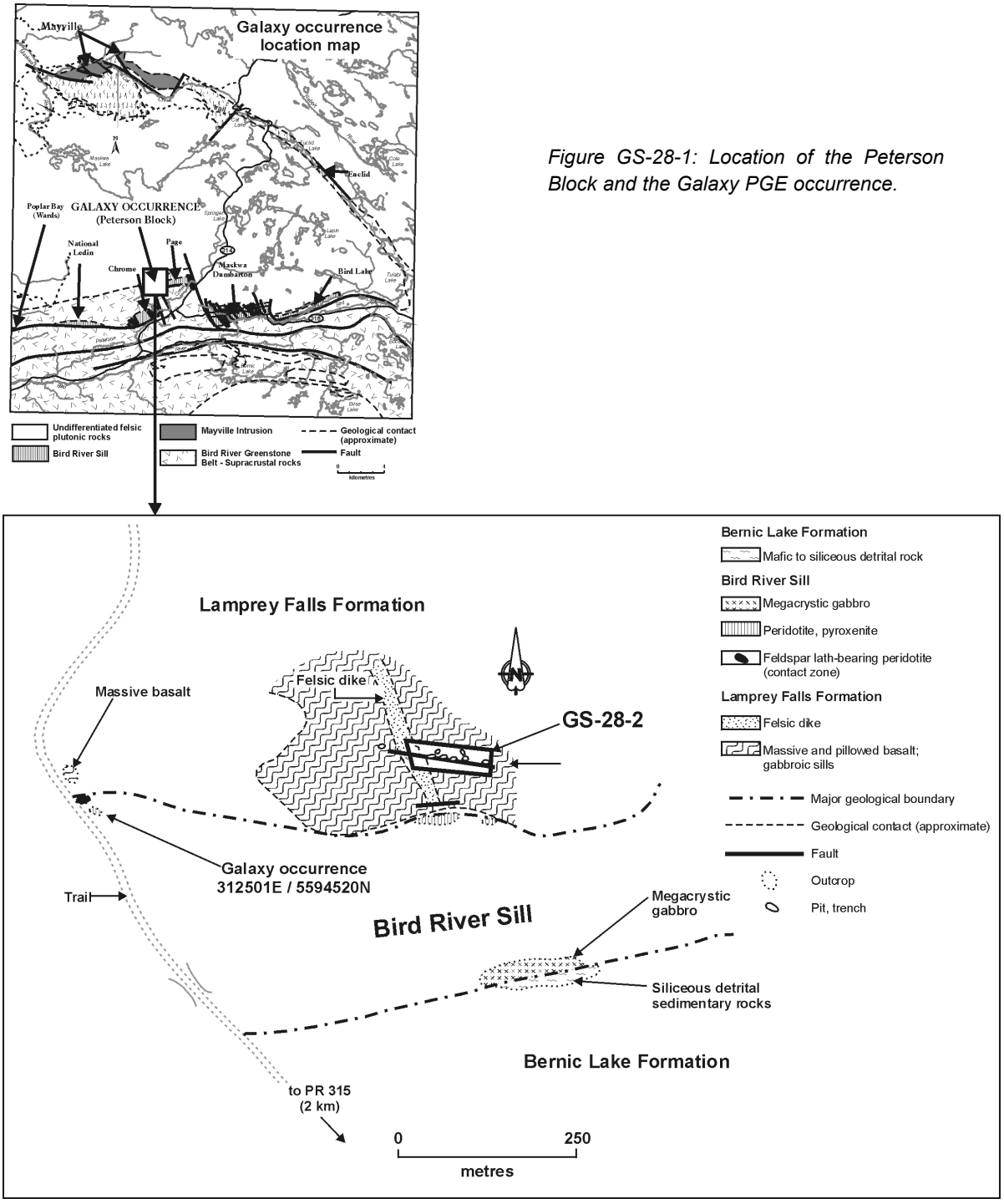


Figure GS-28-1: Location of the Peterson Block and the Galaxy PGE occurrence.

