

British Columbia Geological Survey Publications 2023 including peer-reviewed external papers co-authored by BCGS staff

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Papers

Paper 2023-01

Geological Fieldwork 2022. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey Paper 2023-01, 95 p.

Wildgust, N., Cui, Y., Clarke, G., and Hickin, A.S., 2023. British Columbia Geological Survey annual program review 2022-2023. In: Geological Fieldwork 2022, British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey Paper 2023-01, pp. 1-11.

Ootes, L., 2023. Did epithermal mineralization in the northern Toadoggone region develop synchronously with large scale folding? In: Geological Fieldwork 2022, British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey Paper 2023-01, pp. 13-21.

Miller, E.A., van Straaten, B.I., and Hunter, R.C., 2023. Update on bedrock mapping in the Kitsault River area, northwestern British Columbia. In: Geological Fieldwork 2022, British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey Paper 2023-01, pp. 23-32.

van Straaten, B.I., Friedman, R.M., and Camacho, A., 2023. Stratigraphy of the Stuhini Group (Upper Triassic) in the Galore Creek area, northwestern British Columbia. In: Geological Fieldwork 2022, British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey Paper 2023-01, pp. 33-49.

Johnston, R., Kennedy, L., and van Straaten, B.I., 2023. Preliminary observations of a high-strain zone along the western flank of the Galore Creek deposit area, northwestern British Columbia. In: Geological Fieldwork 2022, British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey Paper 2023-01, pp. 51-63.

Schiarizza, P., and Friedman, R.M., 2023. U-Pb zircon dates for rhyolite and sandstone of Cadwallader terrane, lower Chilcotin River area, south-central British Columbia. In: Geological Fieldwork 2022, British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey Paper 2023-01, pp. 65-84.

Rukhlov, A.S., Coats, B., Van der Vlugt, J., Beaupre-Olsen, I.J., and Zaborniak, K., 2023. British Columbia Geological Survey Sample Archive: An emerging resource for public geoscience. In: Geological Fieldwork 2022, British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey Paper 2023-1, pp. 85-90.

Appendix: British Columbia Geological Survey Publications 2022, including peer-reviewed external papers co-authored by BCGS staff, pp. 91-95.

Open Files

OF 2023-01

Clarke, G., Northcote, B., Corcoran, N.L., Heidarian, H., and Hancock, K., 2023. Mines, mine development, selected proposed mines, and selected exploration projects in British Columbia, 2022. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey Open File 2023-01.

OF 2023-02

Hickin, A.S., Orovan, E.A., Brzozowski, M.J., McLaren, K., Shaw, K., and Van der Vlugt, J., 2023. Critical minerals in British Columbia: An atlas of occurrences and producing mines, 2023. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey Open File 2023-02, 102 p.

GeoFiles

GF 2023-01

Clarke, G., Northcote, B., Corcoran, N.L., Heidarian, H., and Hancock, K., 2023. Exploration and mining in British Columbia, 2022. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey GeoFile 2023-01 (poster).

GF 2023-02

Corcoran, N.L., 2023. Exploration and mining highlights, Northwest Region, 2022. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey GeoFile 2023-02 (poster).

GF 2023-03

Heidarian, H., 2023. Exploration and mining highlights, North Central and Northeast regions, 2022. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey GeoFile 2023-03 (poster).

GF 2023-04

Northcote, B., 2023. Exploration and mining highlights, Southwest and South Central regions, 2022. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey GeoFile 2023-04 (poster).

GF 2023-05

Hancock, K., 2023. Exploration and mining highlights, Southeast Region, 2022. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey GeoFile 2023-05 (poster).

GF 2023-06

Mihalynuk, M.G., Ootes, L., Drobe, J.R., Wall, C., and Friedman, R.M., 2023. Lardeau Group mapping update—implications for ultramafic-associated massive sulfide and critical metal exploration in southeast British Columbia. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey GeoFile 2023-06 (poster).

GF 2023-07

Elia, E.A., Ferbey, T., Ward, B.C., Shives, R.B.K., Best, M., and Martin-Burtart, N., 2023. Remotely piloted aircraft system (RPAS) for investigating surface sediments in the Interior Plateau of British Columbia: Methods, data, and products. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey GeoFile 2023-07, 22 p.

GF 2023-08

van Straaten, B.I., Logan, J.M., Nelson, J.L., Moynihan, D.P., Diakow, L.J., Gibson, R., Bichlmaier, S.J., Wearmouth, C.D., Friedman, R.M., Golding, M.L., Miller, E.A., and Poulton, T.P., 2023. Bedrock geology of the Dease Lake area: Supporting GIS, structural, magnetic susceptibility, and other digital data. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey GeoFile 2023-08, 5 p.

