



Mines

**INDICATOR MINERAL RESULTS FROM A
2018 TILL SAMPLING AND SURFICIAL
MAPPING STUDY, NTS MAP AREA 13N,
HOPEDALE BLOCK, LABRADOR**

H.E. Campbell and M.B. McClenaghan

Open File 013N/0156

**St. John's, Newfoundland
October, 2019**

NOTE

Open File reports and maps issued by the Geological Survey Division of the Newfoundland and Labrador Department of Natural Resources are made available for public use. They have not been formally edited or peer reviewed, and are based upon preliminary data and evaluation.

The purchaser agrees not to provide a digital reproduction or copy of this product to a third party. Derivative products should acknowledge the source of the data.

DISCLAIMER

The Geological Survey, a division of the Department of Natural Resources (the “authors and publishers”), retains the sole right to the original data and information found in any product produced. The authors and publishers assume no legal liability or responsibility for any alterations, changes or misrepresentations made by third parties with respect to these products or the original data. Furthermore, the Geological Survey assumes no liability with respect to digital reproductions or copies of original products or for derivative products made by third parties. Please consult with the Geological Survey in order to ensure originality and correctness of data and/or products.

Recommended citation:

Campbell, H.E. and McClenaghan, M.B.*

2019: Indicator mineral results from a 2018 till sampling and surficial mapping study, NTS map area 13N, Hopedale Block, Labrador. Government of Newfoundland and Labrador, Department of Natural Resources, Geological Survey, Open File 013N/0156, 13 pages.

* Geochemistry Section, Geological Survey of Canada, 601 Booth Street, Ottawa, ON, K1A 0E8



Mines

INDICATOR MINERAL RESULTS FROM A 2018 TILL SAMPLING AND SURFICIAL MAPPING STUDY, NTS MAP AREA 13N, HOPEDALE BLOCK, LABRADOR

H.E. Campbell and M.B. McClenaghan

Open File 013N/0156



St. John's, Newfoundland
October, 2019

CONTENTS

	Page
ABSTRACT	ii
SUMMARY	1
ACKNOWLEDGMENTS	2
REFERENCES	4
APPENDICES	8

FIGURES

Figure 1. Sample locations underlain by bedrock geology (<i>see Wardle et al., 1997</i>). The study area is indicated by the box in the regional inset map	1
Figure 2. Flow chart illustrating the sample processing of bulk till samples and recovery of indicator minerals at Overburden Drilling Management (ODM) Limited.	3

ABSTRACT

This report provides till indicator mineral results from a surficial mapping and sampling study conducted in 2018 in the Hopedale (NTS 13N) map area. This study is part of a 2-year collaborative program between the Geological Survey of Canada (GSC), under its Geo-Mapping for Energy and Minerals (GEM) Program, and the Geological Survey of Newfoundland and Labrador (GSNL), the Nunatsiavut Government, and the University College of Cape Breton.

The study area is located west of the coastal community of Hopedale, which has limited access by air or sea. The Voisey's Bay Ni–Cu–Co mine is located 110 km north of the study area, west of Nain. Big Bay is located to the north, Udjoktok Bay to the south and Harp Lake on the southwestern boundary.

Sample sites were accessed using a Bell 206 LR helicopter and targeted based on the examination and processing of geological mapping, historical geochemical and recent geophysical datasets. Datasets used to determine sites also include lake-sediment geochemistry from the National Geochemical Reconnaissance (NGR) program and a targeted GSNL lake-sediment survey, till geochemistry data from the Geological Survey of Canada, indicator mineral studies, and detailed airborne-magnetic survey flown in 2018. Data from 1:500 000 GSC and 1:50 000 GSNL surficial maps were used to further refine site locations. Additional samples were taken in areas remote from potentially mineralized rocks, to establish background grain counts for non-mineralized till.