Drillhole G2

This hole, oriented 022°/45°, is 19.5 m long. The core is characterized by four well-defined, decimetre-long mineralized zones hosted by homogeneous peridotite. Barren peridotite intersected at and below the collar of the hole is mineralized from a depth of approximately 60 to 70 cm with up to 5% pyrrhotite and trace chalcopyrite. The mineralization occurs principally as massive veins and minor fracture fillings. The next intensely mineralized intersection occurs at a depth of approximately 1.5 m. It is separated from the previous mineralized zone by barren peridotite. This mineralized zone consists of approximately 30 cm of up to 8% pyrrhotite and minor chalcopyrite concentrated in fractures. The mineralization decreases to approximately 2% disseminated pyrrhotite and, at approximately 4 m depth, the core is barren of sulphide minerals. A third mineralized zone, with up to 5% pyrrhotite,

occurs between depths of 5.3 and 6 m. The core between depths of 6 m and approximately 7.3 m is mineralized with approximately 1% pyrrhotite. At 7.3 m, pyrrhotite concentrations rise abruptly to form the fourth mineralized zone, with more than 50% pyrrhotite over approximately 15 cm and then gradually declining to trace sulphide mineralization at 9.5 m. The drillhole ends in massive serpentinized peridotite that contains trace disseminated pyrrhotite.

Drillhole G3

This hole, oriented 202°/45°, is 13.4 m long. It intersected pyroxenite characterized by intensely silicified intervals. Pyrrhotite occurs as minor fracture fillings and in small millimetre-size clusters, but never exceeding approximately 3% of the core. Massive, fine-grained, dark grey, barren rocks interpreted as basalt were intersected from a depth of 9.1 m to the end of the hole.

Drillhole G4

This hole, drilled vertically, is 9.1 m long. It intersected pyroxenite and peridotite mineralized with traces of pyrrhotite, except for the interval between 7.6 and 7.9 m, where a brittle fracture is mineralized with up to 3% pyrrhotite and trace pyrite.

Despite the fact that all four holes were collared at virtually the same location, the presence of different rock types suggests that they intersected different parts of the ultramafic sequence of the sill.

Platinum concentrations range from 13 to 774 ppb and palladium concentrations range from 83 to 3490 ppb. The Pt-Pd ratio fluctuates from sample to sample, with the average ratio of all samples being 1:3.8. This ratio is substantially greater than the approximately 1:2.5 (Pt:Pd) ratio from a set of samples collected across the entire Ultramafic Series exposed on the Chrome property of the sill (Theyer, 1985). The latter ratio was corroborated by the results published by Hulbert (1988). All samples returned anomalously elevated concentrations of Pt and Pd, defined here as a combined Pt+Pd concentration exceeding 100 ppb. The highest concentrations were intersected in drillhole G2, where four discrete intersections of massive pyrrhotite and minor chalcopyrite are hosted by fractured zones in peridotite.

DISCUSSION

The Galaxy PGE occurrence is hosted by peridotite of the Ultramafic Series of the Bird River Sill, closely associated with feldspathic peridotite of the 'Contact Zone'. This suggests that the Galaxy mineralization occurs at or near the stratigraphic base of the Ultramafic Series of the sill. Elevated PGE concentrations hosted by peridotite in a comparable stratigraphic location are known elsewhere in the sill, such as on the Page property (Theyer, 2001; Theyer et al., 2001) and the Chrome property (Theyer, 1985). It is suggested that Ultramafic Series of the sill close to the contact with the underlying basaltic rocks of the Lamprey Falls Formation is an underexplored target in the search for PGE.

INVESTIGATIONS IN THE LAMPREY FALLS FORMATION

The Lamprey Falls Formation (Trueman, 1980), consisting of basalt and related subvolcanic gabbro, stratigraphically underlies the Bird River Sill. It is characterized by massive, fine-grained and dark grey–weathering basalt and pillowed flows containing pillows, amoeboid pillows and pillow breccias. Some pillows are metre size and well preserved, with south-facing tops. Parallel to subparallel with the flows are intercalated, mafic, coarse-grained, subvolcanic 'gabbroic' sills, ranging from 1 to 5 m in thickness. Numerous observations of gabbroic material intruding, disrupting and, in places, fragmenting the basalt suggest that at least some of the gabbroic phase intruded late and brittly fractured the basalt.

