

## Preliminary results of metamorphic P-T studies on East Sør-Rondane, Antarctica

Grantham G.H.<sup>1,7</sup>, Kawakami, T.<sup>2</sup>, Ishikawa, M.<sup>3</sup>, Satish-Kumar, M.<sup>4</sup>, Tsuchiya, N.<sup>5</sup>, Graser, P.<sup>6</sup>.

<sup>1</sup> Council for Geoscience, P/Bag X112, Pretoria, South Africa. [grantham@geoscience.org.za](mailto:grantham@geoscience.org.za)

<sup>2</sup> Department of Geology and Mineralogy, Kyoto University, Kyoto 606-8502, Japan

<sup>3</sup> Graduate School of Environment & Inf. Sci., Yokohama National University, Yokohama 2408501, Japan.

<sup>4</sup> Institute of Geosciences, Shizuoka University, Oya 836, Suruga-ku, Shizuoka 422-8529, Japan

<sup>5</sup> Graduate School of Environmental Studies, Tohoku University, Sendai 980-8579, Japan.

<sup>6</sup> Dept of Geology, University of Pretoria, Pretoria, South Africa

<sup>7</sup> National Institute of Polar Research, 10-3, Midoricho, Tachikawa, Tokyo 190-8518, Japan

The Balchenfjella occupy the eastern end of the Sør Rondane mountains in E. Antarctica. Previous studies of the metamorphic geology of the area include those of Asami et al. (1992). Samples collected during JARE51 confirm granulite grade assemblages reported by these authors.

Preliminary studies have focused on metapelitic and metabasic rocks. The metapelitic granulites are characterized by Grt + Sill + Qtz + Plag + Rt + Kfs + Bt. P-T modeling using THERMOCALC for the metapelites suggest peak conditions of ~8.5kb and ~850°C constrained by the GRIPS, GASP and GRAIL equilibria. These temperatures are confirmed by preliminary Zr in rutile thermometry (Zack, 2004).

Varying compositions of metabasic to ultrabasic rocks affected by different retrogressive conditions contribute to various assemblages with varying textural expression. Grt + Opx + Pl + Bt show granoblastic equilibrium textures except for retrogressive biotite resulting from partial hydration. These suggest peak conditions of ~750°C and 7kb. Grt + Cpx + Hbl + Pl + Mt assemblages show spectacular hydration textures with symplectitic intergrowths of Hbl + Pl + Mt developed between groundmass Grt + Cpx + Pl. Modelling suggests the hydration occurred at between 750°C and 850°C.

Meta-clinopyroxenites have an equilibrium assemblage of Cpx + Hc. Partial retrogression involving H<sub>2</sub>O+CO<sub>2</sub> has resulted in the crystallization of Amph+An+Cc indicating that the clinopyroxene has substantial Ca-Tschermaks component in solid solution. Exsolution lamellae and small inclusions of virtually pure anorthite in deformation zones and cracks suggest decompression with associated hydration and carbonation at ~750°C and ~7.5kb.

The absence of anhydrous reaction textures in some samples may suggest P-T evolution trajectories close to reaction curve slopes implying a near isothermal decompression cooling path followed by retrogressive hydration and carbonation, the latter observed only in some samples.

These assemblages are similar to granulites described from the allochthonous Monapo Complex in northern Mozambique (Grantham et al., 2007 a&b) where a near isothermal decompression path from ~10kb and ~900°C to ~6-7kb and 700°C followed by isobaric cooling were inferred. These similarities support correlation of the granulites from Sør Rondane with rocks from the Monapo Complex which has been interpreted as erosional klippen remnant of rocks from the East African Orogen of N.Mozambique which has been tectonically emplaced during the Kuungu Orogeny during the amalgamation of Gondwana.

### References

Asami M., Osanai Y., Shiraishi K. and Makimoto, H. (1992) Metamorphic evolution of the Sor Rondane Mountains, East Antarctica. p7-15. In Yoshida, Y. Kaminuma K. and Shiraishi K. (eds.), Recent progress in Antarctic earth science, Terra Scientific Publishing Company, Tokyo p796.

Grantham, G.H. Macey, P.H. Botha G.A., Ingram, B.A. Roberts, M.P., Rohwer, M., Opperman.R. Manhica, V. Alvares, S. Bacalhau, C. Du Toit,M. C, Cronwright, M. & Thomas R.J. (2007) Map Explanation of Sheets Meconte (1439) and Nacala (1440) National Directorate of Geology, Republic of Mozambique, p240.

G.H. Grantham, P.H. Macey, Miller J.A., Armstrong R.A., Eglington, B.M., Graser, P., Azevedo, S. (2007) The P-T-t path and structural evolution of the Monapo Complex, Northern Mozambique: Its contribution to the understanding of the Kungu Orogeny and the amalgamation of N and S. Gondwana. Abstract 4<sup>th</sup> International Symposium on Gondwana , Fukuoka, Japan organized by IAGR.

Zack T., Moraes R., Kronz A. (2004) Temperature dependence of Zr in rutile: empirical calibration of a rutile thermometer. Contributions to Mineralogy and Petrology, 148, 471-488.