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This publication compiles geochemical data from a variety of sources on magmatic rocks of the High Arctic Large Igneous Province in Canada (~130-70 Ma), in the form of an Excel® spreadsheet, and an accompanying document that provides analytical details. This is very much a 'work in progress', and we anticipate that further analysis and modeling will lead to changes in the future with respect to attribution of magmatic affinities to certain samples. In this light, some of the columns contain working notes where anomalous signatures or tentative correlations between individual samples are recorded; whereas others contain working notes on the petrography and field context gleaned from field books and older compilations.

There are 2 main sections in the spreadsheet: *Data Source and Plot Order*.

All the data is provided in both, the only difference being the sort order, which is embedded in columns A and B, respectively, allowing users to easily shift from one sort order to the other. The *Data Source* worksheet presents data according to the source of the data, starting with new data and finishing with previously published data. The *Plot Order* worksheet reorders the data according to the types of rock and magmatic affinity as defined in Bédard et al. (2021a,b), and is most amenable to construction of geochemical diagrams.

Igneous rocks are divided into magmatic suites depending on their geochemical signatures using the criteria discussed in Bédard et al. (2021a,b). Rocks are divided into subalkaline (tholeiitic) vs alkaline stems based on the classic Total alkali –Silica and Zr/Ti vs Nb/Y plots. Tholeiitic rocks were subdivided by Ce content and NMORB-normalized Sm/Yb ratio, whereas alkaline rocks are subdivided by age, location and iterative comparison of unknown samples with those constrained by age data or stratigraphy. Some igneous rocks with incomplete data could not be assigned to any specific suite and are listed as alkaline or tholeiitic only. Rocks with normalized MgO <3 wt% are mostly not assigned to the newly-defined suites, and in most cases retain the suite assignments of the original publications. Some igneous rocks that showed unusually high (or low) concentrations of alkalis, CaO or SiO₂ were classed as 'altered' because they deviated from similar, but fresher samples on Harker plots, or because they were noted as being altered in the original source descriptions. Some of these were excluded from the averaging.

The symbols in column C are those used for the construction of geochemical diagrams by Bédard et al. (2021a,b). Column D adds refinements to the basic classification, with the + or – suffix representing samples affected by accumulation or fractionation (respectively) of Fe-Ti-oxides, while those with an asterix suffix are averages that exclude these anomalous samples. The –f suffix indicates felsic facies. Columns E and F attribute the Typology codes to volcanic rocks of the Isachsen and Strand Fiord Fms, respectively. Column G has various header lines to make the sheet easier to read. Column K has duplicate lab numbers which are used in some published papers. Some sample numbers have an r suffix indicating these are duplicate samples, r for reanalysis. Columns T and U provide the basic suite and subsuite classifications. Note that no distinction was made between the Queen Elizabeth Dyke Suite which is dominated by radial dykes and sills, and the concentric dykes from Buchan & Ernst (2018).

For the alkaline suites, the subsuites are LP, IP and HP (low- intermediate and high-P₂O₅), respectively. Mafic rocks previously assigned to the alkaline Hansen Point Volcanics are reassigned to the Audhild Bay Suite defined by Bédard et al. (2021b), but the low-MgO rocks were not reclassified systematically. More specifically, some of the sub-alkaline felsic rocks assigned to the Hansen Point Alkaline Volcanics in previous studies would need to be re-examined, as some may belong to the newly-defined Hansen Point Tholeiitic Suite of Naber et al. (2021).

SOURCES of DATA

As part of the GEM2 Program of the Geological Survey of Canada, 251 new HALIP rock samples were collected and analyzed between 2013 and 2017. In addition, we analysed 156 rocks recovered from the archives of the Geological Survey of Canada and Dalhousie University in Halifax (Saumur, 2015; Saumur et al., 2015, Saumur & Williamson, 2016), as well as 38 new samples collected by C. Tegner during the 2017 CASE expedition. These 445 new analyses are combined with data (N=548) compiled from the literature (Osadetz & Moore, 1988, N=24; Trettin, 1996, N=42; Kontak *et al.*, 2001, N=8; Estrada & Henjes-Kunst 2004, 2013 (N=75); Jowitt *et al.*, 2014, N=97 with additional S analyses provided by B.M. Saumur; Evenchick *et al.*, 2015, N=8; Estrada, 2015, N=17; Kingsbury *et*

al., 2016a, N=60 with additional elements added (C. Kingsbury, pers. comm.); Estrada *et al.*, 2016, N=122; Estrada *et al.*, 2018, N=16; Estrada & Piepjohn, 2018, N=8; Dockman *et al.*, 2018, N=72; Dostal & MacRae, 2018, N=27, numbered sequentially (JD28 to JD72); Naber *et al.*, 2021, N=10). Geographical coordinates for some older data (i.e. pre-GPS) were determined from published location maps, and some outcrops originally assigned to volcanic units were reinterpreted as sills or dykes based on new field evidence (Bédard *et al.*, 2016; Evenchick *et al.*, 2019).

