Different metamorphic records in the Western Kaoko Zone (NW Namibia) and their timing

Fuchs, P.[1*], Tajčmanová, L.[1,2], Milke, R.[1] & Konopásek, J.[2]
[1]Institute of Geological Sciences, Free University, Berlin, Germany ([*]parveen.fuchs@fu-berlin.de)
[2]Czech Geological Survey, Prague, Czech Republic

The Kaoko belt is situated in NW Namibia and represents a part of the Neoproterozoic orogenic belt system of western Gondwana developed between the Congo Craton, the Kalahari Craton and the Rio de la Plata Craton in southern Brazil. The metamorphic evolution of the eastern and central part of the Kaoko belt has already been well described by means of thermodynamic modelling [1]. On the contrary, well-constrained data on pressure-temperature (P-T) evolution of the western part of the Kaoko belt are still missing. The westernmost unit of the western Kaoko Zone, the so called Coastal Terrane (CT), is a unit with metamorphic ages of 650-630 Ma and an independent tectonic evolution prior to its collision with the Congo Craton at ~580-550 Ma. The CT consists of migmatitic metasedimentary rocks that are intercalated withfine -grained orthogneisses and amphibolites. Along its eastern margin, the Boundary Igneous Complex (BIC) is exposed and defines the suture between the CT and Congo Craton-related rocks of the Kaoko belt. The BIC is composed of various types of granitoids associated with isolated bodies of pervasively molten metapelites metamorphosed at 580-550 Ma. As the relationship of the CT with the rest of the Kaoko belt and the affinity of granitoids from the BIC is still a matter of debate, we have focused on the key metamorphic lithologies from both units in order to characterize the metamorphic evolution and partial melting in detail. This information combined with already existing geochronological, geochemical and structural data from the two units can help to a better description of the overall tectonic evolution of the area.

In this work, we have particularly focused on metasedimentary rocks from both units because they contain the most suitable assemblages for phase equlibria modelling. All phase equilibria calculations were carried out by using the thermodynamic software set Perple_X. The metasediments from the CT are characterized by a Grt-Bt-Pl-Kfs-Ms-Qtz mineral assemblage. The foliation is defined by biotite and muscovite bands alternating with a quartz-feldspatic matrix. Although the rock was affected by melting, the presence of muscovite documents that temperatures higher than 700°C have never been reached. Samples from the BIC underwent pervasive melting and have a strong stromatitic character. Three different assemblages have been described reflecting the slightly different pressure conditions of equilibration attained during the metamorphic evolution: Grt-Sil-Bt-Pl-Kfs-Qtz; Grt-Crd-Sil-Bt-Pl-Kfs-Qtz and Crd-Sil-Bt-Pl-Kfs-Qtz. Two different generations of garnet occur in the Grt-Sil-Bt samples. The First generation is characterized by medium grained garnets elongated parallel to the foliation and the second generation by undeformed porphyroblasts. This observation serves for more accurate description of the *P-T* path. The temperatures for all three assemblages exceeded 750°C. Regarding the *P-T* results from both units, the two different metamorphic events are characterized by different thermal evolution. The higher temperatures attained during the metamorphic event at 580-550 Ma are interpreted to be connected with an emplacement of a huge amount of granitoids within the BIC.

[1] Will, T.M., Gruner, B.B. & Okrusch, M. (2004) *S. Afr. J. Geol.*, **107**, 431-454.

Island-Arc signature in amphibolites from the boundary between the Ossa Morena Zone and the Central Iberian Zone in Central Portugal

Henriques S.B.A.[1*], Neiva A.M.R.[2], Ribeiro M.L.[1] & Dunning G.R.[3]
[1]Dpt. of Geology, LNEG, Amadora, Portugal ([*]susana.henriques@ineti.pt)
[2]Dept. of Earth Sciences and Geosciences Centre, University of Coimbra, Portugal
[3]Earth Sciences Dept., Memorial University, St. John's, Canada

The Iberian Terrane contains an important tectonic boundary, the Tomar-Badajoz-Cordoba shear zone, between the Ossa Morena Zone and the Central Iberian Zone, where the Cabeço da Moura amphibolites (Pouchão Mafic Complex), crops out close to Abrantes, Central Portugal. It consists of a fine-grained amphibolite that comprises three main mineral assemblages: a) labradorite, magnesiohornblende, augite, diopside, quartz and ilmenite; b) bytownite rimmed by andesine, ferrohornblende, hedenbergite, diopside, epidote, titanite, quartz, magnetite and apatite; c) andesine, magnesiohornblende rimmed by actinolite, diopside, quartz and magnetite. Estimated P-T conditions, based on hornblende Al content [1] and hornblende-plagioclase equilibrium [2], are T=702-724º C, P=4.6-4.9 kb (± 0.6 kb) for the assemblage a); T=703-727º C, P=6.7-7.4 kb (± 0.6 kb) for the assemblage b), showing a progressive metamorphism and T=640-708º C, P=3.8-6.2 kb (± 0.6 kb) for retrograde crystallization evidenced by the formation of actinolite. The analyzed amphiboles have important coupled substitutions such as edenite in all the amphiboles, hastingsite-pargasite in ferrohornblende and magnesiohornblende, titanotschermakite in magnesiohornblende, ferrotschermakite in magnesiohornblende and actinolite and hastingsite in actinolite.

The Cabeço da Moura amphibolites are basic (SiO_2=45.68-50.03 wt %), subalkaline and tholeiitic. The MORB- normalized spider diagram shows enrichment in LILE relatively to HFSE (Rb_N/Y_N=2.67-15.76), a negative Th anomaly and a HFSE pattern (from P_2O_5 to Yb) parallel to MORB, but at a lower level, and in general LILE are enriched above MORB, suggesting an island arc setting. The chondrite normalized REE patterns display enrichments in MREE relatively to HREE (Sm_N/Yb_N=1.07-1.25) and do not show significant negative Eu anomalies (Eu/Eu*=0.92-1.05). The Th-Hf/3-Ta and Zr/4-2Nb-Y diagrams show N- and E-MORB affinities, supported by La_N/Sm_N (0.72-0.91) and La_N/Sm_N (1.29-1.51). Enrichment in LREE relatively to HREE only occurs in E-MORB samples (La_N/Yb_N=1.08 to 1.81), contrasting with N-MORB samples (La_N/Yb_N=0.85-0.87). The ID-TIMS U-Pb age of the metamorphic zircon, that has an equant multi-faceted morphology, is 539 ± 3Ma. These data suggest the presence of a Precambrian island arc that generated magmas from depleted and enriched mantle sources and were metamorphosed in the early Cambrian under amphibolite facies conditions.

Acknowledgements: This study was supported by a PhD grant given to S.B.A. Henriques by the Portuguese Foundation for Science and Technology.

[1]Schmidt, M.W. (1992) *Contrib. Mineral. Petrol.*, **110**, 304-310. [2] Holland, T. & Blundy, J. (1994) *Contrib. Mineral. Petrol.*, **116**, 433-447.