

Phanerozoic polycyclic evolution of the southwestern Angola margin: New insights for apatite fission track and (U-Th)/He methodologies

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The low-temperature thermochronology has been an important tool to quantify geological process in passive continental margins. In this context, the Angolan margin shows evidence of a polycyclic post-rift evolution marked by different events of uplift, basin inversion and changes in sedimentation rates to the marginal basins, which have controlled the salt tectonics and the hydrocarbon deposits (1,2,3,4).

To understand the post break-up evolution of the southwestern Angola margin, it were collected outcrop samples for apatite fission track (AFT) and (U-Th)/He analysis ranging in elevation from 79 m to 1675 m from the coast toward the interior plateau in a profile between Namibe and Lubango cities. The area lies on the edge of Central and Southern Atlantic segments a few kilometers northward the Walvis ridge and encompasses the Archean and Proterozoic basement rocks of the Congo craton.

The AFT ages ranging from 120.6 ± 8.9 Ma to 328.8 ± 28.5 Ma and they show a trend of increasing age toward the Great Escarpment with some exceptions. The partial mean track lengths (MTLs) vary between 11.77 ± 1.82 μm to 12.34 ± 1.13 μm with unimodal track length distributions (TDLs). The partial (U-Th)/He ages ranging from 104.85 ± 3.15 Ma to 146.95 ± 4.41 Ma and show the same trend of increasing ages landward, little younger than the AFT ages, which could be interpreted as a fast exhumation episode in Late Jurassic - Early Cretaceous times.

The thermal histories modelling has been constrained with the kinetic parameters Dpar (5) and c-axis angle (6) by the software Hefty (7). Both AFT and (U-Th)/He thermal histories modelling indicate three episodes of denudation/uplift driven cooling: (a) from Late Jurassic to Early Cretaceous, (b) a smallest one in the Late Cretaceous and (c) from Oligocene-Miocene to recent, which are compatible with geophysical data of the offshore Namibe basin that estimate the greater thickness of sediments formed in the first and third episodes, respectively (8,9).

Our preliminary data suggest a polycyclic evolution of the southwestern Angola margin and support the importance of the Cenozoic event in the area which has been widely reported along the Angolan margin (2,4,10,11) but has not been evident in other regions of southern Africa where it has been documented mean Cretaceous events (12,13,14,15).

Differences in magnitude of Late Cretaceous events between southern Angola and northern Namibia (16,17) suggest a likely basement control linked to different tectonic-denudation episodes, with the Neoproterozoic shear zones absorbing more deformation than the Congo craton during the shortening events of the margin during Late Cretaceous times.

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