ANALYTICAL METHODS

New major and trace element analyses were generated at Actlabs (Activation laboratories Ltd, Ancaster, Ontario, Canada); at Acme Labs (Vancouver, B.C., Canada); at the Ontario Geological Survey Geolabs (Sudbury, Ontario, Canada); and at the Institut National de la Recherche Scientifique (INRS-ETE, Québec City, Canada).

INRS-ETE laboratories. Weathered rinds were removed with a diamond saw, and sawmarks removed with a grinding wheel. Samples were crushed in a tungsten carbide shatterbox. Sample fusion was operated on a Claisse fluxer using LiBO_2 and LiBr. The HNO_3 – HCl sinter technique was employed to circumvent potential problems associated with high field-strength elements (HFSE) and rare earth elements (REE) in refractory minerals. The major elements and Ba, Sr, Sc, V, Co, Cr, Cu, Ni, and Zn compositions were determined by inductively coupled plasma – atomic emission spectrometry (ICP–AES). The analytical detection limit is limit is <0.05%, and the precision is $\pm 3\%$. Trace elements were determined by inductively coupled plasma – mass spectrometry (ICP–MS) using a method similar to that described by Varfalvy *et al.* (1997). The detection limit is <0.2 ppm for Y; 0.1 ppm for Th and Zr; 0.04 ppm for Nb and Gd; 0.02 ppm for Rb and Cs, U, Hf, La, Ce, Nd, Sm, Dy, Yb, and Er; and 0.01 ppm for Ta, Eu, Tb, Pr, Tm, Ho, and Lu. The precision is better than 1% for La, Ce, Pr, Nd, Eu, Tb, Lu, and Ba; 2% for Sm, Gd, Dy, Ho, Er, Tm, Yb, Th, Zr, Rb, and Sr; 4% for Cs, Y, and U; and 10% for Nb (standard analyses from ICP–MS of INRS-ETE are available in Table S1 of Leclerc *et al.* (2011).

Activation Laboratories Ltd. (Ancaster Ontario) data were generated using their research grade package 4LITHORES (see <https://actlabs.com/> for methods and accuracy estimates). Lithium metaborate/tetraborate fusion was followed by analysis by fusion ICP (major elements) and fusion ICP/MS (traces) on a Perkin Elmer Sciex ELAN 6000, 6100 or 9000 ICP/MS. The following detection limits are given by Actlabs: (a) REE— 0.05 ppm for La, Ce, Nd; 0.01 ppm for Pr, Sm, Gd, Tb, Dy, Ho, Er, Yb; 0.002 ppm for Lu; 0.005 ppm for Eu and Tm, and (b) other trace elements—5 ppm for Pb; 1 ppm for Rb; 0.2 ppm for Nb; 0.1 ppm for Cs and Hf; 0.01 ppm for Ta and U; 0.05 ppm for Th and Tl. We compared duplicate analyses generated at Actlabs and INRS-ETE and found them essentially identical for the HALIP compositional range.

Data from Ontario Geological Survey Geolabs (Ministry of Northern Development and Mines, Sudbury) was generated with their research grade package ([www.mndm.gov.on.ca > default > files > 2018_geo_labs_brochure](http://www.mndm.gov.on.ca/default/files/2018_geo_labs_brochure) for methods and accuracy estimates). Prior to shipment, sample preparation was performed at facilities of the GSC. Weathered rinds were removed with a diamond saw and sawmarks removed with a grinding wheel. At GeoLabs, samples were crushed with a jaw crusher, riffled, and finally pulverized with an aluminium oxide planetary ball mill. Data were generated using their research grade packages ([www.mndm.gov.on.ca > default > files > 2018_geo_labs_brochure](http://www.mndm.gov.on.ca/default/files/2018_geo_labs_brochure) for details; methods are summarized here). Major elements were obtained by X-Ray Fluorescence (XRF). Samples were run for loss on ignition (LOI: 105 °C under nitrogen atmosphere, 1000 °C under oxygen atmosphere). The calcined samples were then fused with a borate flux to produce a glass bead for XRF analysis. Trace elements were obtained by ICP-MS. The solution for this analysis was prepared via closed vessel multi-acid digestion. PGEs were generated utilizing the Ni-sulphide Fire Assay method; the preparation method here utilized chrome-steel mills. We compared duplicate analyses of whole rock and trace elements generated at GeoLabs and INRS-ETE and found them essentially identical for the HALIP compositional range. High-resolution Platinum group element and precious metal analyses were determined using a nickel sulfide fire-assay technique with an ICP-MS finish. This technique fuses the sample with a mixture of Ni and S to produce a nickel sulfide button; the button is then dissolved and Au, Pt, Pd, Rh, Ru, and Ir coprecipitated with Te, producing a concentrate that is dissolved in aqua regia prior to analysis. Detection limits for all analytical methods are given in Table 2 of Jowitt *et al.* (2014). Precision is estimated at better than 5% for PGEs.

