Abstract

The Kaoko belt is situated at the northwestern coast of Namibia and is part of the late Neoproterozoic (Pan-African) mobile belt system of western Gondwana. It consists of pre-Pan-African basement rocks as well as Pan-African volcano-sedimentary cover sequences and large granitoid intrusions. Both, basement and cover rocks were subjected to polyphase deformation and probably two phases of metamorphism during Pan-African orogenesis. The investigated area is an approximately 100 km long E-W/NE-SW orientated transect through the Kaoko belt, following the Gomatum-Hoarusib valleys. The aim of this study is to document the Pan-African metamorphic evolution by applying conventional geothemobarometry as well as modern phase petrological methods and, by using the results, to examine the geodynamic history in the Kaoko belt.

Based on investigations of metapelites is was possible to distinguish different metamorphic zones increasing in grade from greenschist facies in the east to granulite facies in the west:

- a garnet zone	g + bi + chl + mu ± pg + pl + q,
- a staurolite zone	st + g + bi ± chl + mu + pl + q,
- a kyanite zone	ky + st + g + bi + mu + pl + q,
- a kyanite-sillimanite-muscovite zone	ky + fibr./sill ± g + bi + mu + pl +q,
- a sillimanite-muscovite zone	sill + g + bi + mu + pl + q,
- a sillimanite-K-feldspar zone	sill + g + bi + ksp + pl + q,
- a garnet-cordierite-sillimanite-K-feldspar zone	g + cd + sill + bi + ksp + pl + q.

The formation of critical mineral assemblages occured syn- to post-kinematically with respect to the main deformation event in the whole Kaoko belt.

To reconstruct the P-T conditions experienced by the metamorphic rocks during their Pan-African tectono-metamorphic evolution different methods were used: conventional geothermobarometry, calculation of mineral endmember reactions, application of petrogenetic grids and T-X sections, calculation of P-T pseudosections, and the Gibbs method. As a result it was possible to unravel P-T paths or P-T paths segments for the different metamorphic zones above. The following peakmetamorphic conditions were determined: garnet zone: 500 ± 30 °C / 9 ± 1 kbar; staurolite zone: 580 ± °C / 7 - 8 kbar, kyanite zone: 590 ± 30 °C / 6.5 - 8 kbar, ky-sill-mu zone: 650 ± °C / 9 ± 1.5 kbar, sill-ksp zone: 690 ± 40 °C / 4.5 ± 1 kbar, g-cd-sill-ksp zone: 750 ± 30 °C / 4 - 5.5 kbar.

Consequently, two different types of metamorphic evolution can be distinguished in the Kaoko belt:
- a greenschist to amphibolite facies medium to high-T/ medium-P Barrovian-type evolution with a geothermal gradient of c. 20 °C/km in the eastern and central part, and
- an amphibolite to granulite facies HT/LP Buchan-type evolution with a geothermal gradient of c. 50 °C/km in the western part.

The boundary between these two metamorphic types coincides with the Puros lineament, a shear zone ranging over a few km in width in the central Kaoko belt. The Pan-African transpressional stress regime in the study area led to compression with crustal thickening and associated Barrovian type metamorphism east of the lineament and to a more extensionally-dominated regime with Buchan type metamorphism, connected with large scale granitoid intrusions, west of the lineament.