Fieldwork was carried out in July 2018. Forty-seven samples were collected from till overlying bedrock of the Archean Hopedale Block (including the ca. 3105 Ma Hunt River greenstone belt, late Archean (ca. 2567 Ma) rocks of the Aucoin prospect and mid-Mesoproterozoic rocks of the Nain Plutonic Suite) with samples covering parts of NTS map areas 13N/02, 05, 06, 07, 09, 10 and 12. The larger (8–20 kg) till samples for indicator mineral analysis were collected, along with smaller (3–5 kg) samples for till geochemical analysis and pebbles for lithology identification and counts, the results of which will be released later. The bulk till samples were submitted to Overburden Drilling Management (ODM), in Ottawa, Ontario, where they were panned for gold grains, PGMs and other fine-grained metallic indicator minerals, then subjected to heavy-liquid separation and picked for kimberlite indicator minerals (KIMs), and metamorphosed and magmatic massive sulphide indicator minerals (MMSIMs). In addition, the lithologies of the pebble fraction of the indicator mineral samples were identified and counted. The heavy mineral and pebble lithology data are presented in Excel format, along with sample location data, in Appendices A and B. Discussion of the results will be presented in later publications. The results from the 2018 till indicator mineral study will assist in future exploration programs by identifying areas of higher mineral potential and mineral signatures dispersed from bedrock overlain by till.

SUMMARY

Till samples were collected at locations over the 1:250 000 Hopedale (NTS 13N) map area. Sampling regions were determined by assessing historical NGR lake-sediment geochemical datasets (Hornbrook *et al.*, 1979; Hornbrook and Friske, 1990; Friske *et al.*, 1993), historical kimberlite indicator mineral studies (Ryan and McConnell, 1995; McConnell and Ryan, 1996), till geochemistry (Klassen and Bolduc, 1986; Klassen and Knight, 1995), a 2017 till indicator mineral study (Campbell and McClenaghan, 2019) and historical and recent geophysical datasets for areas of mineral potential (Teskey *et al.*, 1982; Coyle, 2019a–d). Sample sites (Figure 1) were further refined by inspecting the mapped surficial geology of the area (Ricketts, 1984, 1988, 2011a, b; Klassen *et al.*, 1992; Batterson, 1995, 1996, 1999, 2000a–d) and on satellite imagery, in order to avoid sampling in regions covered by glaciofluvial and glaciomarine sediments, as these glacial deposits have a more complex history (McClenaghan *et al.*, 2013). As a result, most of the samples were collected from test-pits and mudboils (30 to 90 cm deep) in till, overlying and, dispersed from the late Archean ($<2567 \pm 4$ Ma) alkaline plutonic rocks of the Aucoin prospect in NTS map area 13N/06 (Sandeman and McNicoll, 2015), and from the amphibolite-facies mafic

