Chronology of magmatic and hydrothermal processes related to plagiogranite formation in the Oman Ophiolite: Insights from high-resolution $^{40}Ar/^{39}Ar$ geochronology and trace element geochemistry

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The origin of ophiolitic plagiogranites can be attributed to different magmatic and hydrothermal processes. To address the chronology of these processes in the Oman ophiolite, we investigated plagiogranites, granites, quartz diorites and gabbros from the crustal and mantle sections in Wadi Haymiliah and Somrah. $^{40}Ar/^{39}Ar$ ages were determined on amphiboles, micas and K-feldspars. Amphibole ages from the crust range from 103.6±1.0 to 93.6±0.7 Ma. The higher ages suggest that at least some parts of the crust were generated prior to the time span regarded as major formation period of the ophiolite (96.5 to 94.5 Ma) [e.g., 1]. In general, the amphibole ages display a "normal" top-to-bottom cooling within the crust. In contrast, the mica ages (97.6±0.7 to 95.4±0.7 Ma) from mantle-hosted granites imply a rapid and decoupled bottom-to-top cooling at the base of the ophiolite, which is best explained by intra-oceanic thrusting. The youngest ages (89.9±1.5 to 72.1±1.8 Ma) from mantle-hosted granitic K-feldspars indicate subsequent cooling at a much slower rate, likely due to the limited heat capacity of the overridden plate. Whole rock trace element data in combination with the new ages indicate plagiogranite formation and cooling at different times, and reflect processes in response to a transition from spreading to intra-oceanic thrusting. The sheeted dyke hosted-plagiogranite from Wadi Haymiliah formed due to fluid-induced partial melting of gabbroic crust [2, 3], and emplaced the ophiolite close to an active ridge likely at >98 Ma. In contrast, gabbro unit-hosted Somrah plagiogranites and Wadi Haymiliah quartz diorite as well as mantle-hosted Wadi Haymiliah granites were formed from melts that originated from a fluid- and sediment-contaminated mantle by fluid-induced partial remelting during intra-oceanic thrusting, at about 97 to 93 Ma.

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