GOVERNMENT OF
NEWFOUNDLAND AND LABRADOR
Department of Natural Resources
Geological Survey

ANALYSIS OF SELECTED TILL SAMPLES FROM THE HOLLINGER AND CAVERS LAKE MAP SHEETS (NTS 23J/9 AND 23J/16) FOR PLATINUM GROUP ELEMENTS

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Open File LAB 23J/0332

St. John’s, Newfoundland
July 20, 2004

NOTE

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Cover photo:
Geochemical sampling by boat, Attikamagen Lake.

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ABSTRACT

Sixty samples obtained from C-horizon tills from the Labrador part of the 23J/16 (Hollinger Lake) and the 23J/9 (Cavers Lake) NTS sheets were analysed for platinum and palladium to evaluate the potential for PGE mineralization in the central Labrador Trough. All samples analysed give results above detection limit for both platinum and palladium. The highest platinum value recorded is 3.1 ppb, but all values are above detection limit. Whether this reflects enrichment and possible mineralization, or simply high background levels in platinum is not clear. Average palladium values are 2.5 ppb, with a maximum of 6.9 ppb associated with 19 ppb gold. Although no notably anomalous values were obtained for these elements, the results support the suggestion that this area of Labrador has potential for platinum and palladium mineralization.

INTRODUCTION

The Labrador Trough extends from Labrador City into northern Quebec, and has been the site of mining and exploration for over forty years (Figure 1). In recent years the Newfoundland and Labrador part of the central Labrador Trough has seen little activity. Work by the Geological Survey of Newfoundland and Labrador indicated that this area shows high potential for PGE and sediment-hosted massive sulphide mineralization (McConnell, 1984; Wardle, 1987; Swinden *et al.*, 1991; Swinden, 1991; Swinden and Santaguida, 1993). A previous publication (Liverman *et al.*, 1993) described the geochemistry of surficial sediments in the area. At that time, analysis for platinum group elements was not performed, but in the light of increasing exploration interest sixty samples were selected for re-analysis, on the basis of recording high copper values in the earlier investigation. This open file presents the results of analysis of these samples for platinum, palladium and gold.

LOCATION, ACCESS AND PHYSIOGRAPHY

The study area consists of the Labrador part of the Hollinger Lake (23J/16) and the Cavers Lake (23J/9) 1:50 000 NTS sheets. The major lake systems that lie south and east of Schefferville provide excellent access to large parts of the field area. Boats can be transported by truck from Schefferville to Iron Arm of Attikamagen Lake, which allows access to the entire Attikamgen Lake system. The eastern part of the study area has no direct road or lake access from Schefferville, and so helicopter or float plane support was required.

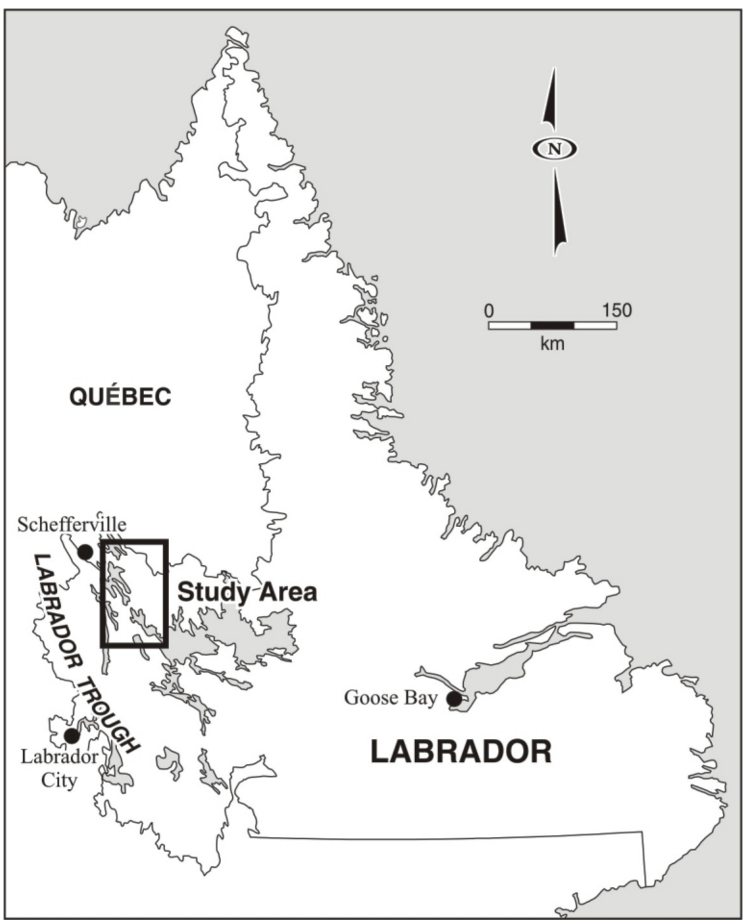


Figure 1. *Location of study area.*

The study area is part of the Labrador lake plateau (Henderson, 1959), a wide upland area with little relief and covered by many lakes. Topography is strongly controlled by bedrock, with most higher ground consisting of elongate northwest-southeast oriented bedrock ridges, parallel to bedrock strike. Lake basins show the same elongate pattern. In the study area, Attikamagen, Petitsikapau, Dyke and Astray lakes form a major lake system that drains southward by way of the Ashuanapi River into the Smallwood Reservoir. These lakes are mostly shallow, with depths typically of 2 to 5 m. Attikamagen and Petitsikapau Lakes form wide, low relief basins, with many islands. Greater relief is found at the western and eastern sides of these lakes.

