Geochemical data from the Kamloops Group

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Front cover: Hoodoos carved into andesitic to dacitic tuffs, lahars, and lacustrine volcaniclastic deposits, upper member of the Tranquille Formation (Eocene, Kamloops Group). View to the northwest; outcrop within Kamloops city limits. **Photo by Nancy Van Wagoner.**

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Summary

The Kamloops Group (Eocene; Ewing, 1981) forms part of a discontinuous belt of graben-fill volcanic and sedimentary rocks that extends from the Challis volcanic field in Idaho through central British Columbia to southern Yukon. The whole-rock major, trace, and rare-earth element geochemical data presented herein are part of a study to better understand the volcanism and geochemical evolution of the Kamloops Group and the relationship of the unit to other volcanic complexes (e.g., Penticton Group), and to early Eocene tectonics, mineralization, and climate. The results are from samples collected during 2019 and 2020 and serve as a data repository for summaries and interpretations presented in Van Wagoner et al. (2021) and Van Wagoner and Ootes (2022). Most of the samples are from the type area of the Kamloops Group, near Kamloops, British Columbia (Fig. 1). Some additional samples are from the Savona area ~40 km west of the type area. Appendix 1 includes whole rock major and trace element geochemical results, listed by formation and member. Appendix 2 includes data tables and graphs for accuracy and precision for analytical results from 2019 (Table_QC_A20-01302) and 2020 (Table_QC_A20-13768).

Samples were collected during mapping in 2019 and 2020 by N. Van Wagoner and J. Thomson-Gladish. Sample preparation was carried out at the British Columbia Geological Survey by L. Ootes and G. Jones where weathered surfaces were removed with a rock saw then crushed and split and unaltered pieces selected. About 100 grams of each crushed and split sample was submitted to Activation Laboratories (Actlabs; Ancaster, Ontario) for whole rock major, trace, and rare earth element analysis. At Actlabs the samples were further crushed to pass a 2 mm screen, mechanically split using a riffle splitter, and pulverized using a mild steel pulverizer to 95% passing 105 µm (code RX1). The resulting pulp was dissolved and lithium metaborate/tetraborate fusion was performed to produce a molten bead, which was rapidly digested in a weak solution of nitric acid. Major elements were determined by inductively coupled plasma optical emission spectroscopy (ICP-OES), and trace element concentrations were measured using inductively coupled plasma mass spectroscopy (ICP-MS; Code 4Lithores). Measurement accuracy was determined using certified standards provided by Actlabs. In addition, blind in-house standards provided by the British Columbia Geological Survey were analyzed with the unknowns (BBB in 2019, and 20N-50 and its blind duplicate 20N-51 in 2020). One blind duplicate was run in 2019, and two were run in 2020. Duplicate samples were run every 10-20 analyses.

To quantify accuracy the percent relative difference between the measured value of the reference standards and the certified value were calculated. Major element accuracy is generally within 5% error, and typically less than 2%. Major elements MnO, K_2O and P_2O_5 have the greatest error (up to 10%) due to their low concentrations in particular standards (< 2 wt%).

The trace element and rare-earth element (REE) accuracy is typically within 10% error with a few exceptions. Generally, where the error exceeds 10% the elements are in low concentrations (<10 ppm). The exception is the analysis of Zr. For the 2019 data, the accuracy of Zr is just over 10% error in DNC-1, and up to 30% RSD in BIR-1a, though accepted values for Zr concentrations in these standards are greater than 10 ppm. Similarly, for the 2020 analyses, Zr concentrations are 18% error in DnC-1 and W-2a, and 28% error in BIR-1a. The REE are almost always within 10% error, and typically within 5%.

To determine precision, the relative standard deviations (%RSD) were calculated using the duplicate reference material. Major element precision based on duplicate measurements was <3% RSD in the 2020 analyses and <7% RSD in the 2019 analyses. Trace element measurements were within 11% RSD in most cases. Where it exceeds 11% the elements are in low concentrations.

