

FIG.26. PART OF A.M. GROUP, SKAGIT RIVER



$^{40}\text{Ar}/^{39}\text{Ar}$ geochronologic data from samples collected at Giant Copper

Janet E. Gabites and Mitchell G. Mihalynuk

**Ministry of Mining and Critical Minerals
Mines Competitiveness and Authorizations Division
British Columbia Geological Survey**

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Front and Back Covers:

Map of the geological setting and underground workings at the A.M. group (Canam Mining Corporation, Ltd.), the claims that covered the AM mineralized chalcopyrite-tourmaline breccia at Giant Copper, as known in 1949. The AM breccia is the source of the mineralized samples analyzed by $^{40}\text{Ar}/^{39}\text{Ar}$ techniques and reported on here. Map by W.H. White. In: Annual Report of the British Columbia Minister of Mines for the Year 1949, pp. A210-A213.

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GeoFile 2026-06

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Janet E. Gabites^{1,*}, and Mitchell G. Mihalynuk^{2,a}

¹ Pacific Centre for Isotopic and Geochemical Research, Department of Earth, Ocean and Atmospheric Sciences, The University of British Columbia, Vancouver, BC, V6T 1Z4

² British Columbia Geological Survey, Ministry of Mining and Critical Minerals, Victoria, BC, V8W 9N3

* retired

^a corresponding author: Mitch.Mihalynuk@gov.bc.ca

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Abstract

Digital data presented in this GeoFile supplement the report by Mihalynuk et al. (2026) wherein $^{40}\text{Ar}/^{39}\text{Ar}$ thermochronological results are interpreted as dating mineralization at the Giant Copper polymetallic tourmaline breccia deposit. These data corroborate a recent metallogenic study of Giant Copper in southwestern British Columbia where the inferred mineralizing intrusions of the Invermay magmatic suite were dated by U-Pb methods (24.9 ± 0.2 Ma, Late Oligocene; Fischer, 2022). The corroborating data here are based on step heating $^{40}\text{Ar}/^{39}\text{Ar}$ (biotite) release spectra from both the Invermay intrusive suite and the mineralization. Well-behaved spectra from the intrusion and two from mineralization yield 24.22 ± 0.15 Ma, 24.87 ± 0.33 Ma, and 24.08 ± 0.19 Ma (Oligocene).

Keywords: Giant Copper, porphyry copper, copper-silver-gold tourmaline breccia, $^{40}\text{Ar}/^{39}\text{Ar}$ geochronology, Oligocene, thermochronology, Invermay magmatic suite, Ancestral Cascades porphyry belt, Hozomeen terrane, Bridge River terrane, Methow basin, Ladner Group, Dewdney Creek Formation

1. Introduction

The Introduction and Methods sections herein are reproduced from Mihalynuk and Gabites (2026) to provide context for the included datasets ([BCGS_GF2026.zip](#)). Please see that report for a discussion of results from each sample and their broader implications.

Giant Copper is a tourmaline-magnetite breccia-hosted deposit in southwest British Columbia, 37 km southeast of Hope and 20 km north of the US border (Fig. 1). It has an indicated resource of 45.37 million tonnes grading 0.47% copper, 11.19 g/t silver, and 0.38 g/t gold (Imperial Metals Corporation, Information Circular 1999-1, in MINFILE). Sphalerite is commonly found within the breccia pipes, and some zones contain molybdenite (\pm associated uraninite) and galena; although, the resource calculation does not consider molybdenum, uranium, zinc, or lead contents. At the time of our sampling, the mineral tenures were surrounded by parkland (Skagit River Park to the west and Manning Park on all other sides); however, the claims have since been surrendered to the Province of British Columbia (Imperial Metals News Release, January 19, 2022, in MINFILE 092HSW002).

Mineralization at Giant Copper is concentrated in a cluster of seven breccia bodies (Fig. 2). The first was discovered in 1930, the AM breccia (MINFILE 092HSW001), followed by the Invermay breccia in 1933 (MINFILE 092HSW002). Mineral production has only been recorded from one of the breccias, the Invermay body, which generated 94 metric

tonnes of ore between 1936 and 1947, from which 10.6 tonnes of zinc, 9.65 tonnes of lead, 313 kg of silver, and 0.7 kg of gold were recovered (copper production is not recorded, MINFILE 092HSW002). Since 1947, mineral exploration at Giant Copper has been intermittent (Robertson, 2006), with the last major effort including drilling and production of a digital map, conducted in 1996 by Imperial Minerals Corp., followed by geochemical surveys in 2015 (Miller-Tait, 2016).