GEOLOGY

The geology of the area was first described by Low (1896). Further detailed mapping was performed from the 1940s onward by the Iron Ore Company of Canada, the Geological Survey of Newfoundland and Labrador, and the Geological Survey of Canada. Wardle (1982) compiled existing information on the central Labrador Trough geology into a comprehensive map of the area. The study area is mostly underlain by Aphebian sedimentary and volcanic supracrustal rocks of the Labrador Trough (Greene, 1974; Wardle, 1978). These include iron formation, chert, quartzites, dolomite, sandstones, siltstones and shales of the Sokoman, Denault, Menihek, Fleming, LeFer, Wishart and Dolly Formations; and gabbros and basalts of the Nimish Formation and Montagnais Intrusive Series (Evans, 1978; Wardle, 1982) (Figure 2).

The eastern margin of the Labrador Trough hosts more than 50 pyrite and base metal occurrences (Swinden, 1991). The Martin Lake #1 showing was discovered by prospecting, 150 m north of Martin Lake (Bloomer, 1954). It consists of a massive sulphide lens of mostly pyrite with some chalcopyrite and sphalerite, surrounded by calcaereous argillite to siltstone. Grab samples showed copper values ranging from 0.025 to 0.549 %, but no other anomalous metal values apart from a single assay of 1450 ppb gold (Swinden and Santaguida, 1993). The Martin Lake #2 and Martin Lake #3 showings, located 1 to 1.5 km north of the Martin Lake #1 showing, consist of sporadic occurrences of pyrite hosted in argillite and gabbro respectively, with no anomalous base or precious metal values (Swinden and Santaguida, 1993). The Jimmick Lake showing is located close to the Quebec-Labrador border, 2 km northwest of the Martin Lake #1 showing. Mineralization consists mostly of pyrrhotite with associated chalcopyrite and pyrite, seen mostly in boulders. Values up to 0.4% Cu, 2.2% Zn and 460 ppb Au were obtained from grab samples (Swinden and Santaguida, 1993).

Three further showings are located in the area of Chicago Lake, 2 km west of the Martin Lake #1 showing. The main sulphide mineralization in these showings is pyrrhotite with common pyrite and chalcopyrite. Grab samples gave values of up to 0.23% Cu (Swinden and Santaguida, 1993). Preliminary geochemical studies of samples from these showings indicated that Co and Cu are strongly correlated, and Zn and Pb are weakly correlated with Cu.

The Katy Lake showing consists mostly of massive pyrite, and no anomalous base or precious metal values were obtained from samples by Swinden and Santaguida (1993).

ICE FLOW AND SURFICIAL GEOLOGY

The area was affected by two major ice-flow events; an early southeast to south flow, and a later northeast to eastnortheast flow (Liverman *et al.*, 1993). The southeast flow was parallel to bedrock strike and has had a major effect on the geomorphology of the area, sculpting bedrock surfaces, but leaving only a fragmentary striation record. Most polished bedrock surfaces are covered by striae relating to the later northeastward flow. Clast fabrics and the pattern of dispersal of

