$^{40}Ar/^{39}Ar$ dating of ribbon-textured veins and wall-rock material from Meguma lode gold deposits, Nova Scotia: implications for timing and duration of vein formation in slate-belt hosted vein gold deposits[1]

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Results of fifteen $^{40}Ar/^{39}Ar$ age spectra for whole-rock argillite samples collected from within and adjacent to veins from eight Meguma gold districts in the Meguma Terrane of southern Nova Scotia are presented. The samples give excellent plateau ages (i.e. concordance of plateaux, correlation and integrated ages) that range from ca. 379 to ca. 403 Ma and there is no apparent correlation of age with bulk rock composition (K_2O, Al_2O_3) or sampling localities. In addition, apparent ages for samples from a district are similar within analytical error, except for one deposit, and there is no difference for samples from within ribbon-textured veins versus samples collected outside of the gold districts (i.e. in areas free of quartz veining). The results of this work compare well to previous whole rock $^{40}Ar/^{39}Ar$ dating of Meguma Group samples and we concur with previous workers that the range in dates (i.e. 380 to 410 Ma) reflects diachronous cooling of the area through the intracrystalline retention temperature for argon in mica (i.e. ca. 300-350°C). However, with respect to the vein samples, there is a marked difference between the $^{40}Ar/^{39}Ar$ ages of vein-hosted whole-rock samples and hydrothermal minerals (amphibole, muscovite, biotite) from the same deposits previously dated, which indicates that whole-rock samples have retained their metamorphic ages and have not been reset by the later hydrothermal event responsible for vein formation, despite being incorporated within the high-temperature fluids (ca. 400-450°C). This discrepancy in ages indicates that the wall rocks and veins were in thermal disequilibrium, as the vein temperatures were well above that required to cause diffusion of argon out off mica phases within the whole-rock samples, and implies therefore that the fluids must have been derived from depth. The results have the following important implications for models of vein formation: (1) vein formation was rapid and is consistent with models of hydrofracturing due to fluid overpressure, and (2) the vein-forming fluids were derived from depth and cannot have been produced by a lateral secretion processes whereby fluids and gold are derived from the Meguma Group.

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