Recent metallogenic study of the Giant Copper tourmaline breccia pipes (Fischer, 2022; Fischer et al., 2023, 2024) focused primarily on the AM body which is analogous to other porphyry-related pipes globally, such as those famously found at the world's third largest porphyry copper deposit, Rio Blanco-Los Bronces, in Chile (Frikken et al., 2005). Laser ablation ICP-MS dating of the Invermay intrusive suite at Giant Copper produced a weighted mean U-Pb age of 24.9 ± 0.2 Ma (from 99 zircon grains). Such a young age was not fully expected because some prior works inferred a Cretaceous age (e.g., Robertson, 2006). Based on the assumption that the intrusive suite dated was the source of mineralization, this Oligocene date was taken to be the maximum limit on mineralized breccia pipe formation (Fischer, 2022; Oligocene is 33.9 to 23.04 Ma, Cohen et al., 2025). The $^{40}\text{Ar}/^{39}\text{Ar}$ (biotite) release spectra from both the Invermay intrusive suite and the mineralization presented here corroborate geochronological results and their interpretation in Fischer (2022) and Fischer et al. (2023, 2024).

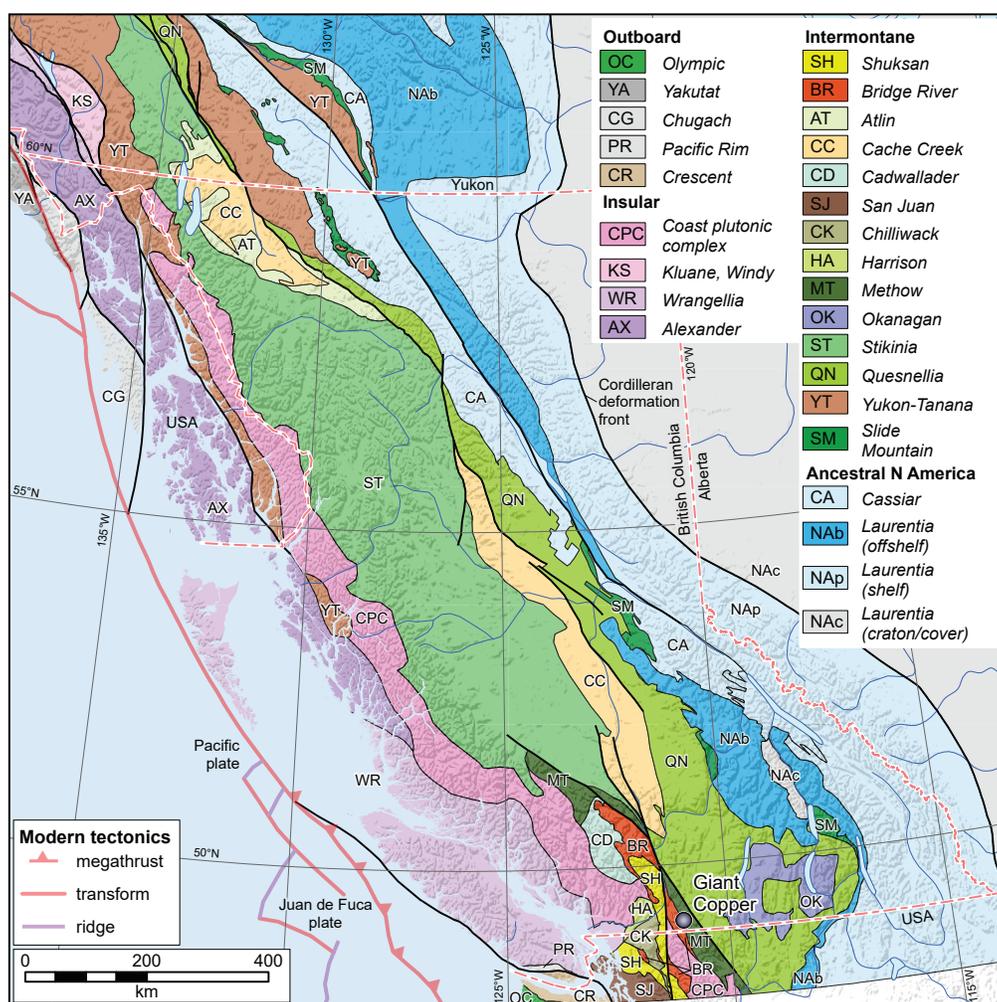


Fig. 1. Location of study area. Terranes after Wheeler et al. (1991), Colpron (2020), and Zagorevski et al. (2021).

