Chemical and isotopic features of mafic granulites from Serre massif (Calabria-Italy)

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Different types of mafic granulites characterize the lower crust of the Serre Massif (Calabria, Southern Italy). They consist of: layered metagabbros (Pl+Opx+Amph±Cpx±Bt±Qtz±Grt) and metric bodies of meta-monzogabbros (Pl+K-feld+Opx+Cpx+Bt±Qtz±Grt) at the base of the lower crust and lenses or layers of metabasites (Pl+Opx+Cpx±Bt±Amph±Qtz±Grt) interleaved with migmatitic metapelites and felsic granulites overlying the metagabbros. The magmatic protoliths are Neoproterozoic (~570 Ma), whereas the granulite-amphibolite facies metamorphism took place in Variscan times [1].

Metagabbros and metabasites are sub-alkaline (Na_2O+K_2O=1-5%) with K_2O<1%, whereas meta-monzogabbros show alkaline character (Na_2O+K_2O=5-7%) with K_2O around 3% reflecting the contents of biotite.

The meta-monzogabbros showing enrichment of incompatibile elements are interpreted as derived from small degree of partial melting of enriched mantle, probably as underplating magma in Neoproterozoic times. Subsequent or incremental mantle partial melting events produced melts with tholeiitic and calc-alkaline affinities forming the protoliths of metagabbros and metabasites.

The isotopic features (Sm-Nd, Rb-Sr) of metabasites reflect some crust contamination assisted by fluids derived from host metasediments. On the other hand, also the participation of biotite in the partial melting could account for the variation of Rb-Sr characteristics within the metagabbros and metabasites (Fig. 1).

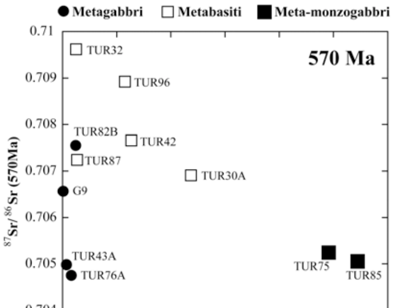

Fig. 1 Rb-Sr isotopic compositions of mafic granulites.

[1] Fornelli *et al.* (2011) *Mineral Petrol* **103**, 101-122.

Crustal evolution of the intracontinental Warburton–Cooper–Eromanga Basin system, central Australia

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The Warburton–Cooper–Eromanga basins host one of the most prospective hot dry-rock geothermal resources (Big Lake Suite granite; BLS) that stems from unusual enrichment in radiogenic elements (up to 144 ppm Th and 30 ppm U). The overlying Eromanga Basin is also endowed with substantial hydrocarbon reserves. Despite these attributes, holistic basin analysis has not been attempted leaving much of central Australia's crustal evolution poorly constrained. By conducting geochemical and geochronological analyses of primary, vein-hosted and authigenic phases, this study elaborates on its crustal evolution throughout the Palaeozoic and the influences on basin thermal and fluid flow events.

U–Pb (420 ± 6.7 Ma) and U–Th–total Pb (407 ± 16 Ma) of granite-hosted primary zircon and uraninite, respectively, provide coincident ages with Sm–Nd of carbonate veins (437 ± 17 Ma) of Warburton vein carbonates. Authigenic illite from Warburton sediments produce a Rb–Sr isochron age of 323.3 ± 9.4 Ma, consistent with previous U–Pb zircon ages estimating emplacement of the Big Lake Suite (Marshall *et al.* unpublished). Rb–Sr of granite-hosted clay fractions yield ages of 87.4 ± 4.9 Ma and 101.1 ± 6.4 Ma, in agreement with quartz encapsulated Ar–Ar total-gas ages of the same clay separates. Isotopically more robust Sm–Nd dating, however, produces older ages of 128 ± 16 Ma. Calculated $\delta^{18}O$ and δD fluid isotopic values are compatible with an influx of meteoric waters in an extensional environment.

Multifaceted analysis of primary and secondary phases produced geologically significant ages attributed to substantial thermal events throughout basinal evolution. Warburton Basin dates provide evidence of episodic magmatic activity associated with relaxation-related and back-arc extension. Dating of illite from the Cooper–Eromanga constrains intra-cratonic basin formation consistent with episodic rifting of Gondwana and opening of the Tasman Sea along the eastern margin of Australia [1]. Such consistency suggests plate-wide transmission of tensional stress to intra-continental crust weakened by abnormally high geothermal gradients, associated with the BLS, and preceding basinal tectonism [2].

[1] Bryan *et al.* (2012) *Episodes* **35**, 142–152. [2] Friedmann & Burbank (1995) *Basin Res.* **7**, 109–127.

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