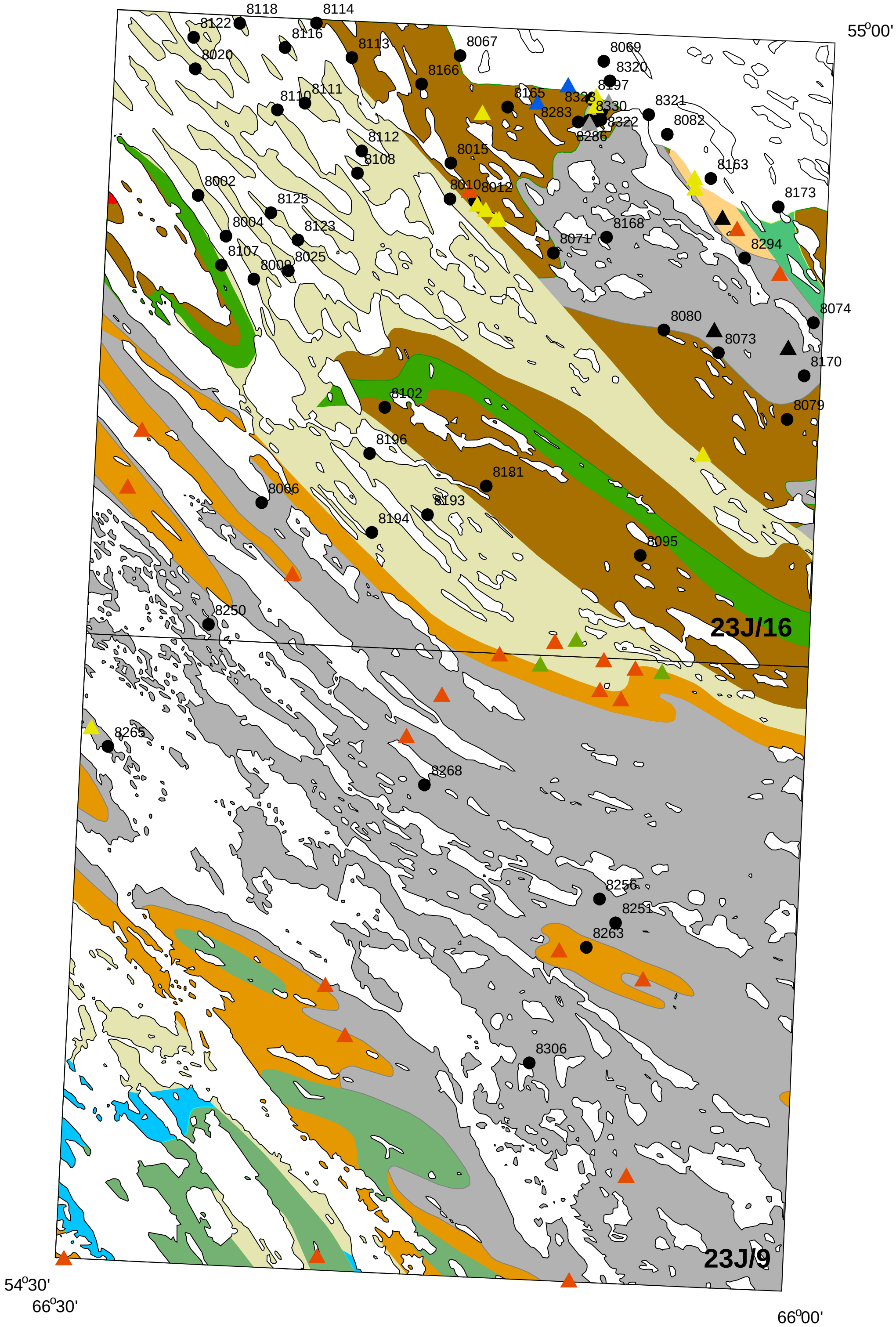
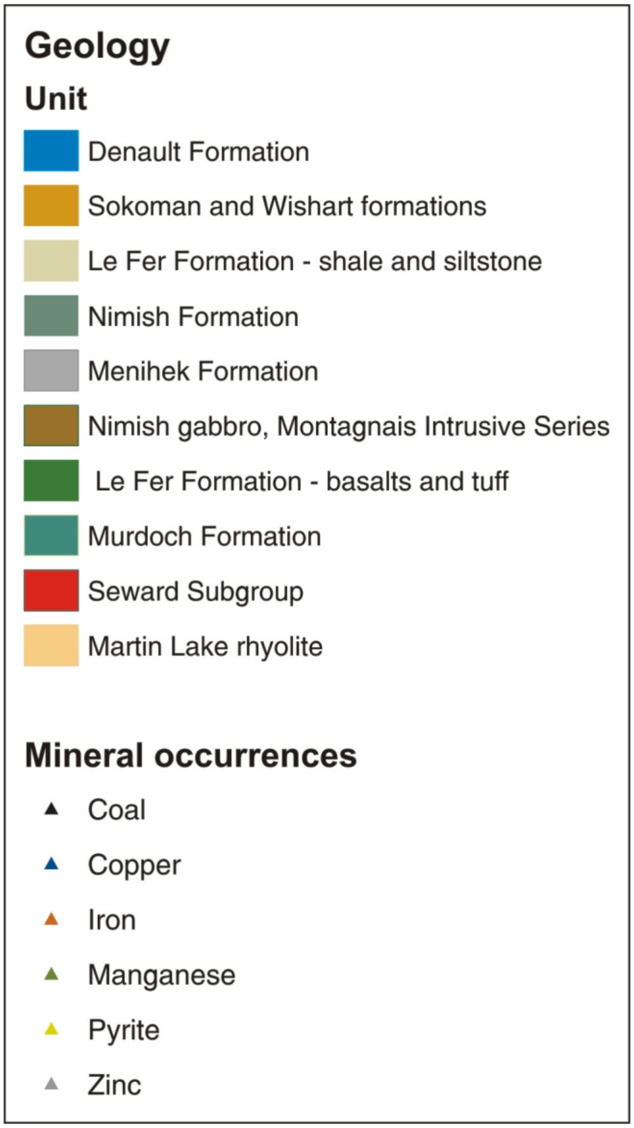


Figure 2. *Geology and sample locations.*



Legend for Figure 2.

clasts from outcropping gabbro and iron formation indicate that the later northeast flow was the dominant agent of dispersal of surface diamictons.

Surficial geology is controlled by bedrock type and topography, with thicker sediment cover in topographic lows underlain by shale. Surface sediment is mostly diamicton, or bog, with minor glaciofluvial gravels. Close to Attikamagen and Petitsikapau lakes the surface diamicton has been affected by higher lake levels, with silt and clay winnowed from the coarser fraction. Drainage was probably reversed following deglaciation, due to differential isostatic depression, and higher lake levels were possibly caused by damming of northward drainage by the retreating ice sheet.

METHODS

Sediment sampling was mostly from hand-dug pits 0.3-1.3 m deep, where possible from the C-soil horizon of soils developed on glacigenic diamictons (tills). Where this was not obtainable, BC or B horizons were sampled.

The silt-clay fraction (<0.063 mm) of samples was routinely used in geochemical analysis due to the low clay contents in many samples, and the additional cost of sample preparation if only the clay fraction is analyzed (Batterson and Liverman, 2001). As standard procedure in the laboratory, every tenth sample is alternately a laboratory standard, or a duplicate analysis. This allows evaluation of the accuracy and reproducibility of the analysis.

Platinum, palladium and gold contents were evaluated by Actilabs (Ontario) using fire assay inductively coupled plasma mass spectrometry (FA-ICP-MS). A 30 g split of the sample is mixed with fire assay fluxes, and fused at 1050°C for one hour. After cooling the lead button is separated from the slag and cupelled at 1000° C to recover the AG (doré bead) and Au, Pt, Pd. After cooling for two hours, the sample solution is analyzed for Au, Pt and Pd by ICP-MS using a Perkin Elmer Sciex ELAN 6000 or 6100 ICP-MS.

RESULTS

Maps are presented for palladium (Figure 3), platinum (Figure 4) and gold (Figure 5). Because of possible relationships between copper, nickel and PGE elements, data for copper (Figure 6) and nickel (Figure 7) from Liverman *et al.*, (1993) is presented here for the samples analysed.

