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NEWFOUNDLAND AND LABRADOR
Department of Natural Resources
Geological Survey

PGE RESULTS FROM SELECTED SAMPLES ALONG THE SOUTHERN SHORE OF CONCEPTION BAY, AVALON PENINSULA

(NTS MAP SHEETS 1N/6 and 1N/11)

M.J. Batterson and D.M. Taylor

Open File 1N/0757

St. John's, Newfoundland
May, 2005

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Cover photo: Looking north along Colliers Bay, Conception Bay. Palaeo-ice flow was northward along the axis of the valley into Conception Bay. The western part of the Colliers Bay shows outcrop of Cambrian sediments which are a potential target for PGE's along the southern shore of Conception Bay.

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CONTENTS

Page

ABSTRACT ii

INTRODUCTION 1

BEDROCK GEOLOGY 1

GLACIAL GEOLOGY 1

METHODS 1

RESULTS 3
PALLADIUM 3
PLATINUM 4
GOLD 4

CONCLUSIONS 8

ACKNOWLEDGMENTS . . . . .

REFERENCES 8

APPENDIX 1: LISTING OF TILL GEOCHEMISTRY DATA 9

FIGURES

Figure 1. Bedrock geology of the northern Avalon Peninsula (after King, 1988) showing the study area in Conception Bay. 2
Figure 2. Distribution of palladium in till 5
Figure 3. Distribution of platinum in till 6
Figure 4. Distribution of gold in till 7

TABLES

Table 1. Summary statistics (n=10). Previously unreported data in bold. Other data from Batterson and Taylor (2004a) 4
Table 2. Correlation matrix for selected elements (n-10) 4

ABSTRACT

Ten till samples from areas overlying Cambrian to Ordovician sedimentary bedrock along the southern shoreline on Conception Bay were analysed for their PGE content, to examine the potential for sediment-hosted Ni–Mo–PGE mineralisation in this part of the Province. Platinum and palladium were recorded in most of the samples analysed, although the values were generally low (maximum 2.9 ppb Pt; and 1.9 ppb Pd). Nevertheless, the strong correlation of Pt and Pd with elements known to be associated in sediment-hosted PGE environments is perhaps significant, and suggests that further investigation as a potential exploration target is warranted in this area, and areas of similar geology around Trinity Bay.

INTRODUCTION

Sediment-hosted Ni–Mo–PGE mineralisation has been described from the Yukon and China (Lefebure and Coveney, 1995). Black shale is commonly the host for this form of mineralization, and which occurs associated with limestone, dolomite, shale, siltstone and tuff, in rocks of Devonian to Cambrian age. Similar rocks underlay the southern part of the Conception Bay coastline north from Holyrood. A regional till geochemistry survey that extended over the western part of this area (Batterson and Taylor, 2004a) provided the opportunity to select samples to evaluate the content of PGE's. Ten samples were selected as part of this pilot study from an area extending from Seal Cove to Kelligrews along the southern shore of Conception Bay.

Detailed descriptions of the field area and a complete listing of till geochemistry data is reported by Batterson and Taylor (2004a, b).

BEDROCK GEOLGOY

Green and red shale and limestone of the Early Cambrian to Middle Ordovician Adeytown Group are found along the southeastern shore of Trinity Bay, south from Chapel Arm, and along the eastern shore of Conception Bay where they unconformably overlie rocks of the Holyrood Horst (Figure 1).

Along Conception Bay, Adeytown Group rocks are stratigraphically overlain by dark shale and quartzose sandstone of the Late Cambrian to Early Ordovician Kellys Island Formation of the Bell Island Group, and these represent the youngest rocks within the study area (King, 1988).

GLACIAL GEOLOGY

The entire area was covered by ice during the last, late Wisconsinan glacial period. Striation data indicates that the southern shore of Conception Bay was covered by northward flowing ice which extended across the Holyrood Horst into Conception Bay where it coalesced with northeastward flowing ice to cross Bell Island. Tills along the southern shore of Conception Bay contain significant proportions of sediment derived from the south (Batterson and Taylor, 2004b).

METHODS

A regional till sampling program was conducted using the surficial geology as a guide. Glaciofluvial, fluvial, marine, and aeolian sediments were excluded from the data collection. Most samples were from the C- or BC-soil horizon, taken at about 0.5 m depth in test pits, or 0.5 to 1.0 m depth in quarries or road cuts. Sample spacing was controlled by access as well as surficial geology, but were generally about 1 sample per 1 km^2. Ten samples from till overlying Cambrian sedimentary bedrock were randomly selected for analysis.

