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ASSESSMENT OF THE TI-IN-ZIRCON THERMOMETER BY DOCUMENTING PROGRADE AND RETROGRADE ZIRCON GROWTH IN HIGH-PRESSURE MIGMATITIC PELITIC SCHIST OF THE CANADIAN CORDILLERA

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U-Pb ages and trace elements acquired simultaneously on zircon grains from a garnet–kyanite–biotite migmatitic pelitic-schist, collected in the southeastern Canadian Cordillera, were linked with results of phase equilibria modeling. Three phases of zircon growth were documented. The first occurred between 77 and 72 Ma during muscovite dehydration melting in the kyanite field at temperatures >725 °C on its prograde path. It produced zircon with a shallow positive slope in high rare-earth elements (HREE) The second occurred at c. 69 Ma as the rock crossed the biotite dehydration melting reaction that formed garnet and rutile at temperatures of 780–875 °C. It produced zircon depleted in HREE. The third took place at c. 63 Ma as the rock crossed back across the latter reaction on the retrograde path and thus consumed garnet and rutile at temperatures >780 °C. It produced zircon similar to the first generation, but also enriched in Nb and Ta released during rutile breakdown. This latter phase occurred prior to feldspar crystallization in the melt, as suggested by the moderate Eu anomaly in the zircon. In contrast with the high temperature of zircon growth documented above, Ti-in-zircon thermometry yields unrealistically low estimates (470–739 °C) with 80% below the wet solidus; there are no uncertainties in the buffering assemblage, as rutile and quartz were present throughout, and no effect of pressure because a pressure-dependent calibration was used. This study, therefore, demonstrate that zircon growth along a prograde path is possible and, moreover, highlights the need to use caution when interpreting results of zircon thermometry in metamorphic rocks.