Geophysical Research Abstracts
Vol. 12, EGU2010-11056, 2010
EGU General Assembly 2010

Thermochronological data from northern Mozambique – an example for the cooling history of an orogen-passive margin system.

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On a global scale, most passive margins are located within crustal segments which were stressed by compressive tectonics and crustal thickening in their previous geological past. These margin types can be referred as "orogen – passive continental margin systems". There older orogenic structural anisotropies were reactivated during the later passive margin formation. Even so, inherited structures seem to have a dominant control on continental break-up kinematics, the coherence between orogen related structures and the post-orogenic thermo-tectonic evolution during continental break-up is insufficiently studied and documented. Here, we focus on the metamorphic basement of northern Mozambique which represents the remnant of a deeply eroded orogen [Viola et al., 2008]. Today, its mid-crustal roots are exposed to surface conditions displaying metamorphic basement rocks with well defined structural anisotropies like ductile high strain zones or major shear zones (e.g., the Lurio Belt). We present a conceptual model to describe the post Pan-African (<530 Ma) basement cooling pattern for northern Mozambique. The cooling history is derived from combined low-temperature thermochronological data comprising of titanite (T), zircon (Z) and apatite (A) fission track (FT) data with ages spanning from ca. 580 to 220 Ma (TFT), 390 to 170 Ma (ZFT) and 330 to 60 Ma (AFT). All thermochronometers were used to model inverse cooling paths for basement rocks. After fast post orogenic cooling (>15 °CMyr-1) the basement was mainly affected by extensional tectonics and relatively slow cooling of max 4.5 to 2 °CMyr-1. Basement rock cooling was the response to rifting between northern Mozambique and fragments of East Gondwana guiding the opening of the Rovuma and Mozambique sedimentary basins. Thereby, totally different margin and basin types evolved. The Rovuma margin represents a transpressional margin were Jurassic tectonic denudation along the margin was localised in a narrow zone (∼30 km). In contrast, the Jurassic-Cretaceous opening of the Mozambique basin was probably associated with magmatic underplating which caused an unusual uniform cooling pattern (with Cretaceous AFT ages) for the basement rocks in a large area (∼150.000 km2) at the hinterland of the basin. Even the Lurio Belt represents a significant thermochronological boundary, in northern Mozambique the structural reactivation of pre-existing local ductile basement fabrics by extensional tectonics during the Gondwana break-up seemed to have only a secondary effect.

Viola, G., I.H.C. Henderson, B. Bingen, R.J. Thomas, M.A. Smethurst, and S. de Azavedo (2008), Growth and collapse of a deeply eroded orogen: insights from structural and geochronological constraints on the Pan-African evolution of NE Mozambique, Tectonics, 27, p. TC5009 10.1029/2008TC002284.