In the field, samples were placed in kraft-paper sample bags, and sent to the Geological Survey's Geochemical Laboratory in St. John's, where they were air-dried in ovens at 40°C and dry-sieved through 63 µm stainless steel sieves.

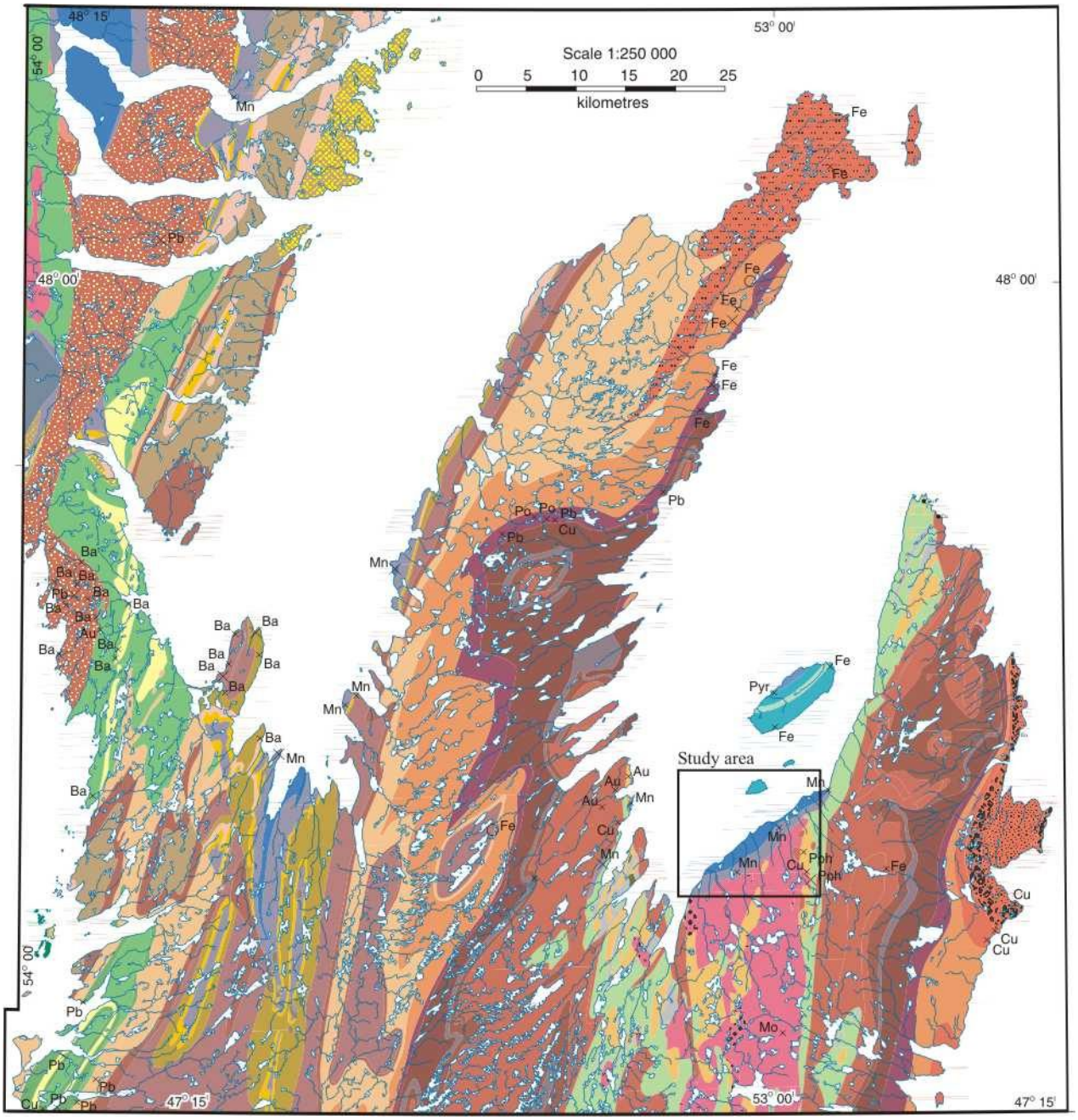

Figure 1. *Bedrock geology of the northern Avalon Peninsula (after King, 1988) showing the study area in Conception Bay.*