2. $^{40}\text{Ar}/^{39}\text{Ar}$ analytical methods

Clean and fresh samples for $^{40}\text{Ar}/^{39}\text{Ar}$ analysis were crushed and sieved to 0.2–0.4 mm size fraction. Mineral separates were hand-picked, washed in acetone, dried, wrapped in aluminum foil and stacked in an irradiation capsule with similar-aged samples and neutron flux monitors (Fish Canyon Tuff sanidine (FCs), 28.02 Ma (Renne et al., 1998)).

The samples were irradiated in March 2007 at the McMaster Nuclear Reactor in Hamilton, Ontario, for 90 MWH, with a neutron flux of approximately 3×10^{16} neutrons/cm². Analyses (n=60) of 20 neutron flux monitor positions produced errors of <0.5% in the J value.

The samples were analyzed at the Noble Gas Laboratory, Pacific Centre for Isotopic and Geochemical Research, The University of British Columbia, Vancouver, BC, Canada. The mineral separates were step-heated at incrementally higher powers in the defocused beam of a 10W CO₂ laser (New Wave Research MIR10) until fused. The gas evolved from each step was analyzed by a VG5400 mass spectrometer equipped with an ion-counting electron multiplier. All measurements were corrected for total system blank, mass spectrometer sensitivity, mass discrimination, radioactive decay during

and subsequent to irradiation, as well as interfering Ar from atmospheric contamination and the irradiation of Ca, Cl and K (Isotope production ratios: $(^{40}\text{Ar}/^{39}\text{Ar})\text{K} = 0.0302 \pm 0.00006$, $(^{37}\text{Ar}/^{39}\text{Ar})\text{Ca} = 1416.4 \pm 0.5$, $(^{36}\text{Ar}/^{39}\text{Ar})\text{Ca} = 0.3952 \pm 0.0004$, $\text{Ca}/\text{K} = 1.83 \pm 0.01$ ($^{37}\text{ArCa}/^{39}\text{ArK}$)).

Ages of heating steps were calculated using ArArCalc (Koppers, 2002). Release spectrum plateaus and correlation ages were calculated using Isoplot v. 3.00 (Ludwig, 2003). Errors are quoted at the 2σ (95% confidence) level and are propagated from all sources except mass spectrometer sensitivity and age of the flux monitor. The most justifiable plateau and plateau age were picked based on the following criteria: three or more contiguous steps comprising more than 50% of the ^{39}Ar ; the probability of fit of the weighted mean age greater than 5%; the slope of the error-weighted line through the plateau ages equals zero at 5% confidence; the ages of the two outermost steps on a plateau are not significantly different from the weighted-mean plateau age (at 1.8σ , six or more steps only); and the outermost two steps on either side of a plateau must not have non-zero slopes with the same sign (at 1.8σ , nine or more steps only).

