

In situ biotite Rb-Sr ages in granulitic polymetamorphic rocks: role of inter- and intragranular diffusion on preservation of metamorphic ages

CHRIS RM MCFARLANE

University of New Brunswick

Presenting Author: crmm@unb.ca

This study examines in situ Rb-Sr biotite ages in the contact aureole of 1322 Ma Mahkavinekh Lake Pluton, northern Labrador. This aureole records the systematic replacement of 1845 Ma garnet by diffusion-controlled symplectites dominated by orthopyroxene and cordierite. Relict 1845 Ma biotite inclusions in garnet are also progressively liberated and at <1000m from the intrusion they completely decompose to neoformed biotite. This well-documented hot 'dry' diffusion-controlled setting provides an opportunity to test how Rb-Sr ages are preserved in biotite from different textural settings. Biotite inclusions in garnet are common in the outer aureole (>4 km from contact). These biotite inclusion suites produce a wide range of ages and Rb/Sr. Younger ages are associated with biotite domains with higher Rb/Sr resulting from Sr diffusion from the biotite. Assuming a fixed initial Sr value (0.725) generates Rb-Sr ages that are strongly correlated with textural setting. However, the distribution of these ages fails to record the known ages of contact metamorphism or regional metamorphism. Regression of 'young' Rb-Sr ages points to initial Sr values between 1.0 and 1.9 that could only be achieved if biotite was recrystallized during contact metamorphism and inherited the local Sr signature accumulated between 1845 Ma and 1322 Ma. Intragranular redistribution of Sr in armoured biotite inclusions may also skew ages to older values. In the inner aureole (< 1 km from contact) relict 1845 Ma textures are obliterated. Biotite occurs only as neoformed grains in textural equilibrium with corona minerals. Free regression of the Rb-Sr data yields ages that overlap with the timing of contact metamorphism but with initial Sr >1.0. This suggests that neoformed biotite incorporated the local initial Sr value inherited from the precursor generation of biotite. Assuming neoformed biotite grew at 1322 Ma data a range of initial Sr between 1.0 and 2.0 is required. This is in good agreement with the $^{87}\text{Sr}/^{86}\text{Sr}$ composition of 1845 Ma biotite grains calculated back to 1322 Ma. This study illustrates the highly localized nature of Rb-Sr systematics in hot dry rocks and emphasizes the need to maintain textural control on each analysis in these diffusion-controlled settings.