Palladium and platinum are moderately correlated (r=0.441), and palladium is well correlated with gold (r=0.7). There are moderate correlations between palladium and copper, and platinum and copper (Table 1).

Table 1. Correlation matrix

	Pd	**Pt**	**Au**	**Cu**	**Ni**
Pd		0.441	0.7	0.358	0.110
Pt			0.084	0.388	0.301
Au				0.013	-0.265
Cu					0.503

Platinum and palladium concentrations are moderate but well above detection limit (1 ppb). The highest platinum value recorded is 3.1 ppb (Table 2). Whether this reflects enrichment and possible mineralization, or simply high background levels in platinum is not clear. Average palladium values are 2.5 ppb, with a maximum of 6.9 ppb associated with 19 ppb gold, from a sample located on Petitsikapau Lake overlying rocks of the Menihek Formation. All samples analysed give results above detection limit.

Table 2. Summary statistics

	Pt (ppb)	**Pd (ppb)**	**Au (ppb)**	**Cu (ppm)**	**Ni (ppm)**
Average	2.5	2.2	4.7	96.9	59.8
Maximum	6.9	3.1	19.2	219	133
Minimum	1.3	0.9	2.0	65	18
Standard deviation	0.902	0.553	2.437	32.7	20.9

GOLD RE-ANALYSIS

Re-analysis of samples for gold using FA-ICP-MS allows comparison with gold results from INAA. Given the known difficulties of geochemical analysis for gold, the results are encouraging, showing that the methods give very similar results. Au (FA-ICP-MS) correlates well with Au (INAA) (r=0.754). One sample (8251) gave a result of 15 ppb using INAA but only 4 ppb with FA-ICP-MS) but for nearly all samples the two methods gave similar results.

