

Timing of UHT metamorphism in eastern Gondwana.

*Durgalakshmi Durgalakshmi¹, Ian S Williams², Satish Kumar M³, Sanjeeva Malaviarachchi⁴, Krishnan Sajeew⁵

1. Department of Studies in Earth Science, University of Mysore, Mysuru, India, 2. Research School of Earth Sciences, Australian National University, Canberra, Australia, 3. Department of Geology, Niigata University, Niigata, Japan, 4. Department of Geology, University of Peradeniya, Peradeniya, Sri Lanka, 5. Centre for Earth Sciences, Indian Institute of Science, Bengaluru, India

The east Gondwana reconstruction is extensively done based on the geochronological and structural studies. In this study we attempt to bring out a precise correlation using the timing of UHT metamorphism and representative mineral assemblages from Antarctica, Sri Lanka, and southern India. East Gondwana continental fragments including Trivandrum Block and Madurai Block southern India, Highland Complex Sri Lanka, southern Madagascar and East Antarctica consist of several occurrences of metapelitic rocks, orthogneiss and charnockite. This study focuses on sapphirine-quartz bearing ultrahigh-temperature metapelites from Rajapalayam, Madurai Block, southern India, Gampola, Highland Complex, Sri Lanka and Rundvågshetta, Lützow-Holm Complex, East Antarctica.

Samples of Cordierite-rich metapelites with sapphirine-quartz assemblage within garnets porphyroblasts were selected for U-Pb geochronology, Ti-in-zircon thermometry and REE analysis by Sensitive High Resolution Ion Microprobe (SHRIMP) from each location. Zircons were analysed both as separated grains and in-situ in thin-sections. Monazite grains separated from the same sample were analysed for U-Pb geochronology. The zircons were classified according to their morphology and REE patterns in the respective zones.

The cathodoluminescence images of zircons from Rajapalayam, Madurai block, showed distinct core with grey mantle and dark rims. On the basis of the chondrite-normalised Yb-Tb ratio, the REE patterns were categorized as 'high' (4.7-6.6) and 'flat' (0.8-1.5). The cores gave a 'high' REE pattern while the grey and dark zones outside the cores gave 'flat' pattern. The Ti in zircon thermometry yielded a range of temperatures between 756°C and 794°C. The cores gave discordant ages as expected from detrital zircons and the oldest age observed was 2.8 Ga. The grey mantle region gave a weighted mean $^{206}\text{Pb}/^{238}\text{U}$ age of 528.6 ± 4.5 Ma and the dark rims gave 522.5 ± 3.7 Ma (95% c.l.). Monazite also gave $^{206}\text{Pb}/^{238}\text{U}$ age 554.6 ± 7.2 while the $^{208}\text{Pb}/^{232}\text{Th}$ age was 544.7 ± 7.2 (95% c.l.). Metamorphic monazite crystallized before metamorphic zircon.

The zircons from Highland Complex, Sri Lanka has detrital cores with pale or grey outer zone. On the basis of the chondrite-normalised Yb-Tb ratio the cores gave 'high' (7.5-23) REE pattern and the outer zone gave 'flat' (0.2-1.4) REE pattern. The Ti in zircon thermometry produced a temperature range from 682°C to 914°C from the separated and in-situ zircon grains. The core ages plots at ca. 900 Ma. The outer regions gave two groups of higher (n=38) and lower (n=42) weighted mean $^{206}\text{Pb}/^{238}\text{U}$ age at 560.4 ± 4.4 Ma and 554.0 ± 4.2 Ma respectively.

The Rundvågshetta zircons in CL showed cores, black inner zone and differentiated inner and outer zones. The cores and the black inner zones gave 'high' (8.1-14.8) REE patterns on the basis of chondrite-normalised Yb-Tb ratio and the inner and outer regions gave 'low' (0.2-0.6) REE pattern. The Ti in zircon thermometry yielded 735°C to 858°C. The cores gave dispersed $^{206}\text{Pb}/^{238}\text{U}$ age between 2.5-2.4 Ga. The black inner zone gave a weighted mean $^{206}\text{Pb}/^{238}\text{U}$ age of 596 ± 11 Ma (n=6). The inner zone formed two groups to produce an older age of 556.3 ± 7 Ma (n=5) and a younger age of 532.0 ± 4.5 Ma (n=14). The outer zone also formed an older group at 549.0 ± 5.8 Ma (n=12) and a younger group at 533.3 ± 5 Ma (n=15). Monazite also gave $^{206}\text{Pb}/^{238}\text{U}$ age 586.1 ± 5.5 Ma while the $^{208}\text{Pb}/^{232}\text{Th}$ age was 580.1 ± 6.7 Ma (95% c.l.). Monazite also gave $^{206}\text{Pb}/^{238}\text{U}$ age 554.6 ± 7.2 while the $^{208}\text{Pb}/^{232}\text{Th}$ age was

544.7 ±7.2 (95% c.l.). Metamorphic monazite crystallized after metamorphic zircon. The above results enable us to understand the linkage between high temperature lower crust of eastern Gondwana. We compare and contrast the UHT conditions in each terrain and present a model of Gondwana correlation

Keywords: UHT metamorphism, Gondwana, Spr-Qtz