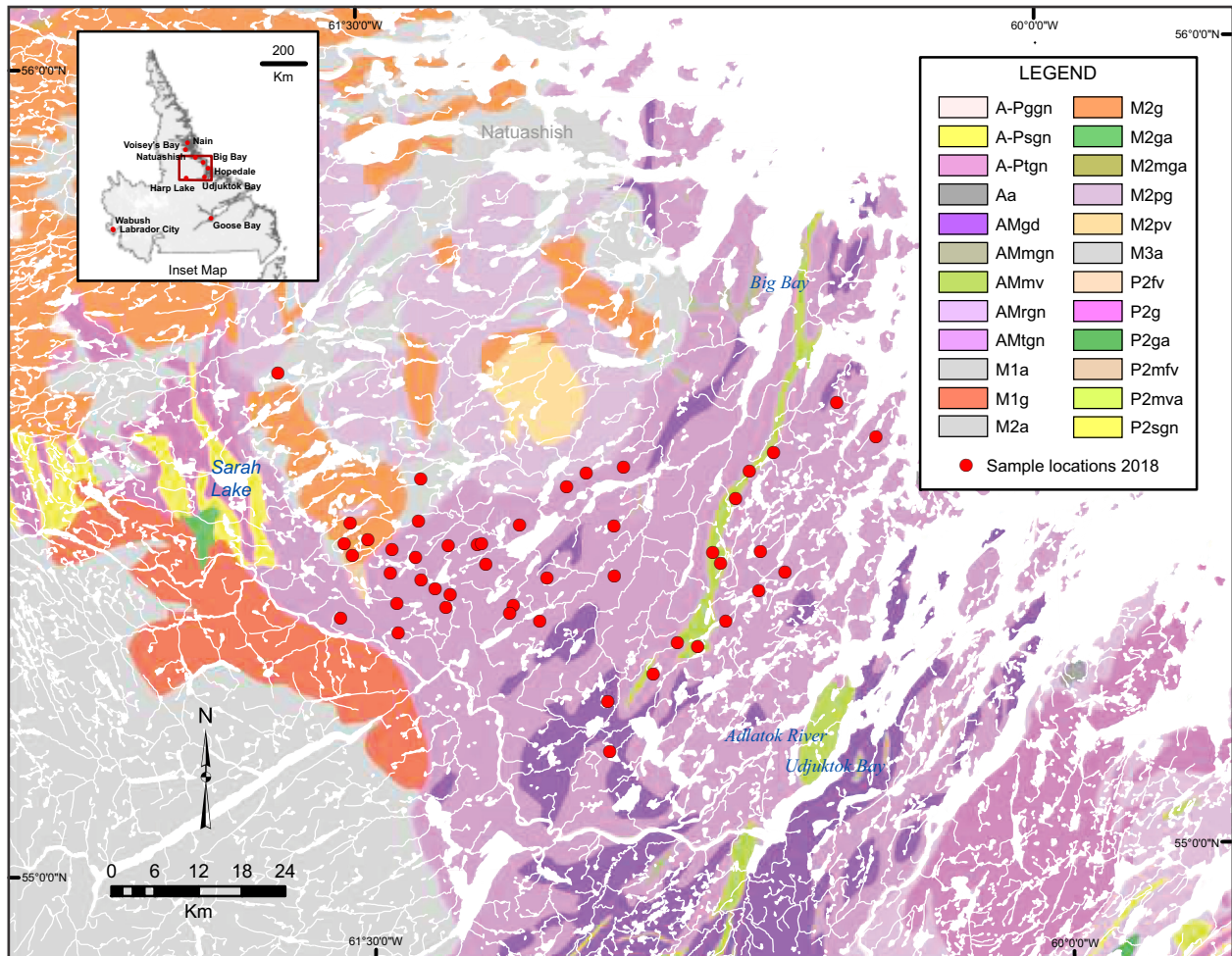


Figure 1. Sample locations underlain by bedrock geology (see Wardle *et al.*, 1997). The study area is indicated by the box in the regional inset map.

metavolcanic rock, komatiite flows and metasedimentary and *ca.* 3105 felsic volcanic rocks of the Hunt River belt (James *et al.*, 2002) in NTS map area 13N/07.

The host rocks of the Aucoin prospect are not distinguished on the 1:1 000 000 compilation map of Labrador of Wardle *et al.* (1997), but are included as part of the Mesoarchean tonalite, diorite and granodiorite gneisses, mafic granulites (AMtgn - Figure 1: *ibid.*) that underlie much of the study area. A few samples were taken in till down-ice of granodiorites and tonalities (AMgd - *ibid.*) and amphibolite rafts (AMmgn - *ibid.*) in NTS map area 13N/07. The amphibolite rafts are interpreted as reworked enclaves of the Hunt River greenstone belt (Ermanovics, 1993; AMmv - Figure 1: Wardle *et al.*, 1997) Other samples were taken from till overlying and down-ice of anorthosite–mangerite–charnockite–granite rocks of the *ca.* 1351–1292 Ma Nain Plutonic Suite (Hill, 1982; Ryan *et al.*, 1991; Thomas and Morrison, 1991; Figure 1 - M2a, M2g - Wardle *et al.*, 1997) in NTS map areas 13N/05 and 06.

Forty-seven bulk till samples, weighing between 8 and 20 kg, were extracted from hand-dug pits, along with 3–5 kg till samples and pebbles, using GEM Program sampling procedures (*see* Spirito *et al.* (2011) and McClenaghan *et al.* (2013)). The samples were put in large plastic bags and taped shut using electrical tape to prevent leakage. The samples were then bagged again, taped (to ensure that the bag did not rip during transport), and put in buckets for transportation, by ferry, to Lewisporte, NL and shipped to St. John's, NL, by truck for sorting and receiving. The bulk samples were then shipped, by truck, to Overburden Drilling Management Limited (ODM) in Ottawa, Ontario, for indicator mineral processing (Figure 2). Four GSC heavy-mineral Bathurst blanks (samples 18HC4054–4057), containing few to no indicator minerals (Plouffe *et al.*, 2013), were inserted in the batch to monitor possible cross-contamination. One blank was inserted at the beginning of the batch to detect cross-contamination from previously processed sample batches (*ibid.*). The remaining blanks were inserted into the sequence immediately following samples taken from areas where till was suspected of containing higher amounts of indicator minerals (*e.g.*, down-ice from the Aucoin prospect).