Figure 3. *Palladium in till.*

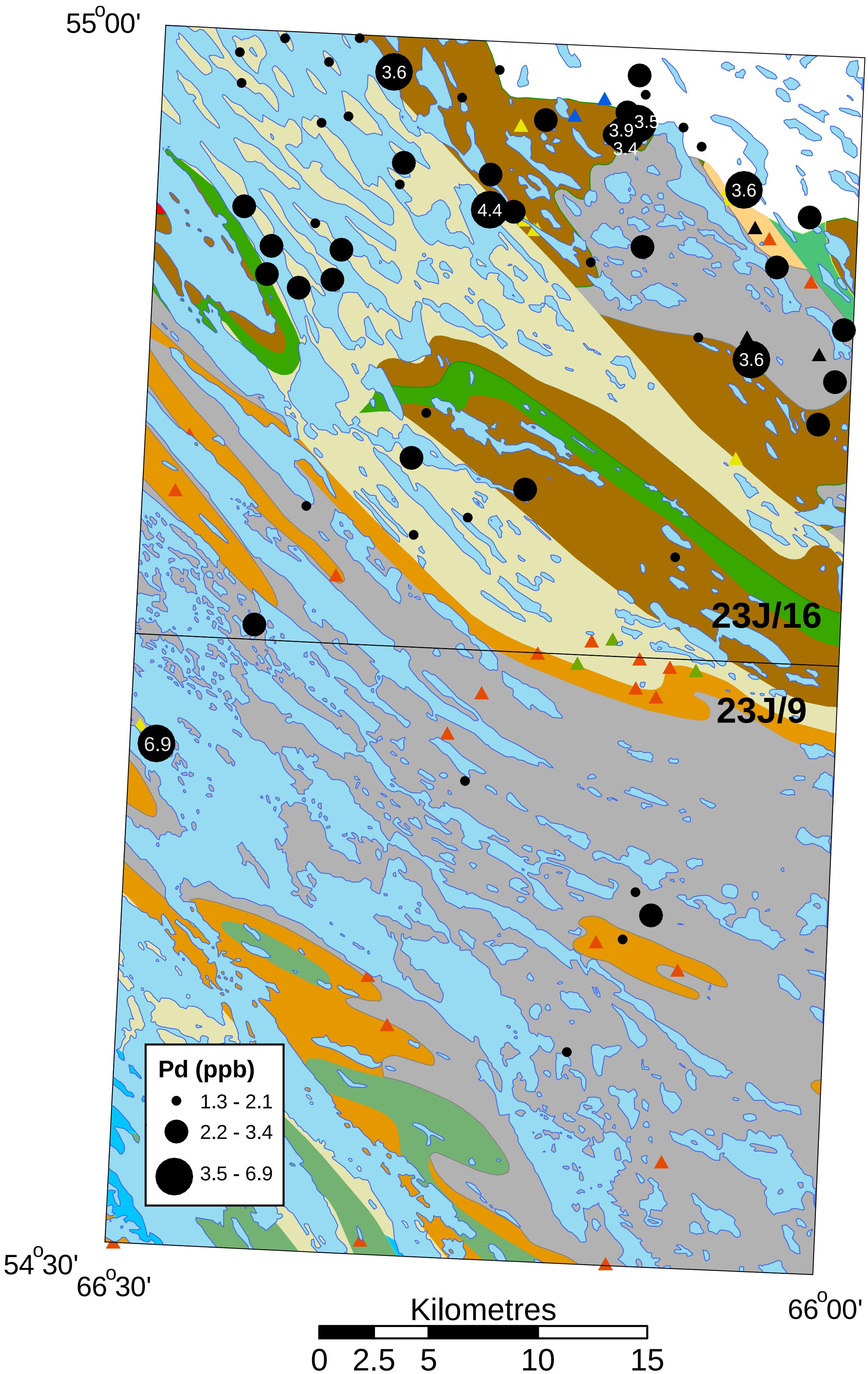


Figure 4. *Platinum in till.*

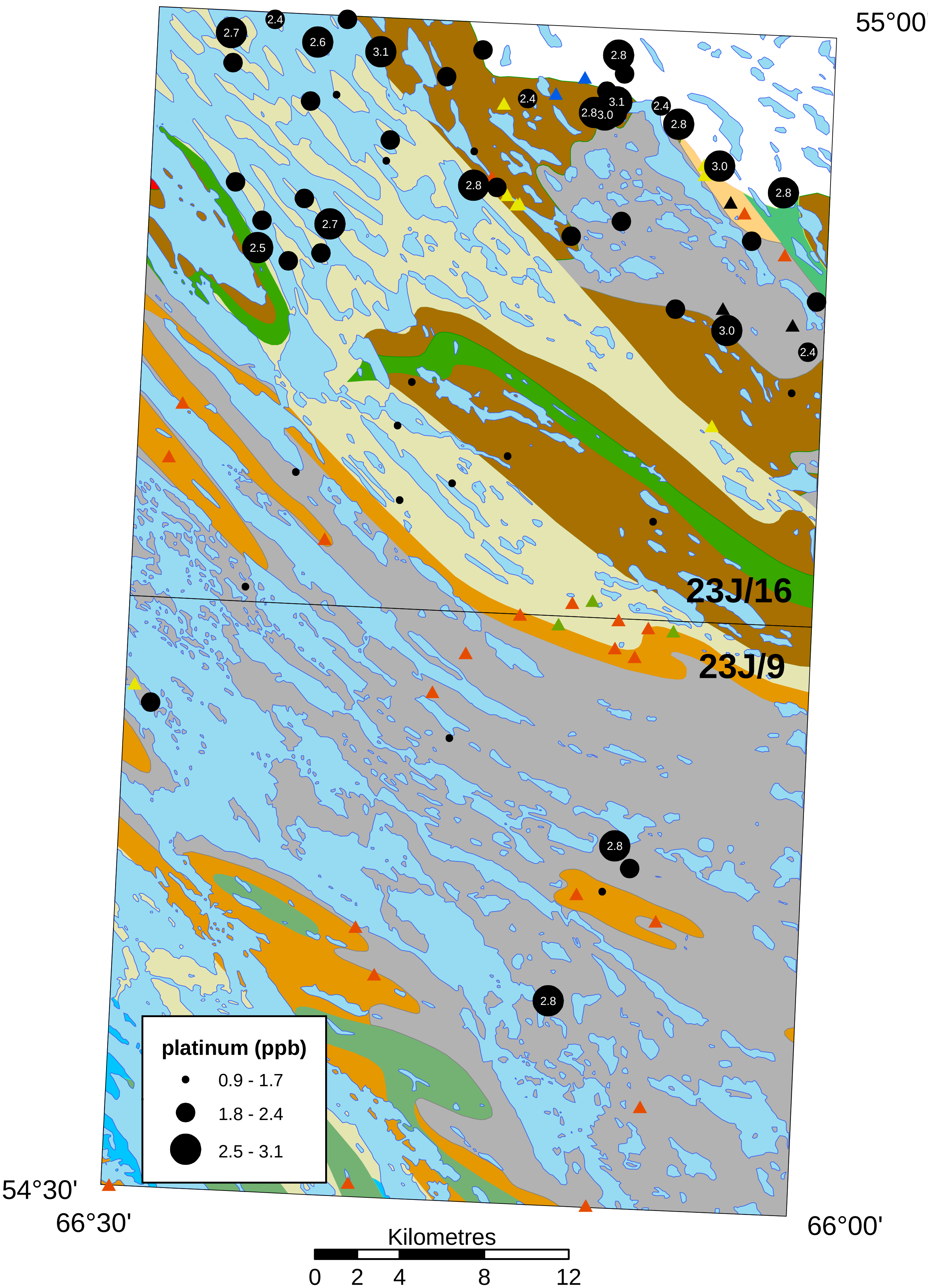


Figure 5. *Gold in till.*

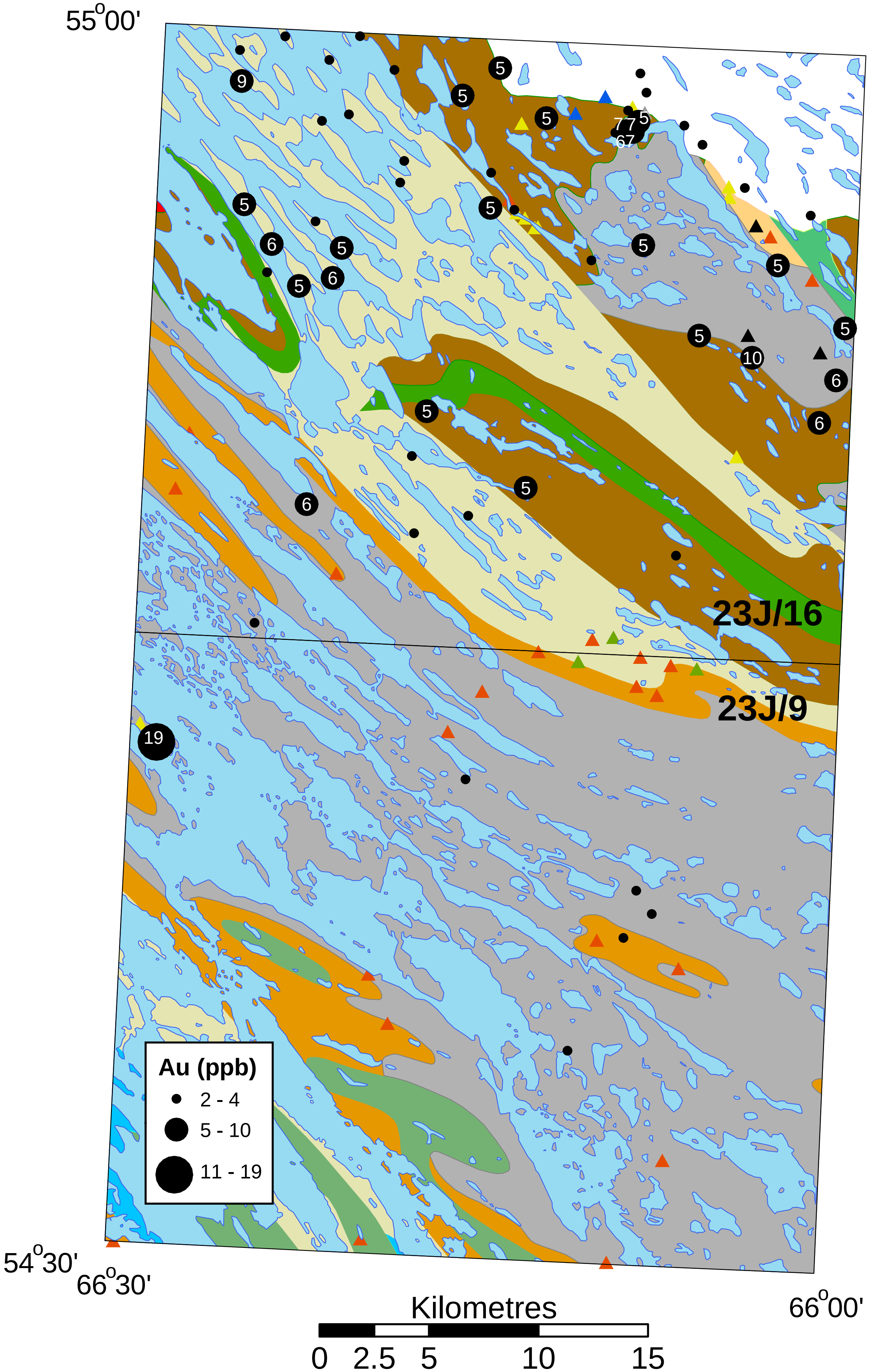


Figure 6. *Copper in till.*

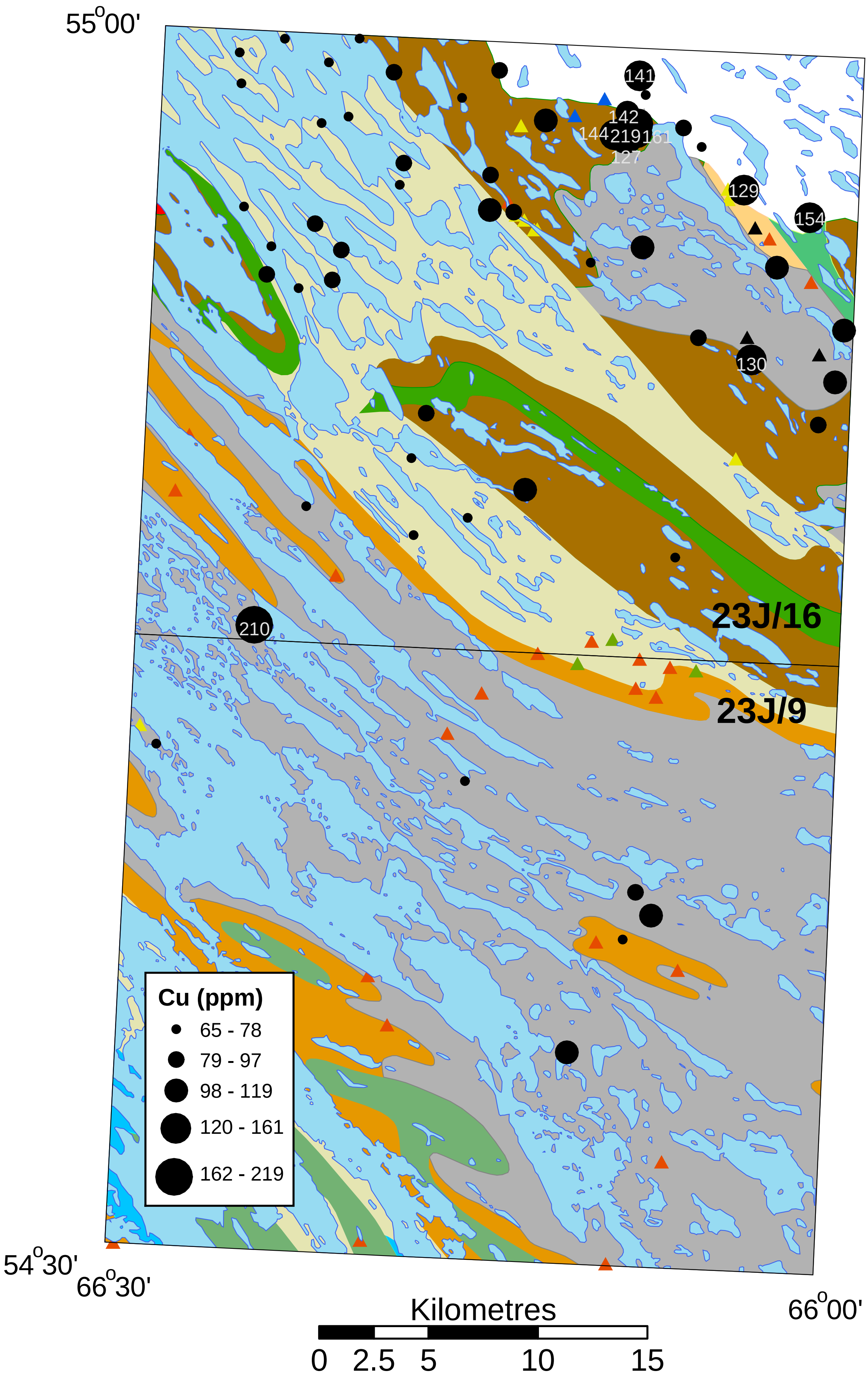
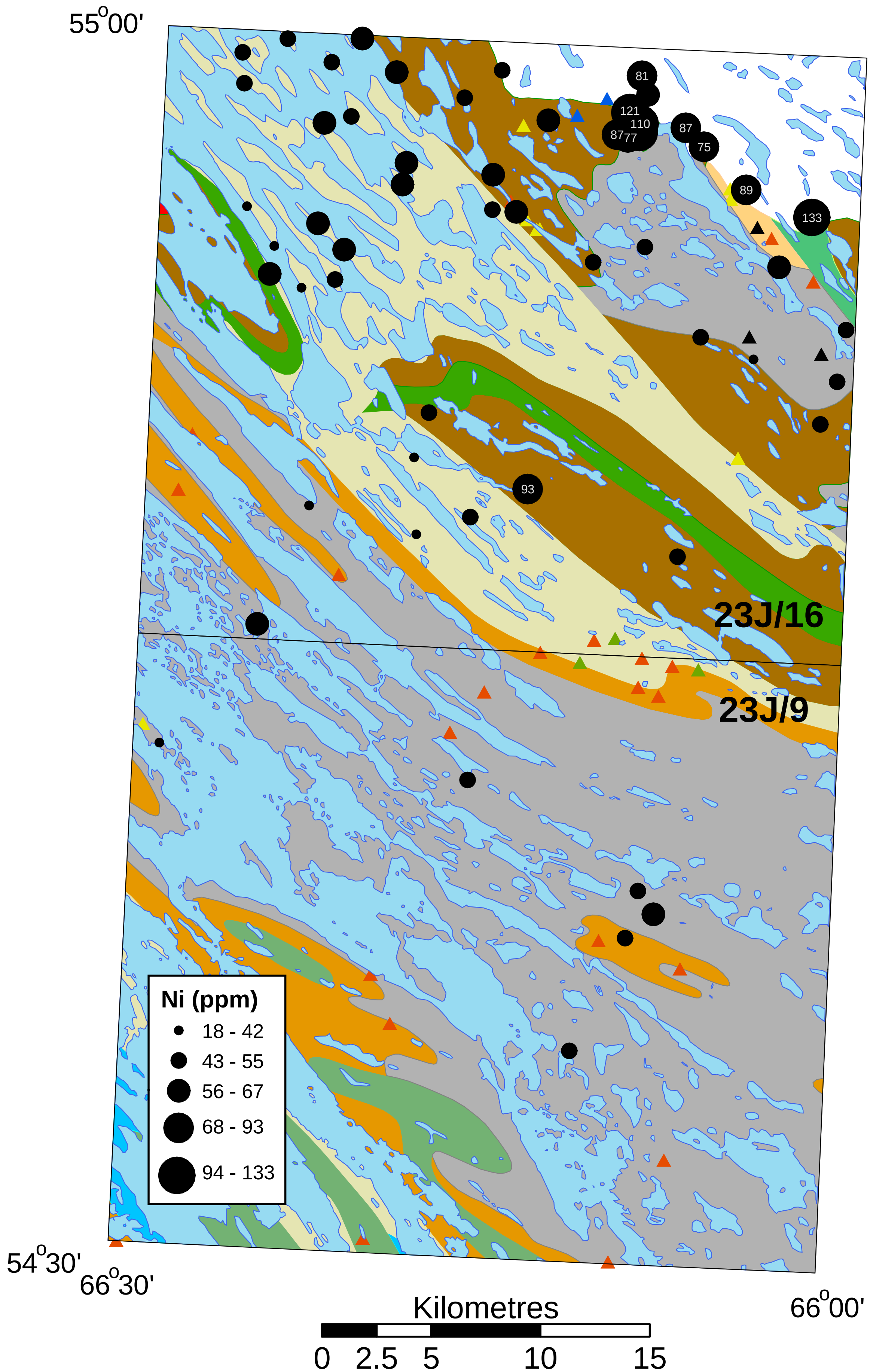


Figure 7. *Nickel in till.*



CONCLUSIONS

Although no notably anomalous values were obtained for platinum and palladium, the results support the suggestion of Wardle (1987) that this area of Labrador has potential for platinum and palladium mineralization. All samples analysed showed platinum and palladium above detection limit. A similar study was conducted by McConnell (2002) around the Baikie showing in the Florence Lake greenstone belt. The Baikie showing is known to contain up to 1020 ppb Pd in grab samples. Soil sampling around the Baikie showing yielded values of up to 11.9 ppb palladium, and 15.7 ppb platinum. However 90% of samples gave results of <0.8 ppb for platinum, and 75% of samples contained <0.9 ppb palladium.