Information Circulars

IC 2023-01

Clarke, G., Northcote, B., Corcoran, N.L., Heidarian, H., and Hancock, K., 2023. Provincial Overview of Exploration and Mining in British Columbia, 2022. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey, Information Circular 2023-01, 142 p.

Clarke, G., Northcote, B., Corcoran, N.L., Heidarian, H., and Hancock, K., 2023. Exploration and Mining in British Columbia, 2022: A summary. In: Provincial Overview of Exploration and Mining in British Columbia, 2022. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey, Information Circular 2023-01, pp. 1-48.

Corcoran, N.L., 2023. Exploration and mining in the Northwest Region, British Columbia. In: Provincial Overview of Exploration and Mining in British Columbia, 2022. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey, Information Circular 2023-01, pp. 49-76.

Heidarian, H., 2023. Exploration and mining in the North Central and Northeast regions, British Columbia. In: Provincial Overview of Exploration and Mining in British Columbia, 2022. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey, Information Circular 2023-01, pp. 77-92.

Northcote, B., 2023. Exploration and mining in the South Central Region, British Columbia. In: Provincial Overview of Exploration and Mining in British Columbia, 2022. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey, Information Circular 2023-01, pp. 93-113.

Hancock, K., 2023. Exploration and mining in the Southeast Region, British Columbia. In: Provincial Overview of Exploration and Mining in British Columbia, 2022. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey, Information Circular 2023-01, pp. 115-128.

Northcote, B., 2023. Exploration and mining in the Southwest Region, British Columbia. In: Provincial Overview of Exploration and Mining in British Columbia, 2022. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey, Information Circular 2023-01, pp. 129-142.

IC 2023-02

British Columbia Geological Survey, 2023. British Columbia Geological Survey. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey Information Circular 2023-02, 14 p. (brochure)

IC 2023-03

British Columbia Geological Survey, 2023. Mineral Development Office. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey Information Circular 2023-03, 4 p. (brochure)

IC 2023-04

British Columbia Geological Survey, 2023. Online databases at the British Columbia Geological Survey. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey Information Circular 2023-04, 14 p. (brochure)

IC 2023-05

British Columbia Geological Survey, 2023. The Golden Triangle of northwestern British Columbia. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey Information Circular 2023-05, 6 p. (brochure)

IC 2023-07

British Columbia Geological Survey, 2023. Mineral potential modelling at the British Columbia Geological Survey: The next generation. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey Information Circular 2023-07, 7 p. (brochure)

External peer-reviewed journal and volume publications

Bai, S., Lei, R., Brzozowski, M.J., Hao, L., Zhang, K., and Wu, C., 2023. Constraints on the timing of magmatism and rare-metal mineralization in the Fangzheng Rb deposit, Altay, NW China: Implications for the spatiotemporal controls on rare-metal mineralization. *Ore Geology Reviews*, 157, article 105427.

<<https://doi.org/10.1016/j.oregeorev.2023.105427>>

Bain, W., Hollings, P., Djon, L.M., Brzozowski, M.J., Layton-Matthew, D., and Dobosz, A., 2023. The geology, geochemistry, and magmatic evolution of the Legris Lake mafic-ultramafic complex, Ontario, Canada. *Mineralium Deposita*.

<<https://doi.org/10.1007/s00126-023-01183-x>>

Brzozowski, M.J., Hollings, P., Heggie, G., MacTavish, A., Wilton, D., and Evans-Lamswood, D., 2023. Characterizing the supra- and subsolidus processes that generated the Current PGE-Cu-Ni deposit, Thunder Bay North Intrusive Complex, Canada: insights from trace elements and multiple S isotopes of sulfides. *Mineralium Deposita*.

