In-situ U-Th-Pb dating of metamorphic garnet, staurolite and accessory phases – A case study from the Straits Schist, Connecticut

L.J. MILLONIG[1*], R. ALBERT ROPER[1], A. GERDES[1], D. AVIGAD[2], J.J. AGUE[3]

[1]Dept. of Geosciences, Goethe University Frankfurt, Germany, (*correspondence: l.millonig@em.uni-frankfurt.de)

[2]Institute of Earth Sciences, Hebrew University of Jerusalem, Israel

[3]Dept. of Geology & Geophysics, Yale University, New Haven, USA

The P-T-*t* evolution of metamorphic rocks is commonly inferred by tying P-T data obtained from major phases to U-Pb geochronological data obtained from accessory phases. This metamorphic evolution would be more completely described if geochronological data obtained by in-situ techniques from major phases including garnet and staurolite could also be considered. Unlike monazite and zircon, however, metamorphic garnet and staurolite generally have very low U contents (<0.3 ppm) and contain abundant inclusions, which renders the extraction of meaningful U-Pb ages difficult.

In this study we apply LA-ICP-MS U-Th-Pb dating of monazite, xenotime, zircon, garnet, and staurolite to samples from the Straits Schist, SW Connecticut, a Silurian-Devonian sediment that experienced amphibolite facies metamorphism at ~400-380 Ma [1, 2].

Our approach includes determining the trace element composition of pure garnet and staurolite, characterization and dating of accessory phases in the matrix and included in garnet and staurolite, and dating of inclusion-poor and inclusion-rich garnet and staurolite domains. Our preliminary results indicate that monazite growth occurred at multiple times between ~390-360 Ma, dependent on the textural setting. For example, monazite included in tourmaline yields ~385 Ma, whereas matrix monazite may be as young as ~360 Ma. Zircon in the matrix and included in garnet and staurolite is mainly inherited; U-Pb ages range between >1000 and ~450 Ma. Furthermore, U-Pb dating of various garnet grains suggests that the main period of garnet growth occurred at ≥394 Ma.

These results, except for the ~360 Ma monazite ages, are in general agreement with published U-Pb monazite ages of ~379-384 Ma, garnet ages of ~418-383 Ma, and staurolite ages of ~400-394 Ma, obtained by solution techniques [1].

[1] Lanzirotti and Hanson (1995) Geochim. Cosmochim. Acta **59**, 2513–2526. [2] Tracy (2002) GSA NE Section - **37th** Ann. Meeting, Session 18.