LEGEND (Figure 1)

DEVONIAN OR EARLIER

CLARENVILLE GRANITE: *Pink to red, medium grained biotite granite*

POWDER HORN INTRUSIVE SUITE: *Fine to medium grained diorite, gabbro and minor granite*

UPPER CAMBRIAN to LOWER ORDOVICIAN

WABANA GROUP: Oolitic, reddish brown ironstone

LEGEND (continued)

BELL ISLAND GROUP: Redmans Formation - grey to white orthoquartzite and minor shale

BELL ISLAND GROUP: Interbedded sandstone and shale

LOWER CAMBRIAN

HARCOURT GROUP: Grey to black, micaceous shale; minor siltstone and limestone

ADEYTOWN GROUP: Green and red shale and slate; thin limestone beds

HADRYNIAN

MUSGRAVETOWN GROUP

Undivided sedimentary rocks

CROWN HILL FORMATION: Red pebble conglomerate and sandstone

TRINNY COVE FORMATION: Olive-green and red sandstone, siltstone and conglomerate

HEART'S DESIRE FORMATION: Olive-green sandstone

HEART'S CONTENT FORMATION: Grey to black shale; contains beds of wispy sandstone

BULL ARM FORMATION:

Mafic to felsic variegated flows, and pyroclastic and sedimentary rocks

Felsic flows and tuffs, and clastic sedimentary rocks

BIG HEAD FORMATION: Wavy bedded, grey to green tuffaceous siltstone and arkose

SWIFT CURRENT GRANITE: Pink to grey, medium grained granite to granodiorite

SIGNAL HILL GROUP

BAY DE VERDE FORMATION: Red and grey, white-weathering sandstone, siltstone and red mudstone

GIBBET HILL FORMATION: Thickly bedded, light grey sandstone; minor sandstone, siltstone and tuff

ST. JOHN'S GROUP

RENEWS HEAD FORMATION: Thin, lenticular bedded, dark grey sandstone and minor shale

FERMEUSE FORMATION: Grey to black shale, with lenses of buff-weathering sandstone and siltstone

TREPASSEY FORMATION: Medium to thinly bedded, grey sandstone and shale; minor tuff

CONNECTING POINT GROUP

Green, grey and black shale, siliceous siltstone and sandstone; minor conglomerate; numerous mafic dykes and sills

CONCEPTION GROUP

DROOK FORMATION: Green siliceous siltstone and sandstone; silicified tuff

MISTAKEN POINT FORMATION: Red and green tuffaceous siltstone and sandstone in upper; sandstone and shale, with minor tuff and fossiliferous near top in lower part.

HARBOUR MAIN GROUP

Green to purple basaltic flows and pyroclastic rocks

Pink to grey felsic tuff and agglomerate

Past Producing Mine

Mineral Showing

Element List

Au Gold
Ba Barium
Cu Copper
Mn Manganese
Pb Lead

Platinum, palladium and gold were evaluated by Actilabs (Ontario) using fire assay inductively coupled plasma mass spectrometry (FA-ICP-MS). A 10 g split of the sample is mixed with fire assay fluxes and fused at 1050°C for 1 hour. After cooling for 2 hours, the sample solution is analysed for Au, Pt and Pd by ICP-MS using a Perkin Elmer Sciex 6000 or 6100 ICP-MS.

The frequency distributions of the geochemical data were examined using the Jenks optimization method, also known as the goodness of variance fit (Jenks, 1967) found within the ArcMap GIS application. The method identifies natural breaks in the data set, and has replaced the selection of breaks using cumulative frequency plots (cf., Batterson and Taylor, 2001). Comparison of the two method produced similar subdivisions of the data. Breaks in slope of the curves were used to subdivide the element values into 4 to 6 natural population groups. These groups are represented by symbols that increase in size with increasing element levels. Statistics (maximum, minimum, median, mean, standard deviation) were generated from the Excel computer application, and are presented in Table 1. A correlation matrix is shown in Table 2.

RESULTS

Maps showing the distribution of palladium (Figure 2), platinum (Figure 3) and gold (Figure 4) are presented.

