Evolution of the south-eastern hinterland in the South Atlantic Neoproterozoic Orogenic System – the Coastal Terrane of the Kaoko Belt (NW Namibia) revisited

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The Coastal Terrane of the Kaoko Belt in Namibia was originally defined as a Neoproterozoic arc terrane that originated outboard of the attenuated Congo Craton margin. Early (~650–630 Ma) igneous activity and high-grade metamorphism were interpreted as connected with subduction of the Adamastor Ocean and related arc magmatism. Protoliths of metasedimentary lithologies were interpreted as juvenile clastic sediments originating from the arc erosion. Later deformation (~580 Ma) was associated with lower amphibolite-facies conditions during thrusting over the Congo Craton margin.

Our research, however, suggests different evolutionary scenario. The structurally lowermost part of the metasedimentary complex contains amphibolites and orthogneisses with U–Pb zircon ages between ~820–785 Ma, interpreted as metamorphosed syn-sedimentary bimodal volcanics. Detrital zircon ages from associated metamorphosed clastic sediments show identical patterns as observed in the metasedimentary cover of the underlying Congo Craton. Towards the structural hanging wall, the metasediments are devoid of metavolcanic rocks, and their detrital zircon age spectra are comparable with those from flysch sediments in the eastern, less metamorphosed parts of the Kaoko Belt.

The structurally lowermost part of the Coastal Terrane shows signs of partial melting broadly coeval with intrusion of ~650 Ma (U–Pb zircon) granitic–dioritic/gabbroic rocks. The temperature and depth of this migmatization event remains unconstrained, because the original mineral assemblages were overprinted during thrusting over the Congo Craton margin.

The thrusting period is characterized by solid-state reworking and partial retrogression of the migmatites in the lower part, and by pervasive metamorphism in the upper part, of the metasedimentary complex. Lu–Hf age (583 ± 2 Ma) of garnet from reworked migmatite shows that the garnet-bearing mineral assemblage represents conditions of thrusting, which were determined at ~660–670°C and 5.5–6 kbar. The ~580 Ma (and beyond) period of deformation
started with development of flat-lying metamorphic fabric, later overprinted by folds with step axial planes, steep cleavage and isolated shear zones with general N–S to NNW–SSE trend. The associated intrusions show steep magmatic fabric, which transits into solid-state deformation in bodies close to the base of the Coastal Terrane.

Rather than an arc, the Coastal Terrane probably represents the inner part of an early Neoproterozoic rift. This interpretation is supported by the zircon provenance data and the presence and age of the bimodal volcanic rocks. The early, ~650–630 Ma magmatic activity and migmatitization coincides with the early period of rift inversion that took place along the western edge of the rift system in the Dom Feliciano Belt (Brazil and Uruguay). At this period, the former rift centre was established as the high-grade hinterland system of the developing Kaoko–Dom Feliciano–Gariep orogen. Inversion of the eastern rift edge started at ~580 Ma, as recorded in the Coastal Terrane, and continued up to ~550 Ma, which is the timing of the metamorphic peak in the Kaoko Belt foreland.

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