<<https://doi.org/10.1007/s00126-023-01193-9>>

- Brzozowski, M.J., Hollings, P., Zhu, J., and Creaser, R.A., 2023. Osmium isotopes record a complex magmatic history during the early stages of formation of the North American Midcontinent Rift-Implications for rift initiation and platinum-group element mineralization. *Lithos*, 436-437, article 106966.
<<https://doi.org/10.1016/j.lithos.2022.106966>>
- Chen, J., Shao, Y., Xiong, Y., He, H., Brzozowski, M.J., Wen, C., Zhou, L., Lu, W., and Shi, J., 2023. Mechanisms of ore formation in Silurian (Caledonian) scheelite deposits of the Nanling Range, South China: a case study from the Pingtan W deposit. *Ore Geology Reviews*, 154, article 105347.
<<https://doi.org/10.1016/j.oregeorev.2023.105347>>
- Di, H., Shao, Y., Jiang, S., Brzozowski, M.J., Wang, Z., and Xiong, Y., 2023. Identifying superimposed W-Sn mineralization events using cassiterite microtextures, trace-element chemistry, and geochronology. *Ore Geology Reviews*, 153, article 105281.
<<https://doi.org/10.1016/j.oregeorev.2022.105281>>
- Hao, Y., Feng, Y., Liang, T., Brzozowski, M.J., Ju, M., Zhou, R., and Wang, Y., 2023. Quantitative evaluation of metamictisation of columbite-(Mn) from rare-element pegmatites using Raman spectroscopy. *Mineralogical Magazine*.
<<https://doi.org/10.1180/mgm.2023.18>>
- Hu, J., Zhang, Y., Jia, D., Muxworthy, A., Selby, D., Li, Y., Brzozowski, M.J., Wei, G., Cao, J., Yin, H., and Li, W., 2023. Combining paleomagnetic and Re-Os isotope data to date hydrocarbon generation and accumulation processes. *Journal of Geophysical Research: Solid Earth*, 128, article e2022JB025955.
<<https://doi.org/10.1029/2022JB025955>>
- Jones, G., Ootes, L., Luo, Y.A., Vezinet, A., Stern, R., Milidragovic, D., and Pearson, D.G., 2023. The relative roles of ancient and juvenile crust in building accretionary orogens-Minimal ancient crust involved in the magmatic evolution of a North American Cordillera accreted terrane indicated by igneous zircon Hf-O. *Lithos*, article 107213.
<<https://doi.org/10.1016/j.lithos.2023.107213>>
- Jun, M., Zhao, S., Brzozowski, M.J., Li, H., Wu, C., and Li, W., 2023. Geology, geochemistry and genesis of the world-class Shizhushan wollastonite deposit, Mengshan area, South China. *Ore Geology Reviews*, 158, article 105469.
<<https://doi.org/10.1016/j.oregeorev.2023.105469>>
- Liu, J., Yang, J., Cao, Y., Ding, T., Brzozowski, M.J., Zhang, H., Zheng, X., and Zhao, T., 2023. Indium mineralization and genesis of the Bainiuchang Ag-Sn polymetallic deposit in southeast Yunnan, China: Evidence from mineral chemistry and U-Pb geochronology. *Ore Geology Reviews*, 158, article 105531.
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- Liu, Y., Zhao, Y., Xue, C., Wang, R., Chu, H., Zhao, X., Brzozowski, M.J., Seltmann, R., Chen, J., and Gao, J., 2023. Multiple stages of Au mobilization and in the Changshagou Au deposit, Eastern Tianshan, NW China: insights from mineral chemistry and fluid inclusions. *Journal of Asian Earth Sciences*, 255, article 105756.
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- Milidragovic, D., Nott, J.A., Spence, D.W., Schumann, D., Scoates, J.S., Nixon, G.T., and Stern, R.A., 2023. Sulfate recycling at subduction zones indicated by sulfur isotope systematics of Mesozoic ultramafic island arc cumulates in the North American Cordillera. *Earth and Planetary Science Letters*, 620, article 118337.
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- Milidragovic, D., Ootes, L., Zagorevski, A., Cleven, N., Wall, C.J., and Luo, Y., 2023. Detrital geochronology of the Cunningham Lake formation: an overlap succession linking Cache Creek terrane to Stikinia at ~205 Ma. *Canadian Journal of Earth Sciences*, 60.
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- Muhtar, M., Xiao, W., Brzozowski, M.J., Chen, S., Aibai, A., Wang, M., and Wu, C., 2023. Genetic link between orogenic Au and porphyry Cu (-Au) mineralization in the Dananhu Arc, NW China: Evidence from geochronology, geochemistry, and Sr-Nd-Hf isotopes of the Tudunbei Au deposit. *Journal of Geochemical Exploration*, 253, article 107280.
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Norris, J.R., Tosdal, R.M., Lipske, J., and Wilson, A.J., 2023. Late-stage low-temperature hydrothermal alteration overprint at the East zone in the Red Chris porphyry Cu-Au deposit, northwestern British Columbia, Canada. *Economic Geology*, 118, 391-409.