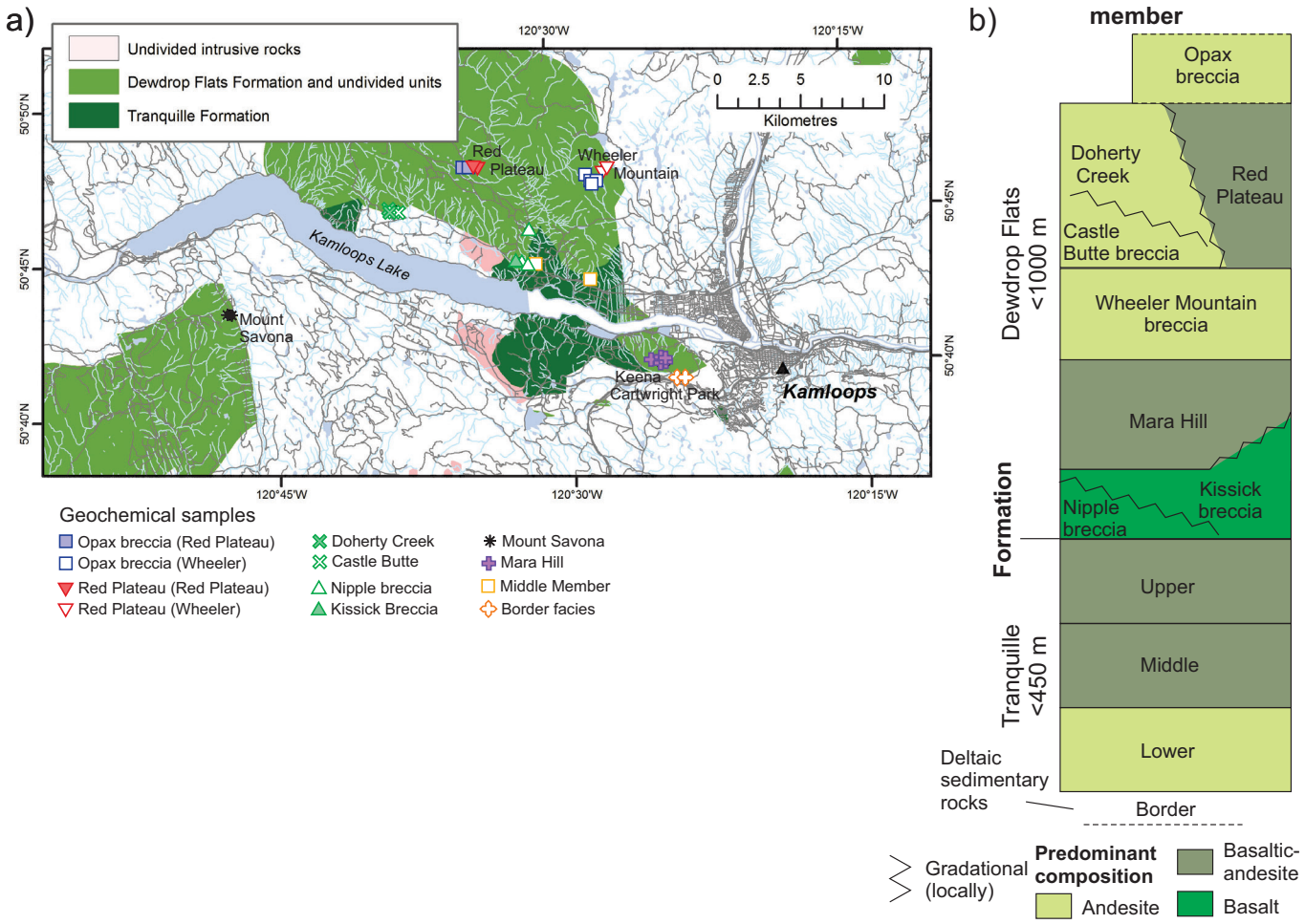

Fig. 1. a) Geological map of volcanic and lesser sedimentary rocks of the Kamloops Group, simplified after Ewing (1982). **b)** Generalized stratigraphy of the Kamloops Group (simplified after Ewing, 1981).

Duplicates run by the laboratory were generally accurate to better than 5% RSD. Greater deviations were found where the certified measurement approaches minimum limit of detection. Data accuracy was determined to be acceptable, with most measurements falling within 5% RSD and greater error only occurring in measurements of very low concentrations.

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