PALLADIUM

The maximum value for palladium was 1.9 ppb (Figure 2), well above the detection limit of 0.1 ppb. Six of the 10

Table 1. Summary statistics (n=10). Previously unreported data is in bold. Other data from Batterson and Taylor (2004a)

	As1	**Au27**	Ba2	Mo1	Ni2	P2	**Pd27**	**Pt27**	Se1	U1	V2	Zn2
Min	40.5	**8.8**	1143.5	22.0	29.5	753.6	**1.9**	**2.4**	5.0	5.5	106.5	84.1
Max	1.4	**2.6**	859.0	0.5	3.0	138.7	**0.1**	**0.1**	0.5	1.0	19.4	16.1
Mean	13.7	**5.2**	960.4	7.3	12.2	368.7	**0.5**	**0.7**	1.2	2.6	59.2	37.4
Median	6.4	**5.3**	938.8	6.0	8.3	242.6	**0.1**	**0.5**	0.5	2.2	47.4	24.9
Std Dev	16.1	**2.4**	94.9	7.6	9.6	240.0	**0.7**	**0.7**	1.5	1.5	33.7	24.8

Table 2. Correlation matrix for selected elements (n=10)

	As1	Au27	Ba2	Mo1	Ni2	P2	**Pd27**	**Pt27**	Se1	U1	V2	Zn2
As1	1.000											
Au27	0.264	1.000										
Ba2	0.589	-0.201	1.000									
Mo1	0.929	0.256	0.482	1.000								
Ni2	0.789	0.526	0.117	0.712	1.000							
P2	0.931	0.446	0.382	0.906	0.893	1.000						
Pd27	**0.914**	**0.464**	**0.302**	**0.837**	**0.954**	**0.950**	**1.000**					
Pt27	**0.224**	**0.422**	**-0.135**	**0.159**	**0.674**	**0.454**	**0.513**	**1.000**				
Se1	0.495	0.089	0.496	0.609	0.210	0.539	0.288	-0.031	1.000			
U1	0.927	0.300	0.497	0.787	0.884	0.877	0.952	0.478	0.242	1.000		
V2	0.934	0.342	0.532	0.879	0.870	0.934	0.918	0.443	0.425	0.925	1.000	
Zn2	0.608	0.542	-0.012	0.577	0.944	0.807	0.834	0.838	0.201	0.737	0.776	1.000

samples analysed were below detection limit. Of elements normally associated with palladium in shale-hosted PGE environments, palladium is well correlated with arsenic (0.914), molybdenum (0.837), nickel (0.954), phosphorous (0.950), uranium (0.952), and zinc (0.918).

PLATINUM

The maximum platinum value recorded was 2.6 ppb (Figure 3), well above detection limit of 0.1 ppb. Two samples were below detection limit. Platinum was well correlated with zinc (0.838).

GOLD

The highest gold value reported was 8.8 ppb (Figure 4). Results are similar to those recorded by INAA analysis and reported in Batterson and Taylor (2004a). Correlations with other elements are generally poor.

