

## **Evidence for Mesoproterozoic UHT metamorphism and two metamorphic events in the central Namaqualand Metamorphic Complex (Kakamas Terrane), South Africa**

J. Bial (1), V. Schenk (1), S. Büttner (2), and P. Appel (1)

(1) Institut für Geowissenschaften, Christian-Albrechts-Universität Kiel, 24118 Kiel, Germany; jb@min-uni-kiel.de, (2) Department of Geology, Rhodes University, Grahamstown, South Africa

The Namaqualand Metamorphic Complex (NMC) of South Africa and Namibia is a classic low-pressure granulite-facies metamorphic terrane that surrounds the Kaapvaal craton to the south (Waters, 1989). Its formation is related to the Mesoproterozoic amalgamation of the supercontinent Rodinia and represents a segment of the global network of Grenville-aged belts (1.3-1.0 Ga). The evolution of the belt is characterized by two phases of granitoid magmatism (1210-1180 Ma and 1040-1020 Ma) (Robb et al., 1999; Clifford et al., 2004).

Robb et al. (1999) associates only the second of these phases of granitoid magmatism (1040-1020 Ma) with the regional low pressure amphibolite to granulite facies metamorphism, reaching locally UHT conditions (>900°C) in the far southwest (e.g. Waters, 1989), whereas Clifford et al. (2004) suggests that both phases corresponds to a single metamorphic cycle reaching peak P-T conditions at 1210-1180 Ma. The lack of HP metamorphic rocks is an enigma to all the Mesoproterozoic belts of southern Africa.

In this study we examine the P-T history of metapelites of the Kakamas Terrane NE' of the Pofadder shear zone in the central part of the belt by analysis of reaction textures and U-Th-total Pb monazite geochronology and zircon geochronology. The methods reveal evidence for two metamorphic events separated by a phase of retrogression. During the first event UHT conditions have been locally attained as evident by orthopyroxene-cordierite-Kfs-Qz symplectites forming pseudomorphs after osumilite and by assemblages like spinel-Qz, corundum-Qz, now separated by a thin garnet-sillimanite and/or garnet-corona, and aluminous orthopyroxene (>7 wt% Al<sub>2</sub>O<sub>3</sub>). Garnet that coexisted with osumilite (Grt 1; X<sub>Mg</sub> = 0.268) is replaced by late-stage orthopyroxene-cordierite-plagioclase±biotite intergrowths. Within these pseudomorphs a second generation of poikilitic garnet (Grt 2; X<sub>Mg</sub> = 0.215) is growing enclosing all the minerals formed after Grt 1.

A clockwise P-T path is indicated by sillimanite pseudomorphs after kyanite and relics of staurolite preserved as inclusions in garnet, occurring only in lower grade areas closer to the northern margin of the belt. Cordierite ± biotite coronas around garnet porphyroblasts is evidence for late-stage decompression.

Two stages of monazite growths have been dated with the U-Th-total Pb method at 1189±14 Ma and 1004±14 Ma. These two ages are interpreted to correlate with the two metamorphic events deduced from reaction textures. The clockwise P-T path of the first metamorphism and the recognition of two distinct metamorphic events is at variance with former work on the NMC.

*Clifford, T. N.; Barton, E. S.; Stern, R. A. & Duchesne, J.-C. (2004) U-Pb Zircon calendar for Namaquan (Grenville) crustal events in the granulite-facies terrane of the O'okiep Copper District of South Africa, Journal of Petrology, Vol. 45, 669-691*

*Robb, L.J.; Armstrong, R.A. and Waters, D.J. (1999) The history of granulite-facies metamorphism and crustal growth from single zircon U-Pb geochronology: Namaqualand, South Africa, Journal of Petrology, Vol. 40, 1747-1770*

*Waters, D. J. (1989) Metamorphic evidence for the heating and cooling path of Namaqualand granulites, In: Evolution of Metamorphic Belts; Daly, J.S., Cliff, R.A., Yardley, B.W.D. (eds.); Geological Society Special Publication No.43, 357-363*