

## Thermochronometric investigation of the thermal history of Paleozoic strata of the Western Desert, Egypt

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The northeast African continental margin of the Western Desert of Egypt is host to a complexly deformed series of Phanerozoic basins. Regional deformation was the result of continental collisions, repeated rifting and inversion cycles, and substantial sedimentary deposition. Limited sedimentary exposure and exploration has resulted in deficient knowledge of Phanerozoic basin evolution. Previous studies of the region have largely relied upon sedimentary analysis, gravity, and 2D/3D seismic data. This study, in contrast, has employed extensive use of detrital zircon (U-Th)/He thermochronology in conjunction with 3D seismic, vitrinite reflectance, well log correlation, chemostratigraphy, and heat flow data to elucidate a spatiotemporally comprehensive tectonic and stratigraphic model.

The lower Paleozoic, Carboniferous, and Mesozoic stratigraphic sequences of the Western Desert represent distinct tectonically controlled basins with independent tectono-thermal evolutions. Initial deposition commenced during mid-Cambrian development of the Ghazalat basin, bounded to the west by the N-S trending Calanshiyu Arch. Nearly continuous deposition persisted until the late Devonian uplift of the Ghazalat basin. This inverted basin shed recycled sediment into the subsided Calanshiyu Arch and established the eastern limit of Carboniferous deposition along N-S trending faults. Initiation of late Triassic-Jurassic rifting caused regional erosion and limited deposition during transition from an intracratonic to a rift controlled basin. Rifting propagated westward along NE-SW trending normal faults attenuating and terminating in the eastern limit of the Carboniferous basin. Voluminous sedimentation of the margin has existed since rifting and transition into a passive continental margin. Localized stacking of sedimentary sequences from Mesozoic rift sediment and Carboniferous strata to the west of the Ghazalat basin have resulted in particularly deep burial of lower Paleozoic strata and exposure to elevated thermal regimes resulting in greater local maturation.

Evidence from heat flow data, faulting relationships, and basin controlling structures indicate that the N-S trending structures of the Calanshiyu Arch define a region of crustal transition. Reduced heat flow and rift fault attenuation to the west indicate that the crust is older and thicker and likely associated with the Archean-Paleoproterozoic Saharan Metacraton. The region east of the Calanshiyu Arch is dominated by elevated heat flow and potentially delineates the western most extent of the juvenile Arabian-Nubian Shield.

**Keywords:** (U-Th)/He, thermochronology, detrital zircon, Egypt, Western Desert