ACKNOWLEDGMENTS

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Appendix 1. Data Listing

Sample #	Site #	East	North	Lab #	Pd27 ppb	Pt27 ppb	Au27 ppb	Cu2 ppm	Ni2 ppm	Au1 ppb
8002	92003	664200	6089500	7230459	2.8	2.2	5	65	32	5.4
8004	92004	665600	6087800	7230461	2.5	2.3	6	77	18	4.7
8009	92005	667000	6086000	7230462	2.6	2.2	5	66	38	5.8
8010	92010	675400	6090300	7230467	4.4	2.8	5	115	54	5.1
8012	92011	676500	6090300	7230468	2.4	2.0	4	97	56	5.3
8015	92012	675300	6091900	7230471	2.3	1.7	4	93	56	4.4
8020	92015	663600	6095100	7230474	1.8	1.8	9	66	55	5.6
8025	92020	668500	6086500	7230479	2.9	2.2	6	87	51	6.4
8066	92024	668200	6076100	7230485	1.7	0.9	6	75	42	5.8
8067	92067	675300	6096700	7230521	2.0	1.9	5	82	54	5.3
8069	92068	681700	6097000	7230522	2.8	2.8	3	141	81	3.8
8071	92070	680200	6088300	7230524	1.7	2.1	4	69	49	5.2
8073	92072	687900	6084500	7230526	3.6	3.0	10	130	35	10
8074	92073	692000	6086200	7230528	2.6	2.3	5	100	55	5.2
8079	92074	691200	6081800	7230529	2.3	1.7	6	92	52	6.8
8080	92080	685400	6085300	7230535	1.8	2.0	5	82	54	4.2
8082	92081	684800	6094000	7230536	2.1	2.8	4	75	75	3.5
8095	92083	685200	6075200	7230538	1.6	1.0	4	71	55	4.2
8102	92096	673300	6080800	7230553	1.4	1.4	5	95	48	13
8107	92102	665500	6086500	7230561	2.5	2.5	4	81	56	4
8108	92106	671200	6091100	7230564	1.9	1.7	3	76	57	3.7
8110	92108	667400	6093600	7230566	1.5	1.8	3	69	61	4.1
8111	92109	668600	6094000	7230567	2.1	1.6	3	68	49	3.1
8112	92111	671300	6092100	7230569	2.6	2.0	4	89	61	4.6
8113	92112	670500	6096200	7230571	3.6	3.1	4	81	58	4.8
8114	92113	668800	6097600	7230572	1.8	1.9	3	68	66	3.6
8116	92114	667500	6096400	7230573	1.7	2.6	4	76	50	1
8118	92115	665400	6097300	7230574	1.8	2.4	3	74	52	3.5
8122	92117	663400	6096500	7230576	2.1	2.7	4	78	50	2.7
8123	92122	668800	6087900	7230581	2.4	2.7	5	86	62	4.5
8125	92123	667500	6089000	7230582	2.0	1.9	4	79.8	59.2	4.8
8163	92166	686900	6092200	7230628	3.6	3.0	4	129	89	6.3
8165	92167	677600	6094600	7230629	2.6	2.4	5	100	63	4.4
8166	92169	673700	6095300	7230632	1.9	1.9	5	74	53	2.7
8168	92171	682500	6089200	7230634	2.4	2.2	5	109	49	5.7
8170	92173	691800	6083800	7230637	3.1	2.4	6	118	45	10
8173	92181	690000	6091200	7230646	3.2	2.8	3	154	133	5.6
8181	92192	678100	6077700	7230659	3.2	1.6	5	107	93	3.7
8193	92193	675600	6076200	7230661	1.9	1.3	4	76	45	3.8
8194	92195	673200	6075200	7230663	1.4	1.1	3	71.4	38.8	3.3

Appendix 1. Continued

Sample #	Site #	East	North	Lab #	Pd27 ppb	Pt27 ppb	Au27 ppb	Cu2 ppm	Ni2 ppm	Au1 ppb
8196	92196	672800	6078700	7230664	2.5	1.5	3	74	41	3.1
8197	92247	681290	6095270	7230707	2.5	2.3	3	113	121	6.1
8236	92250	681270	6094310	7230711	2.9	2.5	7	92	49	10
8239	92301	681290	6094130	7230712	3.4	2.9	4	119	77	5.4
8241	92310	681590	6094310	7230722	3.3	2.6	7	127	67	6.8
8250	92199	666300	6070500	7230723	2.5	1.6	3	210	63	3.2
8251	92262	685500	6058800	7230736	2.3	2.1	4	99.2	57.5	15
8256	92263	684700	6059800	7230738	1.8	2.8	4	81	51	4.9
8263	92266	684300	6057600	7230742	1.7	1.4	3	70	48	4.2
8265	92281	662300	6064700	7230758	6.9	1.9	19	76	37	22
8268	92285	676500	6064200	7230762	1.6	1.4	3	67	44	5.2
8283	92294	680790	6094210	7230771	3.0	2.8	3	144	87	1
8286	92315	681295	6094255	7230784	3.9	3.0	7	219	64	10
8294	92321	688700	6088800	7230795	2.6	2.1	5	111	61	7.5
8306	92351	682200	6052250	7230799	1.3	2.8	2	118	51	3.1
8320	92353	682050	6096150	7230802	2.0	2.0	2	76	65	6
8321	92354	683900	6094800	7230803	1.8	2.4	3	83	87	3.4
8322	92330	681800	6094400	7230811	1.7	1.6	3	161	105	4.4
8323	92334	681800	6094800	7230815	3.5	3.1	5	142	110	7.8
8330	92250	681290	6094320	7230837	2.8	2.3	6	89	51	11

Note: Pt27, Pd27 and Au27 analysis by FA-ICP-MS; Cu2 and Ni2 analysis by ICP-MS; Au1 analysis by INAA. For full data listings and sample details *see* Liverman *et al.* (1993).