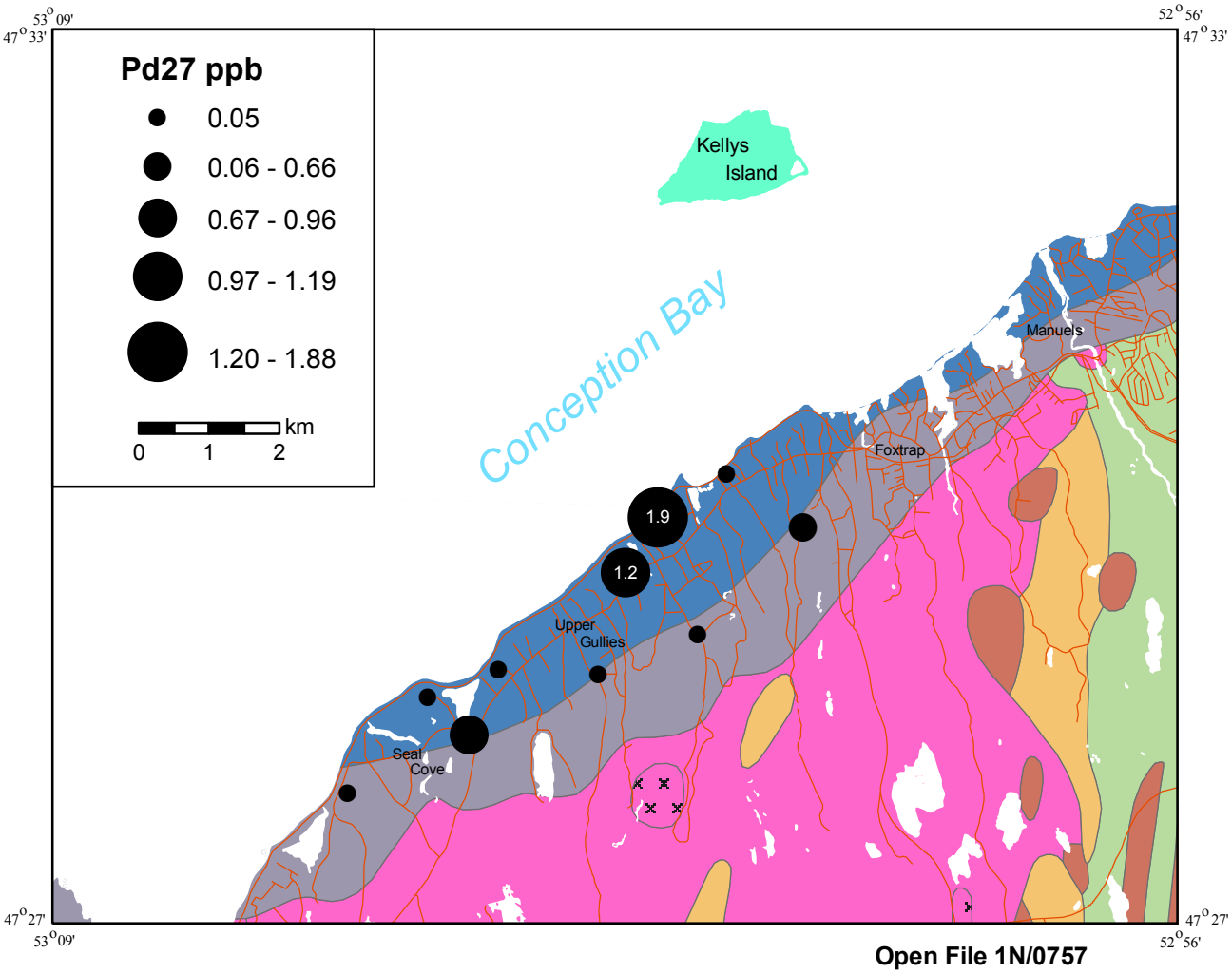

Figure 2. *Distribution of palladium in till.*

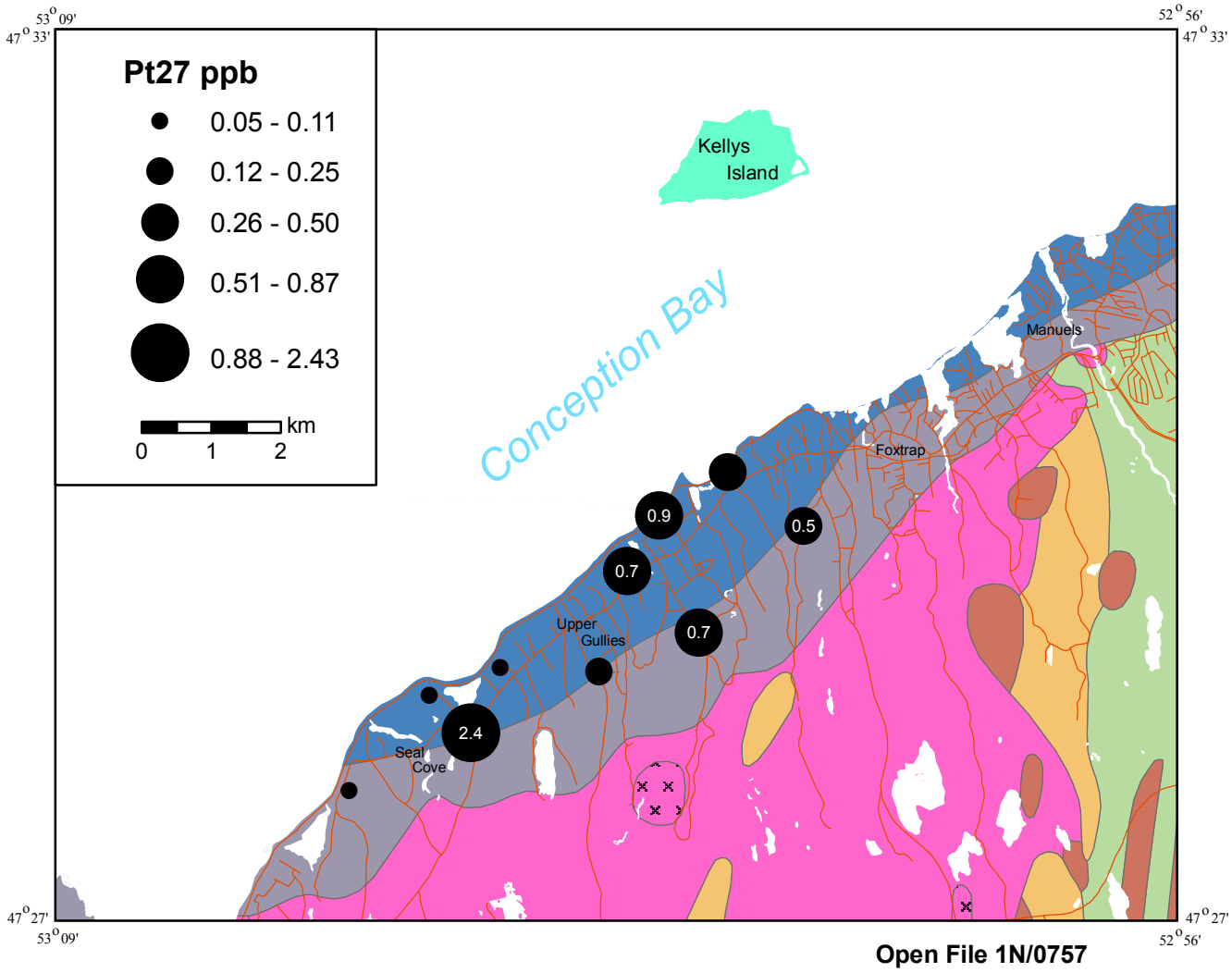

Figure 3. *Distribution of platinum in till.*

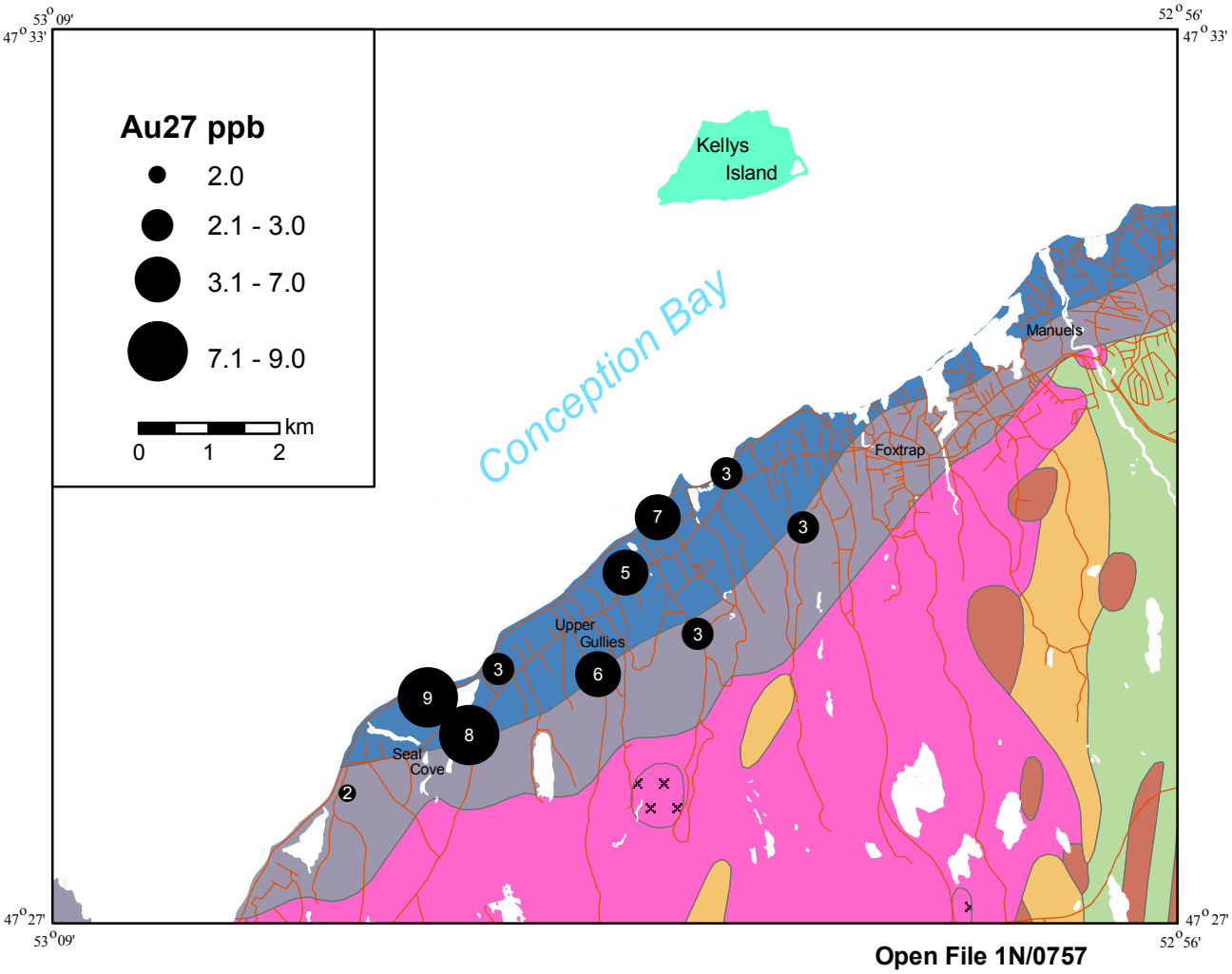

Figure 4. *Distribution of gold in till.*

CONCLUSIONS

There were only 10 samples analysed in this project, and it is thus difficult to come to any substantive conclusions. However, the fact that Pt and Pd were detected in the till samples which contain a large component of sediment derived from the Holyrood horst to the south is encouraging. Similarly, the strong correlation of Pt and Pd with elements known to be associated in shale-hosted PGE environments is