At ODM, the samples were processed using a combination of tabling, panning and heavy liquid separation at a specific gravity of 3.2. All samples processed using a shaking table and the table pre-concentrates were panned to recover gold, Platinum Group Minerals and fine-grained metallic indicator minerals. These grains were counted and measured and then returned to the table pre-concentrates. The samples were then further processed using heavy liquid and magnetic separations following procedures described in McClenaghan *et al.* (2017) and Plouffe *et al.* (2013). A schematic of the processing flow sheet is shown in Figure 2.

This report only includes: 1) Appendix A, a listing of the sample location data in Excel (.xlsx) format; and, 2) Appendices B1–13, the raw data as reported by the heavy mineral lab in Excel (.xlsx) format, with samples listed in the order that they were processed. Interpretation of the data will be presented in a subsequent report.

ACKNOWLEDGMENTS

The authors would like to thank David Corrigan at the GSC for funding, through the GEM program, and for his general support. Alana Hinchey is thanked for heading the GSNL portion of the

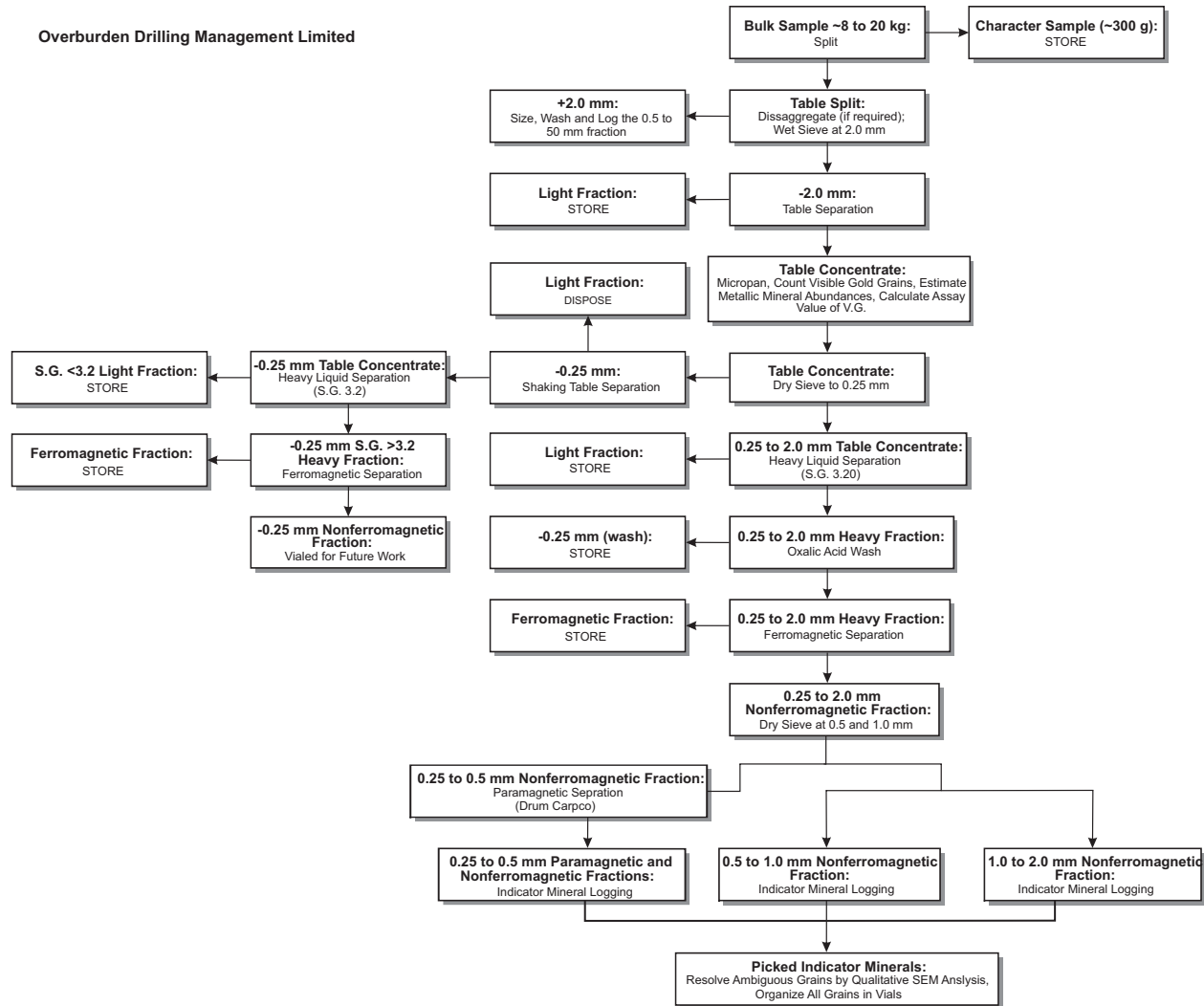


Figure 2. Flow chart illustrating the sample processing of bulk till samples and recovery of indicator minerals at Overburden Drilling Management (ODM) Limited.

project, and for her support of the surficial portion of the project. Hamish Sandeman and Bruce Ryan were extremely helpful, providing information pertaining to the bedrock geological setting, mineralogy and economic potential of the study area. Wayne Tuttle is thanked for his logistical assistance and his daily safety monitoring in the field. Discussions of local geology and traditional knowledge with local prospectors Edmund Saunders and Johnny and Albert Tuglavina were much appreciated, and greatly helped in understanding the economic prospectivity and the history of the area. Stephen Amor is thanked for his insightful review of this paper. The authors are grateful to Kim Morgan for her talent in creating the maps in the report and Joanne Rooney is thanked for her excellent drafting of this paper. Steve, Charles and Lorne from Universal Helicopters are thanked for their skillful piloting. A very big thank you to Pauline Honarvar for her thoughtful review of the appendices accompanying this report and this text.

