Decompressional contamination of granite, Lachlan Orogen, Australia

C.D. QUINN

Geological Survey of NSW, Department of Primary Industries, PO Box 344 HRMC, NSW 2310, Australia
(cameron.quinn@dpi.nsw.gov.au)

Postulate

Decompression can assist assimilation of meta-sediment by granites at higher crustal levels.

Background

S-type granites in the Lachlan Orogen, SE Australia contain a substantive primitive component [1] and can, in some cases, be related to discrete, migmatitic, high-T and low-P (ca. 700 - 750ºC; 2.5 - 4 kbar) meta-sedimentary complexes [2,3]. Richards and Collins [2] inferred open-system or “transfer-zone” characteristics in one such complex, the Cooma Metamorphic Complex (CMC), with respect to proximal S-type granites and Healy *et al.* [3] illustrated a transition from I- to S-type chemistry approaching the CMC, alluding to proximal contamination of initially I-type magma. These points have been expanded by considering phase relationships in the CMC and near-anhydrous high-T, low P metapelitic enclaves in the unrelated S-type Cowra Granodiorite (CG).

Critical Observations and Inferences

Melt-present decompression textures can be inferred within the near-anhydrous metapelitic enclaves of the CG and within the CMC. Metapelitic enclaves in the CG are dominated by cordierite + sillimanite + spinel, separated from relict biotite and garnet porphyroblasts by cordierite. In the CMC; (1) cordierite and ilmenite replace relict sillimanite + biotite and (2) tourmaline overgrows sillimanite adjacent to leucosome. Cordierite and ilmenite-bearing parageneses indicate decompression from ca. 4 kbar to ca. 2.5 kbar whilst tourmaline-bearing parageneses indicate the involvement of B and late-stage melt in the CMC. B-absent, phase diagram calculations (after [4]) indicate both depression of the solidus to lower temperatures and significant melt generation (ca. 15-20 mol%) during near-isothermal decompression within that pressure range, thus assisting the assimilation of sediment.

[1] Collins W.J. (1996) *Trans. R. Soc. Edin.* **87,** 171-181. [2] Richards S.W. & Collins W.J. (2002) *J. Met. Geol.* **20,** 119-134. [3] Healy B., Collins W.J. & Richards S.W. (2004) *Lithos* **78,** 197-216. [4] White R.W. & Powell R. (2002) *J. Met. Geol.* **20,** 621-632.

Heterogeneity of the protoplanetary disk? The case of ^{60}Fe and beyond

G. QUITTÉ

Laboratoire de Sciences de la Terre, CNRS – ENS Lyon – Université de Lyon, 69364 Lyon Cedex 07, France
(Ghylaine.Quitte@ens-lyon.fr)

Excesses of radiogenic ^{60}Ni were first detected in the 90’s [1]. More recently many attempts have been made to apply the ^{60}Fe-^{60}Ni chronometer to various objects, with ambivalent results: while excesses and deficits in ^{60}Ni are indeed observed in some meteorites [e.g. 2-6], no consistent chronology emerges so far from all available data. The meaning of the excesses and deficits is debated, all the more because anomalies have also been reported for other Ni isotopes [4, 6, 7]. In some cases, Ni anomalies are correlated with other isotopes like ^{54}Cr [6] or ^{96}Zr [7] suggesting a nucleosynthetic origin and precluding the use of the ^{60}Fe-^{60}Ni system as a reliable chronometer.

To follow up our previous work on Ni isotopes, I analyzed ureilites and CB chondrites. Besides angrites, CB chondrites represent another good anchor to map short-lived chronometers onto an absolute timescale. The CB chondrite and ureilite results taken together with data previously obtained on eucrites, angrites, iron meteorites, chondrules and CAIs confirm that the Fe-Ni system cannot be used as an ubiquitous short-lived chronometer. It appears instead that ^{60}Fe was most likely heterogeneously distributed in the early solar system and that the latter was characterized by at least two isotopically different reservoirs, in good agreement with the heterogeneity already proposed for other elements [e.g. 8, 9]. An imperfect mixing of multiple nucleosynthetic sources is however difficult to reconcile with the conclusions of Boss [10] who calculated that radionuclides homogenized almost completely within 1000 years. The constraints brought by the meteorite data on the stellar environment of the sun’s birth as well as the solar nebula dynamics will be discussed at the conference.

[1] Shukolyukow & Lugmair (1993) *EPSL* **119**, 159-166. [2] Tachibana & Huss (2003) *ApJ* **588**, L41-L44. [3] Mosteafoui *et al.* (2005) *ApJ* **625**, 271-277. [4] Quitté *et al.* (2006) *EPSL* **242**, 16-25. [5] Cook *et al.* (2007) *LPSC* **38**, abstr. #2287. [6] Bizzarro *et al.* (2007) *Science* **316**, 1178-1181. [7] Quitté *et al.* (2007) *ApJ* **655**, 678-684. [8] Alexander & Carlson (2007) *Workshop on Chronology of Meteorites,* abstr. # 4046. [9] McKibbin S.J. *et al.* (2007) *Workshop on Chronology of Meteorites*, abstr. #4026. [10] Boss A. (2007) *ApJ* **660**, 1707-1714.