



Ediacaran (~620 Ma) high grade regional metamorphism in the northern Arabian Nubian Shield: U/Th-Pb monazite ages of the Elat schist

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Ediacaran times witnessed a hemisphere-scale orogenesis forming the extensive Pan-African mountain ranges and resulting in the final assembly of Gondwana supercontinent. The Elat metamorphic basement (S Israel) located at the northernmost tip of a major Pan-African orogenic suture, the Arabian Nubian Shield (ANS), comprises amphibolite facies schists and gneisses and was most likely shaped by this major continental collision. However the timing, number and duration of metamorphic events in Elat and elsewhere in the ANS are non-conclusive and a major emphasis was given to pre-Ediacaran island-arc related tectonics. This is mostly because U-Pb dating of zircon, widely used in Elat and elsewhere, is very successful in constraining the ages of the igneous and sedimentary protoliths, but is 'blind' to metamorphism at grades lower than granulite. Here U/Th-Pb dating of monazite, a precise chronometer of metamorphic mineral growth, is systematically applied to the Elat schist and unveils the tectono-metamorphic evolution of the Elat basement.

Previous U-Pb dating of detrital zircon has shown that the sedimentary protoliths of the Elat schist are the oldest basement components (≥ 800 Ma), and detailed structural observations of the schists portrayed a complex deformation history including four successive phases (Shimron, 1972). The earliest three phases were defined as ductile and penetrative, but some of the available geochronological data apparently contradict field relations. In-situ analysis of metamorphic monazites by LASS (Laser Ablation Split Stream) involves simultaneous measurement of U/Th-Pb isotope ratios and REE contents in a single $10 \mu\text{m}$ sized grain or domain, thus allowing determining the age of specific texture and metamorphic assemblage. Monazite dating of the Elat schist yielded two concordant age clusters at 712 ± 6 and 613 ± 5 Ma. The corresponding REE patterns of the dated monazite grains indicate that porphyroblast growth, either garnet or staurolite, took place only during the younger event (M2). Likewise the regional south dipping penetrative foliation, common to the Elat schist and to all of the rocks of the Elat association, formed during the Ediacaran event (M2). This profound event started at ~ 630 Ma and reached peak conditions of mid amphibolite facies at ~ 620 Ma. Retrogression and stress relaxation shortly followed, involving overprint of staurolite schists by a cordierite-bearing assemblage at ~ 613 Ma (M3), and was contemporaneous with the intrusion of andesitic dykes that were immediately metamorphosed to low-amphibolite. This metamorphic P-T-t path corresponds to the collision of East- and West-Gondwana as constrained by large geochronological database of post collision batholiths from all around the Arabian-Nubian Shield.