REFERENCES

Batterson, M.J.

1995: Quaternary geology of parts of the central and southern Hopedale Block, Labrador. *In* Report of Activities. Government of Newfoundland and Labrador, Department of Natural Resources, Geological Survey, Report of Activities, pages 3-4.

1996: Quaternary geology of parts of the central and southern Hopedale. *In* Current Research. Government of Newfoundland and Labrador, Department of Natural Resources, Geological Survey, Report 96-1, pages 1-10.

1999: Landforms and surficial geology of NTS map sheet 13N/07 (untitled) Labrador. Map 99-018. Government of Newfoundland and Labrador, Department of Mines and Energy, Geological Survey, Open File 13N/07/0100.

2000a: Landforms and surficial geology of NTS map sheet 13N/06 (untitled) Labrador. Map 99-017. Government of Newfoundland and Labrador, Department of Mines and Energy, Geological Survey, Open File 13N/06/0099.

2000b: Landforms and surficial geology of the Kanairiktok map sheet (NTS 13N/01), Labrador. Map 2000-37. Government of Newfoundland and Labrador, Department of Mines and Energy, Geological Survey, Open File 13N/01/0110.

2000c: Landforms and surficial geology of the Ugjoktok Bay map sheet (NTS 13N/02), Labrador. Map 2000-38. Government of Newfoundland and Labrador, Department of Mines and Energy, Geological Survey, Open File 13N/02/0111.

2000d: Landforms and surficial geology of the Shapio Lake map sheet (NTS 13N/03), Labrador. Map 2000-39. Government of Newfoundland and Labrador, Department of Mines and Energy, Geological Survey, Open File 13N/03/0112.

Campbell, H.E. and McClenaghan, M.B.

2019: Results of a 2017 heavy mineral indicator pilot study in the NTS 13N and 13M map areas, Hopedale Block, Labrador. Government of Newfoundland and Labrador, Department of Natural Resources, Geological Survey, Open File Lab/1743, 10 pages.

Coyle, M.