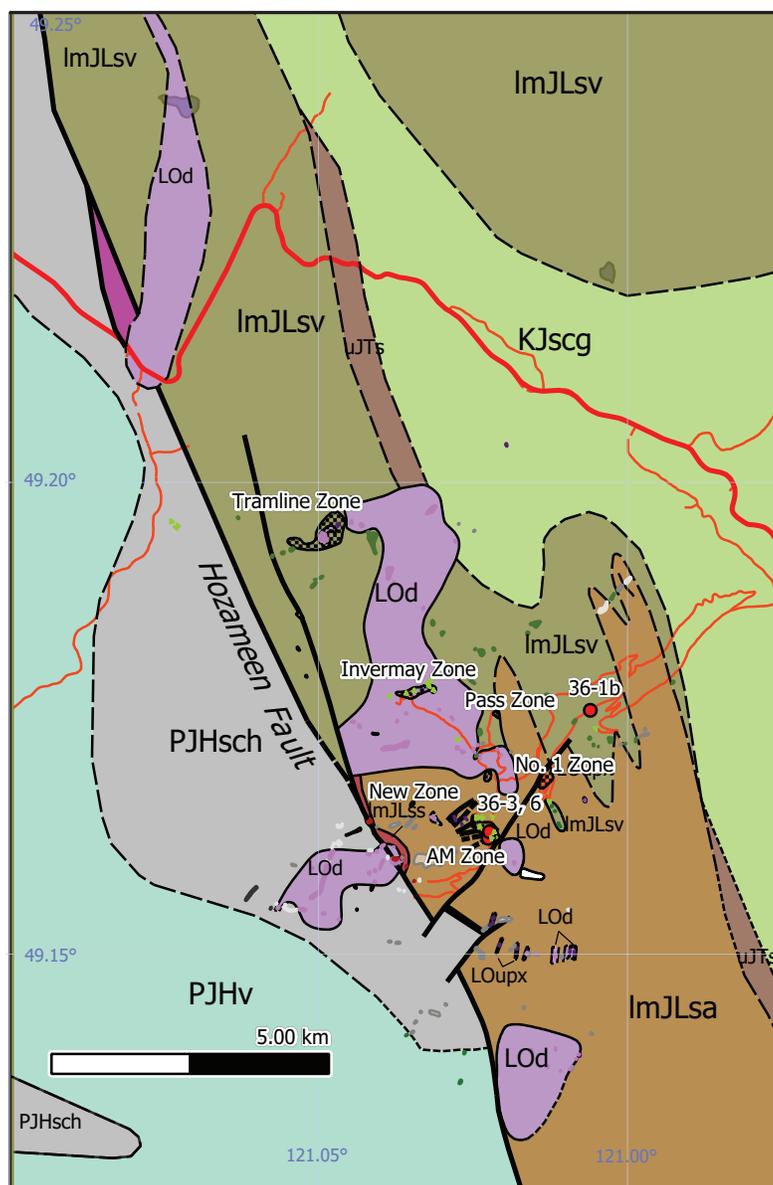
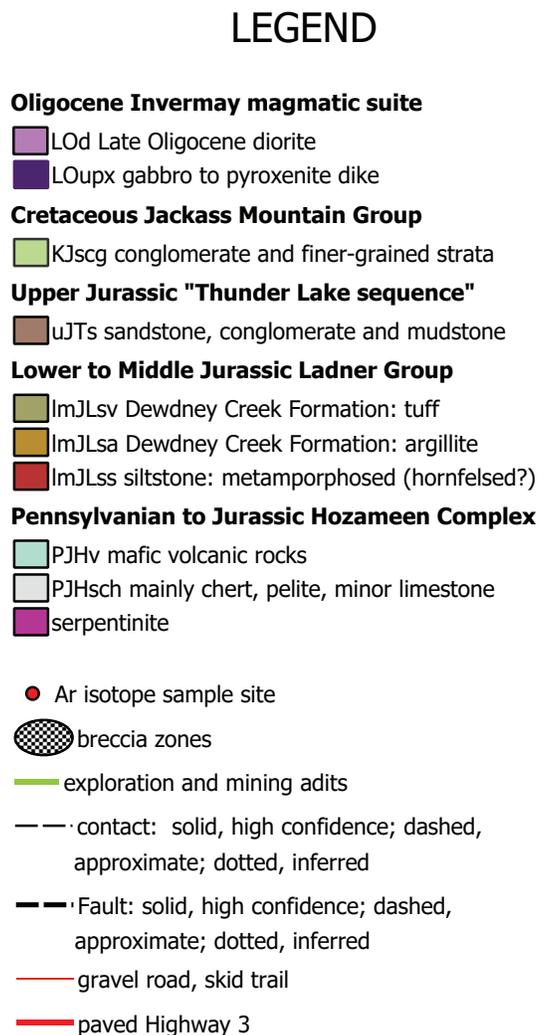


Fig. 2. Geologic setting of breccia zones at Giant Copper principally based on the distribution of rock units exposed in outcrops shown on property maps (and shown here) by Imperial Metals Corporation (e.g., Miller-Tait, 2016). Correlation with regional geological units is constrained by regional mapping by Cairnes (1924, 1944), Monger et al. (1989), and local property-scale observations (e.g., see industry reports accessible from MINFILE 092HSW001, 092HSW002).