Sulphide mineralization (disseminated pyrrhotite) is widespread and occurs as a profusion of rusty outcrops in the Peterson Block area. Most prominent is a southeast-striking fracture investigated by a number of pits and trenches (Fig. GS-28-2). Most of the excavations are filled with overburden and overgrown with trees and shrubs estimated to be at least 60 years old. The mineralization is centred along a fault and consists of pyrrhotite, pyrite and thin layers of massive chalcopyrite and magnetite. A well-exposed trench near a felsic dike displays a symmetric mineralization pattern dominated by sulphide in the centre and grading into silicification toward the edges. The edge of the mineralization consists of weakly silicified basalt that becomes beige to brownish, high-purity silica rock within a distance of 0.5 m. This rock is mineralized with gradually increasing amounts of disseminated pyrrhotite. Together with increasing amounts of pyrrhotite, there is a parallel increase in planar orientation that eventually results in a fabric characterized by intense banding. The centre of the mineralization consists of a prominently banded to massive

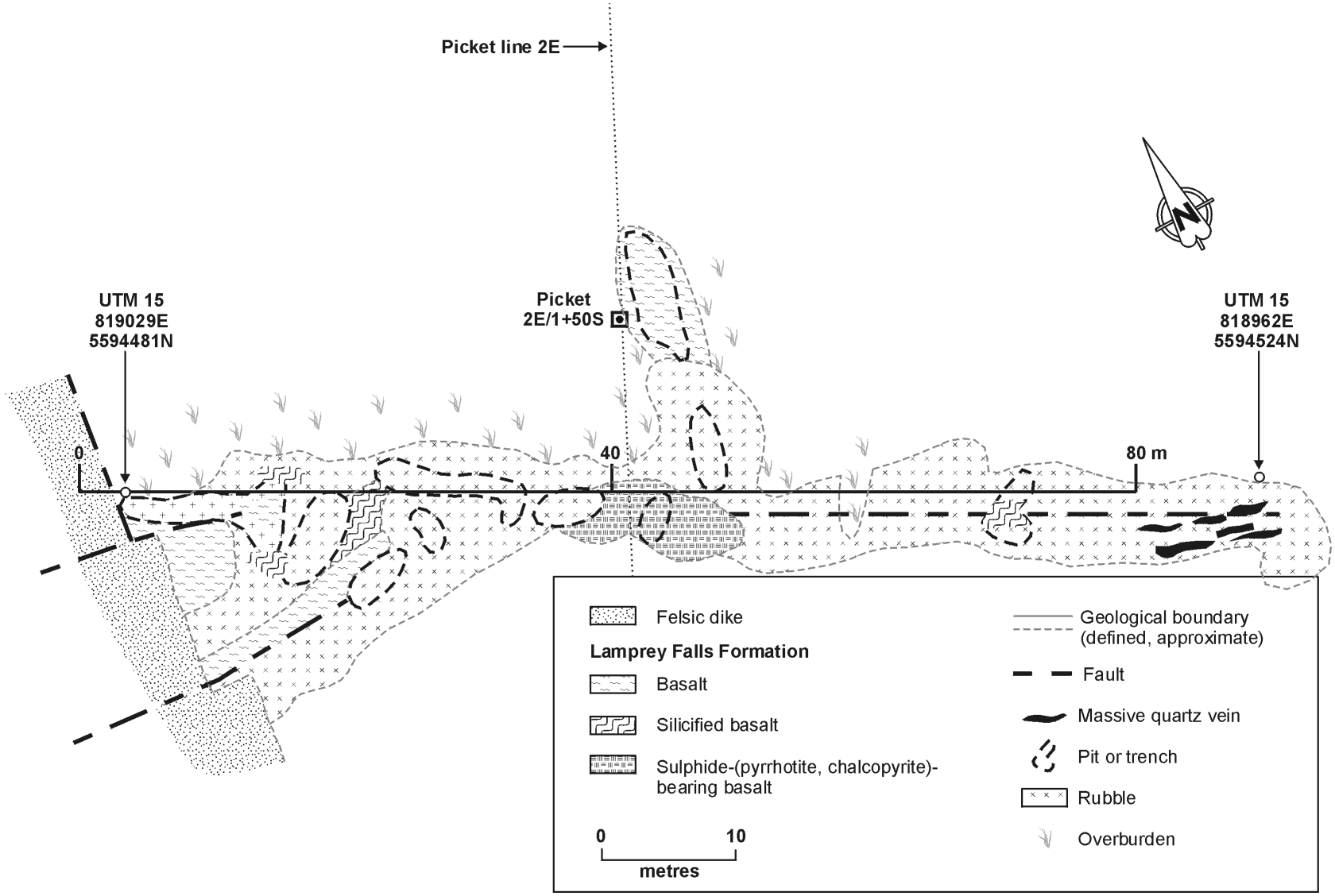


Figure GS-28-2: Geological sketch map of the mineralized vein, showing the location of trenches and mineralization types.

pyrrhotite unit, approximately 40 cm thick, that is interlayered with a number of millimetre-thick chalcopyrite layers. This mineralization and its textures are mirrored on the opposite side of the vein.

DISCUSSION

Any sulphides present in mafic-ultramafic rocks may have been exposed to and concentrated PGE. Sulphide mineralization in the mafic volcanic rocks of the Lamprey Falls Formation is therefore a target of interest for PGE exploration. Moreover, it is well established that PGE are mobile, especially in fluid-rich, saline environments (Olivo and Gauthier, 1994; Distler et al., 2002). This is important, considering the proximity of the sulphide-bearing rocks in the Lamprey Falls Formation to the PGE-bearing rocks of the Bird River Sill.

