



Late-stage orogenic deformation and possible mantle lithosphere removal - an examination of the East-African Antarctic Orogen in northern Mozambique

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In matured orogenic systems, a removal of parts of the mantle lithosphere likely triggers uplift and extension, increased heat flux, and induces extensive crustal melting. The resulting strain and pT-conditions are potentially high enough to both obliterate older fabrics and to reset geochronological systems. Here, we present and review data from the northeastern Mozambique section of the late Proterozoic - early Paleozoic East African-Antarctic Orogen, and examine the extent and distribution of the overprint to which the Mesoproterozoic basement has been subjected. As earlier recognised, there is a marked contrast between a northern basement block and the southern Nampula province, with the latter exhibiting more variable structural trends and a large volume of weakly deformed late-tectonic intrusions. Only few corresponding intrusions are reported from the northern block. In order to test partial delamination, two areas are particularly interesting. This is firstly the late-tectonic Lalaua pluton that intrudes the boundary shear-zone between the two blocks, the Lurio Belt, which is believed to have formed as early as the earliest regional metamorphic record. A second marker is the meta-sedimentary Mecuburi Group that is now known to have formed comparatively late within a restricted continental basin, and that has subsequently been subjected to migmatisation and local compression.

Zircon SIMS-data from the eastern and central part of the Lurio Belt record remarkable differences in peak metamorphism. The youngest records, from the central Lurio Belt, confirm the link between a) contemporaneous intrusion and deformation of the outer lobes of the Lalaua pluton; and b) deformation and migmatisation of the Mecuburi Group. The central belt segment and the southerly adjacent parts of the Nampula Complex define areas of late and more restricted high-grade metamorphism. They correlate in age with much of the voluminous granitoids that have been reported from wide areas of the Nampula province. In contrast, the eastern Lurio Belt shows earlier peak metamorphism and protracted rim formation that is coherent with published ages from the northern basement and that possibly has been overprinted elsewhere. This is coherent with variable reworking of the Nampula complex under elevated heat flux and under general extension, while permitting local compression. It is noted that the main structural trend of the Mecuburi Group, which is at a high angle to the prominent trend of the Lurio Belt, can be found throughout the Nampula province, and is preferably associated with the younger age pattern. The results also prove that the central segment of the Lurio Belt has been active just prior to, or coeval with, the emplacement of the late-tectonic granitoids, possibly accommodating differential movement between delaminated and undelaminated domain. We also present a comprehensive new set of geochronological ages from U/Pb titanite, Ar/Ar hornblende and biotite dating, and compare the resulting distribution with model predictions along representative cross-sections. The results are in agreement with differential uplift following partial delamination of a southern domain, showing slightly older ages north than south. There is however no perfect homogeneity over the inferred southern and northern domain on a scale of over 500 km.

Our study confirms the widespread metamorphic overprint of Mesoproterozoic basement rocks during the late Proterozoic - early Paleozoic orogenic cycle. It also suggests, during the same cycle, variable overprint of early metamorphic records by late metamorphism that is consistent with spatially restricted delamination.