Additional PGE-Au analyses were generated at LabMaTer in Chicoutimi, Québec by the Ni Fire Assay method, with methods and precision as described in Savard *et al.* (2010). New mercury (Hg) analyses were generated at Acme Labs in Vancouver by LECO AMA254 Cold Vapour mercury analyzer ($\pm 10\%$).

ACME Laboratories. The major and trace element contents of 32 whole rock samples from 2017 were measured at ACME (a.k.a. Bureau Veritas Commodities Canada Ltd) by X-ray fluorescence (major elements) and by inductively coupled plasma-mass spectrometry (trace elements) and some of these data are reported in Table 1 of Naber et al. (2021). For the major elements, rock powder was fused into a homogeneous glass disc with lithium-borate and followed by XRF analyses using analytical code LF700. The weight loss on ignition (LOI) of volatile elements in the samples were determined by heating the rock powder to 1000°C. The trace elements were determined by solution LA-ICP-MS analyses from the fused glass discs using the analytical code LF100 or by dissolution in aqua regia using the analytical code AQ200. Certified international reference materials were analysed for major elements (OREAS72B and SY-4(D)), and for trace elements (SO-18, SO-19, OREAS45EA) were analysed in order to constrain the accuracy of the data. The results and the deviation of the measured concentration from the expected value are listed in supplementary data file 4 of Naber et al. (2021). Repeat analyses of the unknown samples are listed in supplementary file 5 of Naber et al. (2021).

New stable isotopic data and abundances of carbon and sulfur were generated at the J. Veizer Laboratory of the University of Ottawa. For whole-rock S analyses, samples were flash combusted at 1800°C with the addition of oxygen, and carried with ultra-pure helium through columns of oxidizing/reducing chemicals to separate gas species. S was separated for analysis by the chemical adsorption "trap and purge" method (Vario Micro Cube), and then carried by helium into a Thermo Finnigan DeltaPlusXP IRMS for isotopic analysis; or into a Elementar VarioEL III thermoconductivity detector (TCD) for elemental analysis. Calibrated internal standards were prepared with every batch of samples for normalization of the data; and analytical precision is +/- 0.2 permil for isotope analyses, and +/- 0.1% (2 sigma) for elemental analyses. For whole-rock C analysis, solids were weighed into tin capsules. Calibrated internal standards were prepared with every batch of samples for normalization of the data. The isotopic composition of organic carbon (and nitrogen) was determined by the analysis of CO₂ (and N₂) produced by combustion on an Elementar VarioEL Cube Elemental Analyser followed by "trap and purge" separation and on-line analysis by continuous-flow with a DeltaPlus Advantage isotope ratio mass spectrometer coupled with a ConFlo III interface. The routine precision of the analyses is 0.20‰.

New whole rock powder oxygen isotope analysis was carried out at the University of Cape Town in South Africa. Oxygen was extracted from samples using a conventional line and ¹⁸O/¹⁶O ratios were determined using a Finnigan MAT 252 mass spectrometer. The whole-rock samples were dried at 50 °C and degassed in a vacuum on a convectional silicate line at 200 °C (see Harris & Vogeli 2010). Samples were reacted with 10 kPa of ClF₃ for 3 h at 550 °C. The liberated O₂ was converted to CO₂ using a platinized carbon rod at high temperature. The internal quartz standard NBS - 28 (δ¹⁸O = 9.64 ‰) was used in normalizing the raw data to the standard mean ocean water (SMOW) scale (Coplen et al., 1983; Coplen 1995). All oxygen data is reported in the standard δ¹⁸O notation relative to the standard mean ocean water (SMOW) where $\delta = (R_{\text{sample}}/R_{\text{standard}} - 1) \times 1000$ and $R = {}^{18}\text{O}/{}^{16}\text{O}$. Analytical error is estimated to be ± 0.1 ‰ (1σ) for δ¹⁸O in all the samples.

New radiogenic isotopic data were generated at the Pacific Centre for Isotopic and Geochemical Research, University of British Columbia, Vancouver. Sr-Nd isotopic ratios were determined from aliquots of powdered basalt. Powders were dissolved using the hot plate method of Weis et al. (2006). Anionic exchange columns were used to separate and purify Sr and Nd (see Connelly et al., 2006; Weis et al., 2006; Nobre Silva et al., 2009 for procedures). Neodymium isotopic compositions were measured using a multi-collector (MC)-ICP-MS (Nu Instruments Ltd, Nu021). Strontium isotopic compositions, were measured by thermal ionisation mass spectrometry (TIMS, Finnigan Triton). Beard et al. (2018) discuss methods and reproducibility.