ACKNOWLEDGMENTS

The author would like to acknowledge J. Sopotiuk, F. Sellers and K. McMurren for allowing him to log their drill core and results of geochemical investigations of the Galaxy prospect. He would also like to acknowledge the cooperation of J. Campbell, who provided geological and geophysical documentation and numerous discussions on the geology of his property.

REFERENCES

Distler, V., Yudovskaya, M., Chaplygin, I. and Znamensky, V. 2002: PGE in the modern hydrotherms of Kudryavy Volcano (Kuril Islands); 9th International Platinum Symposium, Extended Abstracts, Billings, Montana.

Hulbert, L.J. 1988: Geological environments of the platinum group elements; Geological Survey of Canada, Open File 1440, 148 p.

Olivo, G.R. and Gauthier, M. 1994: Palladian gold from the Cauê iron mine, Itabira District, Minas Gerais, Brazil; Mineralogical Magazine, v. 58, p. 579–587.

Scoates, R.F.J. 1983: A preliminary stratigraphic examination of the ultramafic zone of the Bird River Sill, southeastern Manitoba; *in* Report of Field Activities 1983, Manitoba Department of Energy and Mines, Mineral Resources Division, p. 70–83.

Theyer, P. 1985: Platinum-palladium distribution in ultramafic rocks of the Bird River complex, southeastern Manitoba; Manitoba Energy and Mines, Geological Services, Open File Report 85-4, 46 p.

Theyer, P. 2001: Platinum group elements in Manitoba – progress report for 2001 (abstract); Manitoba Industry, Trade and Mines, Manitoba Mining and Minerals Convention 2001, November 15–17, 2001, Winnipeg, Manitoba, Program, p. 45.

Theyer, P. Bruni, E. and Sundell, C. 2001: Stratigraphy, geology and mineralization of selected parts of the Page property, Bird River Sill (part of NTS 52L/5); *in* Report of Activities 2001, Manitoba Industry, Trade and Mines, Manitoba Geological Survey, p. 126–132.

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.