

⁴⁰Ar/³⁹Ar dating constraints on gold-quartz breccia mineralization of the south Gordon Lake region, N.W.T.

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A structural, lithologic and metamorphic model is proposed for the localization of stratabound auriferous quartz breccia zones in the hinge region of a vertically-plunging regional fold; known locally as the 'Gordon Lake re-fold'. The breccias are hosted in black, carbon rich siltstone metaturbidites of the Burwash Formation; part of the Archean Yellowknife Supergroup. Brecciation probably commenced during (and continued after) peak metamorphism, and was accompanied by asymmetrical tightening and migration of the re-fold hinge. This tightening induced a predominately dextral bedding-parallel slip that: (1) developed a distinctive crenulation cleavage, and (2) focused mineralizing fluids into the re-fold centre. ⁴⁰Ar/³⁹Ar dating of five mineral separates (three biotites, a muscovite and a hornblende) was done to provide preliminary temporal and thermal constraints on breccia formation and metamorphism (Table 1).

The hornblende spectra display a steep age gradient. However, the age obtained from the last heating step is in reasonable agreement with U-Pb dates for the formation of the nearby

Yellowknife Volcanic Belt. All the micas exhibit relatively undisturbed spectras and produce well defined plateau ages. Geological interpretation of these data must take into consideration: (1) the variation in sample grain size and quality, (2) the wide range of biotite ages compared to their close spacing (<1 km), and (3) possible differences in mica mineralogy and chemistry.

A favoured interpretation is that the Gordon Lake region reached a peak metamorphism at approximately 2600 Ma. Later, around 2550 Ma, localized areas within the cooling (but still above the closure temperature of biotite) meta-sedimentary pile, were overprinted by thermal highs. These thermal highs were caused by the intrusion of late granites (i.e., Spud Lake Pluton), and structurally focused hydrothermal systems (such as the Gordon Lake quartz-breccia zones). The whole region then slowly cooled below the closure temperature of biotite (ca. 300-350°C) by around 2500 Ma.

Table 1

Sample	Mineral	Location/Type	Interpreted age (Ma)
TS212/6/4	hornblende	Cameron River Volcanics	2620 ± 48
TS83-04	biotite (C)	Kidney Pond breccia zone	2555 ± 8
TS22/6/8	muscovite (C)	Spud Lake Pluton	2554 ± 11
TS86-94	biotite (F*)	Regional metamorphic	2504 ± 4
TS86-84	biotite (F*)	Crenulated metamorphic	2402 ± 4

(C - coarse 500-1500 µm; F - fine 180-250 µm; * - <5% impurities)