2019a: First vertical derivative of the magnetic field, aeromagnetic survey of the Hopedale Area, Newfoundland and Labrador, parts of NTS13-M/north and 13-N/north. Geological Survey of Canada, Open File 8517, 1 sheet.

2019b: First vertical derivative of the magnetic field, aeromagnetic survey of the Hopedale Area, Newfoundland and Labrador, part of 13-N/north. Geological Survey of Canada, Open File 8518, 1 sheet.

2019c: First vertical derivative of the magnetic field, aeromagnetic survey of the Hopedale Area, Newfoundland and Labrador, parts of NTS13-M/south and 13-N/south. Geological Survey of Canada, Open File 8519, 1 sheet.

2019d: First vertical derivative of the magnetic field, aeromagnetic survey of the Hopedale Area, Newfoundland and Labrador, part of NTS 13-N/south. Geological Survey of Canada, Open File 8520, 1 sheet.

Ermanovics, I.F.

1993: Geology of the Hopedale Block, southern Nain Province, and the adjacent Proterozoic terranes, Labrador, Newfoundland. Geological Survey of Canada, Memoir 431, 161 pages.

Friske, P.W.B., McCurdy, M.W., Gross, H., Day, S.J., Lynch, J.J. and Durham, C.C.

1993: National Geochemical Reconnaissance lake sediment and water data, eastern Labrador (NTS 13N). Geological Survey of Canada, Open File 2648, 121 pages.

Hill, J.D.

1982: Flowers River and Notakwanon River areas (two maps), Labrador. Scale 1:100 000. Government of Newfoundland and Labrador, Department of Mines and Energy, Mineral Development Division, Maps 81-136 and 81-137, to accompany the Geology of the Flowers River–Notakwanon River Area, Report 82, 138 pages.

Hornbrook, E.H.W. and Friske, P.W.B.

1990: National Geochemical Reconnaissance lake sediment and water data, east-central Labrador (parts of 13I, 13J, 13K, 13N and 13O). Geological Survey of Canada, Open File 1636 (rev. 1989), 175 pages.

Hornbrook, E.H.W., Maurice, Y.T. and Lund, N.G.

1979: Regional lake sediment and water geochemical reconnaissance data, Labrador. Geological Survey of Canada, Open File 558, 60 pages.

James, D.T., Kamo, S. and Krogh, T.

2002: Evolution of 3.0 and 3.1 Ga volcanic belts and new thermotectonic model for the Hopedale Block, North Atlantic craton (Canada). *Canadian Journal of Earth Sciences*, Volume 39, pages 687-710.

Klassen, R. and Bolduc, A.

1986: Ice flow trends and drift composition, Flowers River area, Labrador. *In* Current Research. Government of Newfoundland and Labrador, Department of Mines and Energy, Mineral Development Division, Report 86-01, pages 317.

Klassen, R.A. and Knight, R.D.

1995: Till geochemistry of central Labrador. Geological Survey of Canada, Open File 3213, 250 pages.

- Klassen, R.A., Paradis, S., Bolduc, A.M. and Thomas, R.D.
1992: Glacial landforms and deposits, Labrador, Newfoundland and eastern Québec. Geological Survey of Canada, Map 1814A, Scale 1:1 000 000.
- McClenaghan, M.B., Paulen, R.C., Rice, J.M., Campbell, H.E. and Pyne, M.D.
2017: Gold grains in till samples from the southern Core Zone, Quebec and Newfoundland and Labrador (NTS 23-P and 23-I): potential for undiscovered mineralization. Geological Survey of Canada, Open File 8222.
- McClenaghan, M.B., Plouffe, A., McMartin, I., Campbell, J.E., Spirito, W.A., Paulen, R.C., Garrett, R.G. and Hall, G.E.M.
2013: Till sampling and geochemical analytical protocols used by the Geological Survey of Canada. *Geochemistry: Exploration, Environment, Analysis*, Volume 13, pages 285-301.
- McConnell, J. and Ryan, B.
1996: The search for kimberlite and lamproite intrusions in northeastern Labrador: Results of a surficial sediment survey and bedrock orientation study. *In Current Research*. Government of Newfoundland and Labrador, Department of Natural Resources, Geological Survey, Report 96-1, pages 193-205.
- Plouffe, A., McClenaghan, M.B., Paulen, R.C., McMartin, I., Campbell, J.E. and Spirito, W.A.
2013: Processing of glacial sediments for the recovery of indicator minerals: protocols used at the Geological Survey of Canada. *Geochemistry: Exploration, Environment, Analysis*, Volume 13, pages 303-316.
- Ricketts, M.J.
1984: Coastal Labrador aggregate resources. Government of Newfoundland and Labrador, Department of Mines and Energy, Mineral Development Division, Open File LAB/0642, 174 pages.