perhaps also significant and suggests that further work as potential exploration targets is warranted along the southern shore of Conception Bay, and in similar rocks along the Trinity Bay coast.

ACKNOWLEDGMENTS

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Appendix 1 - Listing of Till Geochemistry Data

Sample	NTS	Easting	Northing	Site	Elev	Zone	Soil	Depth	As1	**Au27**	Ba2	Mo1	Ni2	P2	**Pd27**	**Pt27**	Se1	U1	V2	Zn2
4861	1N/06	346378	5260128	827	87	22	C	70	1.4	**5.6**	945	1	6	243	**0.1**	**0.2**	2	1.2	30	25
4865	1N/06	347802	5260695	830	70	22	C	75	1.4	**2.6**	927	1	3	187	**0.1**	**0.7**	0.5	1.7	19	16
4868	1N/06	349301	5262217	833	77	22	C	65	22.1	**3.4**	1144	9	10	378	**0.7**	**0.5**	0.5	3.8	83	30
4873	1N/11	348210	5262985	837	5	22	C	60	6.4	**3.2**	963	1	8	178	**0.1**	**0.5**	0.5	2.2	47	25
4875	1N/06	347230	5262366	839	7	22	C	65	40.5	**7.3**	939	17	30	735	**1.9**	**0.9**	0.5	5.5	103	67
4876	1N/06	346770	5261570	840	20	22	C	65	38.6	**5.3**	1089	22	19	754	**1.2**	**0.7**	5	4.0	106	54
4880	1N/06	344957	5260192	844	25	22	C	60	1.5	**2.6**	890	6	5	139	**0.1**	**0.1**	0.5	1.5	31	19
4881	1N/06	344534	5259257	845	10	22	C	120	9.2	**7.9**	859	6	24	493	**1.0**	**2.4**	0.5	3.2	78	84
4882	1N/06	343948	5259791	846	5	22	C	90	2.0	**8.8**	889	4	4	212	**0.1**	**0.1**	0.5	1.0	34	17
4883	1N/06	342799	5258428	847	30	22	C	100	3.1	**2.3**	876	5	6	263	**0.1**	**0.1**	0.5	1.0	43	26