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Rasmussen, K.L., Falck, H., Elongo, V., Reimink, J., Yan Luo, Y.D., Pearson, D.G., Ootes, L., Creaser, R.A., and Pilar Lecumberri-Sanchez, P., 2023. The source of tungsten-associated magmas in the northern Canadian Cordillera and implications for the basement. *Geology*, 51, 657-662.

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Sun, X., Li, X., Lei, R., Brzozowski, M.J., Ma, H., Li, W., Xia, M., Yu, Y., and Wu, C., 2023. Paleoproterozoic crustal evolution of the Tarim Craton, NW China: Constraints from geochronology and geochemistry of orthogneisses and granitic veins in the Xingdi region of the Quruqtagh Block. *Precambrian Research*, 399, article 107247.

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Wang, Y., Lai, J., Cao, Y., and Brzozowski, M.J., 2023. Compositional variations of magnetite in different sulfide ore types in the Jinchuan Ni-Cu-PGE sulfide deposit, NW China: insights into the mineralizing processes of conduit-type systems. *Chemical Geology*, 637, article 121679.

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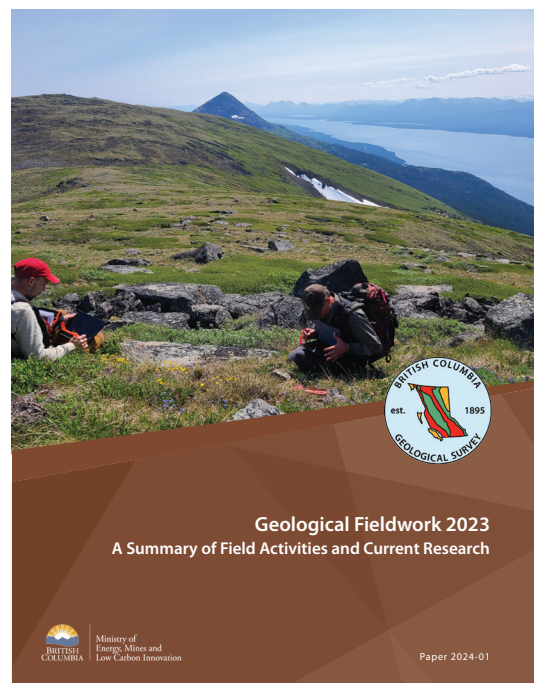
Wu, S., Lei, R., Brzozowski, M.J., Wang, W., Yuan, H., and Wu, C., 2023. Early Neoproterozoic magmatism in the Central Tianshan Block, China: Implications for its tectono-magmatic evolution and relationship to Rodinia. *Precambrian Research*, 397, article 107203.

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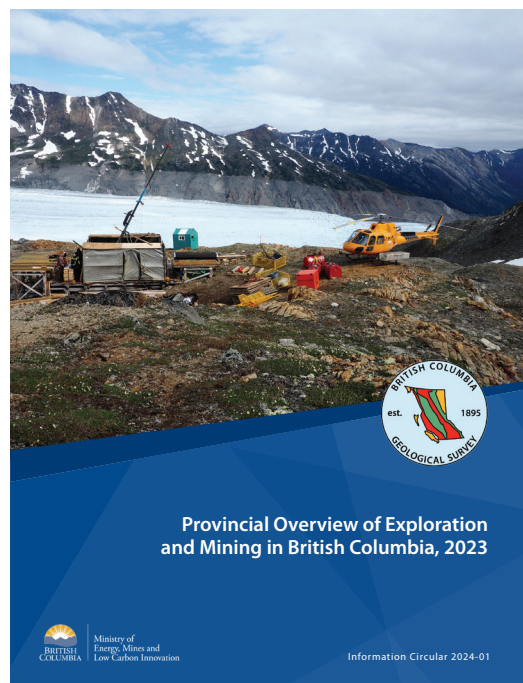
Ye, H., Wu, C., Brzozowski, M.J., Yang, T., Sun, X., Lei, R., and Li, W., 2023. Genesis of the Longwanggou iron deposit in the Yudongzi complex, South China: Implications for the redox state of seawater at the onset of the Great Oxidation Event. *Ore Geology Reviews*, 159, article 105562.

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Each year, the British Columbia Geological Survey publishes *Geological Fieldwork*, a Summary of Fieldwork and Current Research (this volume), and the *Provincial Overview of Mining and Exploration in British Columbia*. All British Columbia Geological Survey publications can be downloaded, at no cost, from www.BCGeologicalSurvey.ca



Geological Fieldwork volume, British Columbia Geological Survey Paper 2024-01



Provincial Overview of Mining and Exploration in British Columbia volume, Information Circular 2024-01