3. Conclusion

The ⁴⁰Ar/³⁹Ar (biotite) release spectra from both the Invermay intrusive suite (24.22 ±0.15 Ma) and from mineralization (24.87 ±0.33 Ma, and 24.08 ±0.19 Ma; Late Oligocene) that are presented in this GeoFile corroborate U-Pb geochronological results (24.9 ±0.2 Ma; Fischer, 2022) from the intrusive suite that is responsible for mineralization at Giant Copper (Fischer, 2022; Fischer et al., 2023, 2024).

Acknowledgment

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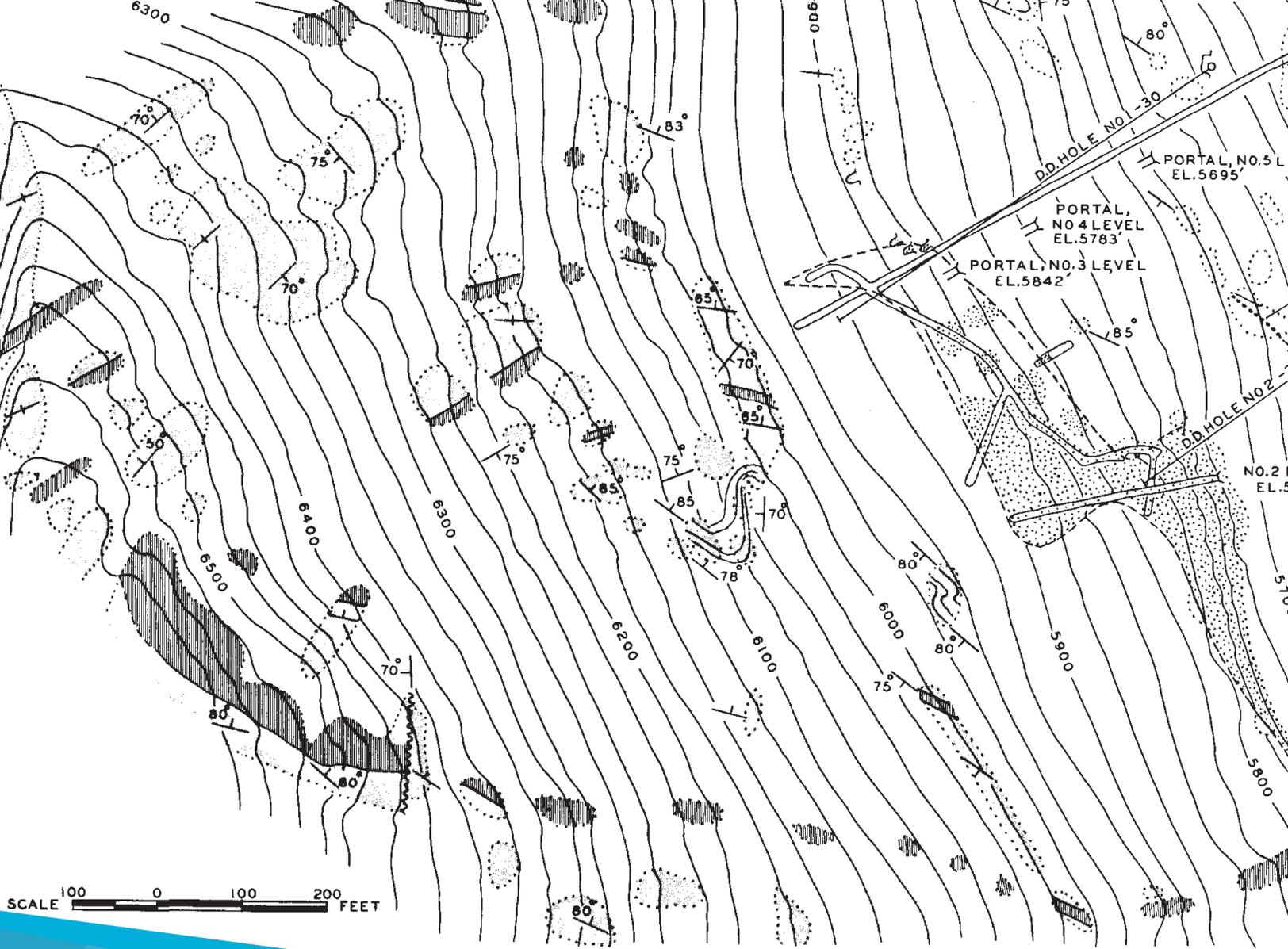


FIG. 26. PART OF A.M. GROUP, SKAGIT RIVER



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