1988: Aggregate review-1988. *In Report of Activities*. Government of Newfoundland and Labrador, Department of Mines, Geological Survey Branch, Report of Activities, page 112.

2011a: Granular-aggregate resources of the Davis Inlet map area (13N/15). Map 2011-33. Government of Newfoundland and Labrador, Department of Natural Resources, Geological Survey, Open File 13N/15/0141.

2011b: Granular-aggregate resources of the Big Bay map area (13N/10). Map 2011-32. Government of Newfoundland and Labrador, Department of Natural Resources, Geological Survey, Open File 13N/10/0140.
- Ryan, B. (Compiler), Krogh, T.E., Heaman, L., Schärer, U., Philippe, S. and Oliver, G.
1991: On recent geochronological studies in the Nain Province and Nain Plutonic Suite, north-central Labrador. *In Current Research*. Government of Newfoundland and Labrador, Department of Mines and Energy, Geological Survey Branch, Report 91-1, pages 257-261.

Ryan, B. and McConnell, J.W.

1995: The search for kimberlite and lamproite intrusions in eastern Labrador: Initial report of a bedrock and surficial-sediment sampling survey. *In* Current Research. Government of Newfoundland and Labrador, Department of Mines and Energy, Geological Survey, Report 95-1, pages 47-54.

Sandeman, H.A. and McNicoll, V.J.

2015: Age and petrochemistry of rocks from the Aucoin gold prospect (NTS map area 13N/6), Hopedale Block, Labrador. Late Archean, alkalai monzodiorite–syenite hosts Proterozoic orogenic Au–Ag–Te mineralization. *In* Current Research. Government of Newfoundland and Labrador, Department of Natural Resources, Geological Survey, Report 15-1, pages 85-103.

Spirito, W.A., McClenaghan, M.B., Plouffe, A., McMartin, I., Campbell, J.E., Paulen, R.C., Garrett, R.G. and Hall, G.E.M.

2011: Till sampling and analytical protocols for GEM Projects from field to archive. Geological Survey of Canada, Open File 6850.

Teskey, D.J., Dods, S.D. and Hood, P.J.

1982: Compilation techniques for the 1:1 million magnetic anomaly map series *In* Current Research, Part A. Geological Survey of Canada, Paper 82-1A, pages 351-358.

Thomas, A. and Morrison, R.S.

1991: Geology along the central part of the Ugjoktok River, NTS 13N/5 and parts of 13M/8 and 13N/6, Labrador. Government of Newfoundland and Labrador, Department of Mines and Energy, Geological Survey Branch, Map 91-50, with accompanying notes.

Wardle, R.J., Gower, C.F., Ryan, B., Nunn, G.A.G., James, D.T. and Kerr, A.

1997: Geological map of Labrador, scale: 1:1 000 000. Government of Newfoundland and Labrador, Department of Mines and Energy, Geological Survey, Open File LAB/1226.

APPENDICES

Appendices A and B1–13 are available as digital excel files (.xlsx) through [this link](#).

Appendix A: Sample Locations

Appendix B1: Abbreviations

Appendix B2: Primary Weights and Descriptions

Appendix B3: Gold Grain Counts

Appendix B4: Detailed Gold Grain Counts

Appendix B5: Laboratory Processing Weights

Appendix B6: Paramagnetic and Non-paramagnetic Fraction Weights

Appendix B7: Heavy Mineral Processing Weights

Appendix B8: KIM Counts

Appendix B9: KIM Remarks

Appendix B10: MMSIM Counts

Appendix B11: MMSIM Summary

Appendix B12: Pebble Weights

Appendix B13: Pebble Lithologies