COMPILED DATA

Interested readers are referred to the original publications for detailed analytical methods of the compiled data, some of which were generated at the commercial laboratories listed above. In the following we summarize the methods and accuracies of the principal laboratories that generated the compiled data.

Most data in papers from Estrada and coworkers was generated at BGR Hannover, complemented by data from Actlabs (Activation Laboratories Ltd.) in Ancaster, Ontario. The following is abstracted from Estrada (2015). For XRF analysed, the sample powders were mixed with lithium metaborate at a ratio of 1:5, fused at 1,200 °C for 20 min, and analyzed using two different XRF spectrometers: a Philips PW 2400 (Rh tube) for the elements Si, Al, Fe,

Mn, Mg, Na, P, S, F, As, Bi, Ce, Co, Cr, Cu, Ga, Hf, La, Mo, and a PW 1480 (Cr tube) for the elements Ti, Ca, K, Cl, Ba, Cs, Sb, Sc, and Sn. The trace-element detection limits are as follows: 20 ppm for Ce and La, 10 ppm for Cu, 5 ppm for Ba, Cs, Hf, Ta, Th, and V, 4 ppm for Pb, 3 ppm for Co, Cr, Ga, Ni, U, Y, Zn, and Zr, and 2 ppm for Nb, Rb, Sc, and Sr. Loss on ignition (LOI) was determined by heating the sample powder to 1,030 °C for 10 min. For ICP-MS analysis, 1 g of the sample powder was digested with aqua regia and diluted to 250 ml volumetrically. The sample solution and simultaneously prepared standards were analyzed using a Perkin-Elmer SCIEX ELAN 6000 Inductively Coupled Mass Spectrometer. Quality assurance is warranted by repeated analysis of samples and CRM. Rb–Sr and Sm–Nd isotope data were obtained on the unleached whole-rock powders using a Finnigan MAT 261 mass spectrometer for Rb measurements and a Thermo-Finnigan TRITON mass spectrometer for Sr, Sm and Nd measurements. Element concentrations were determined by isotope-dilution techniques. All elements were loaded on Re filaments and run on a double-filament assembly in static mode. Isotopic ratios were normalized to $^{146}\text{Nd}/^{144}\text{Nd} = 0.7219$ for Nd and to $^{86}\text{Sr}/^{88}\text{Sr} = 0.1194$ for Sr. Procedural blanks are <0.1 % of the relevant sample concentration and are therefore negligible. Uncertainties at the 95 % confidence level are 0.005 % for $^{143}\text{Nd}/^{144}\text{Nd}$, 0.01 % for $^{87}\text{Sr}/^{86}\text{Sr}$ and 1 % for $^{87}\text{Rb}/^{86}\text{Sr}$ and $^{147}\text{Sm}/^{144}\text{Nd}$.

Kingsbury and coworkers generated major and some trace element data, as well as radiogenic isotope data at Carleton University, Ottawa by fused disc XRF, calibrated against the BCR-2 reference material. See Kingsbury (2016), Kingsbury et al. (2016, 2108) for details. A few additional elements were added to these, courtesy of C. Kingsbury (pers. comm).

Data from Jowitt et al (2014) are mainly from the compilation of Ernst & Buchan (2010). Major and trace element concentrations were determined at the Geological Survey of Canada Laboratories, Ottawa, Canada; major element concentrations were determined using fused beads and wavelength-dispersive X-ray fluorescence (XRF), with trace element concentrations determined by solution inductively coupled plasma-optical emission spectrometry (ICP-OES) and inductively coupled plasma-mass spectrometry (ICP-MS). High-precision F, Cl, and S concentrations were determined by pyrohydrolysis followed by ion chromatography, with total H₂O, CO₂, and S concentrations determined using the combustion method (LECO). Loss on ignition (LOI) was determined by gravimetry after ignition at 900°C. Routine precious metal concentrations (Pt, Pd, and Au) were determined for all samples at Acme Analytical Laboratories, Vancouver, by lead collection fire-assay and ICP-MS analysis. High precision PGE and Au analysis were generated at the Ontario Geological Survey Geoscience Laboratories using a nickel sulfide fire-assay technique with an ICP-MS finish. Detection limits for all analytical methods are given in Table 2 of Jowitt et al. (2014). Analytical precision for all analyses was verified by repeat blind analyses of standards. Repeat analyses indicate precision of the analytical techniques was better than 5% for major elements, trace elements, and the PGEs. A few additional elemental analyses were added as duplicate powders from this study were made available to B.M. Saumur.

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