Differential Neoproterozoic to Palaeozoic postcollisional cooling histories across the Lúrio Belt, northeast Mozambique

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The East African-Antarctic Orogen maks one of the major collision zones in the amalgamation of Gondwana. The tectonic style of the orogen changes abruptly across the Lúrio Belt in its southern part in northeast Mozambique. The orogen north of the Lúrio Belt is characterized by W- to NW-directed nappe stacking, whilst to the south, large volumes of late-tectonic granitoids and charnockites point towards elevated heat flow and possibly a delaminated orogenic root. Further evidence for delamination is given by structures associated with penetrative extension, high-temperature/low-pressure metamorphism, migmatisation and late-tectonic constriction perpendicular to the main collision vector. We have traced the postcollisional tectonic development across the Lúrio Belt and its subsequent cooling from high-temperature metamorphism with an extensive new set of U-Pb titanite, $^{40}Ar/^{39}Ar$ hornblende, and $^{40}Ar/^{39}Ar$ mica analyses. The data are complex and suggest a polyphase metamorphic history from the late Neoproterozoic to the Ordovician within the orogen, with marked differences between the major constituent blocks north and south of the Lúrio Belt. In all the data sets, samples from the basement south of the Lúrio Belt show generally younger ages than those from the north, resulting from the late metamorphic event and slow cooling between ca. 520 and 440 Ma. The ages south of the Lúrio Belt are consistently ca. 30–70 Ma older than those from the north, a difference that is maintained and appears even to increase during cooling from very high temperatures to ca. 350°C. Based on the first-order assumption that all the ages are cooling ages, cooling rates in the south are estimated at ca. 7°–8°C/Ma, while those north of the Lúrio Belt are faster at ca. 16°C/Ma. The data are consistent with previous geochronological, petrographic, and field data and suggest that the late high-temperature/low-pressure metamorphic event affected only the basement rocks south of the Lúrio Belt and portions of the latter. The late metamorphism and subsequent delayed, slower cooling agree well with a model of elevated heat flow following lithosphere delamination and asthenosphere uprise in the southern part of the orogen. It can also explains the observed widespread granitoid magmatism, migmatisation, and renewed deformation in the southern basement. The Lúrio Belt probably marks the northern boundary of the delaminated part of the orogeny and might represent an accommodation zone within the orogeny rather than a fundamental suture zone as has often been postulated. The initial break-up of Gondwana which commenced at ca. 200 Ma took place in a pull-apart fashion within the weaker, southern part of the orogen, where the orogenic root had delaminated in Palaeozoic times.