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Timing of metamorphism in the Arabian-Nubian Shield constrained by in-situ U-Pb dating of accessory and major metamorphic phases

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The Arabian-Nubian Shield (ANS), which forms the northern branch of the East African Orogen, evolved from intra-oceanic island arcs into a mature continental crust in the course of ~300 m.y. of Neoproterozoic Pan-African orogeny. The metapelitic Elat Schist in southern Israel records two metamorphic events that affected the northern part of the ANS, but the significance, extent and the exact timing of these events is controversially discussed. Previous geochronological studies on metamorphic monazite, in conjunction with field evidence, indicate that the main period of regional amphibolite-facies metamorphism occurred at ~620 Ma, just prior to and coeval with regional-scale intrusions of late-orogenic granitoids. However, other field observations from the Elat area provide evidence that regional metamorphism also occurred prior to ~705 Ma. This older age is inferred from an E-W trending, vertically-foliated, ~705 Ma greenschist-facies dike swarm, which cross-cuts the shallow-dipping foliation of the garnet-bearing Elat Schist, thus indicating a more prolonged metamorphic evolution.

In order to gain a more comprehensive understanding of the metamorphic history of this area, we apply in-situ U-Pb dating of monazite, garnet and staurolite to garnet-, garnet-staurolite-, and staurolite-bearing schists from the Elat area. By tying in-situ U-Pb ages from accessory and major metamorphic phases to the pressure-temperature evolution of a metamorphic rock, its geological history can be unraveled in unprecedented detail and different episodes of, $e.g.$, garnet growth may be distinguished. Our preliminary results suggest that garnet grew prior to ~620 Ma and pre-dates the growth of most monazites. However, the interpretation of U-Pb garnet data is complicated due to monazite and/or zircon inclusions. In contrast, staurolite seems to be well-suited for giving meaningful metamorphic ages, because in our case it rarely contains high-μ (^{238}U/^{204}Pb) inclusions.