The Presolar Grain Inventories of Adelaide and Kakangari

CHRISTINE FLOSS* AND FRANK STADERMANN

Laboratory for Space Sciences and Physics Dept., Washington University, St. Louis, MO 63130, USA.
(*correspondence: floss@wustl.edu, fjs@wustl.edu)

Introduction

Presolar silicates are, apart from nanodiamonds, the most abundant type of stardust and have been found in several primitive meteorites (e.g., [1, 2]). Together with Acfer 094 and ALHA77307, the ungrouped C3 chondrite Adelaide and the K chondrite Kakangari have been characterized as primitive with pristine matrix material [3, 4]. We are investigating the latter two meteorites in order to evaluate their presolar grain inventories and the degree to which these have been affected by nebular and/or parent body processing.

Experimental and Results

We used the NanoSIMS to carry out ion imaging searches ($^{12}C^-$, $^{13}C^-$, $^{16}O^-$, $^{17}O^-$, $^{18}O^-$) [e.g., 2] in matrix material from both Adelaide (18,400 μm^2) and Kakangari (10,000 μm^2).

In Kakangari, we found one ^{13}C-rich grain (~9 ppm abundance). No O-anomalous grains were found (≤ 5 ppm abundance). In contrast, we found 22 O-anomalous grains (55 ppm abundance) in Adelaide. All but one belong to O isotope group 1; the remaining grain belongs to group 3 [e.g., 5]. Of ten C-anomalous grains in Adelaide (50 ppm abundance) seven are ^{13}C-rich and three are ^{12}C-rich.

Discussion

Both Kakangari and Adelaide have lower presolar silicate and oxide abundances than Acfer 094 and ALHA77307 (125–145 ppm) [1]. Kakangari, unlike the other three meteorites, contains no amorphous silicates in its matrix [6]. Amorphous silicates are common in two CR chondrites which also have high presolar silicate abundances [2], suggesting that secondary processing, leading to the recrystallization of matrix silicates, also destroys fragile presolar silicate/oxide grains. The intermediate presolar silicate/oxide abundances in Adelaide suggest that it experienced more processing than Acfer 094 and ALHA77307. Moreover, the distribution of presolar grains in this meteorite is highly variable between different matrix areas, possibly due to heterogeneous alteration on a mm-scale.

[1] Nguyen *et al.* (2007) *Astrophys. J.* **656**, 1223-1240. [2] Floss & Stadermann (2009) GCA, in press. [3] Scott & Krot (2005) *LPSC XXXVI*, #2007. [4] Nuth *et al.* (2005) In *Chondrites and the Protoplanetary Disk*, 675-700. [5] Nittler *et al.* (1997) *Astrophys. J.* **483**, 475-495. [6] Brearley (1989) *GCA* **53**, 2395-2411.

Two-way crust mantle interaction, The formation of some granites and of enriched mantle

JOHN FODEN

Department of Geology and Geophysics, University of Adelaide, Adelaide , South Australia

The standard paradigms of igneous petrogenesis recognise that magmas are generated by five potential physical mechanisms *viz*; hot mantle plumes, asthenospheric decompression during lithospheric rifting, solidus depression due to source hydration, post-collisional conductive heating of thickened continental crust and because of intra-crustal heating due to localised radioactive element concentration. Nevertheless it is clear that some well-known and often voluminous magmatic provinces are difficult to explain by any single one of these mechanisms. This is particularly the case where magmatism is taking place in trailing convergent margins such as those operating in eastern Gondwanaland in the western Pacific during the Palaeozoic and perhaps also the Late Proterozoic Pan African terrains. Specific magmatic provinces include the granites of the Cambro-Ordovician Delamerian- Ross-Cape (Saldanian) Orogens.

These terrains are characterised by periodic transitions from extension to contraction and by limited crustal thickening during convergence. Good evidence for subduction is often lacking. Felsic magmatism tends to occur during convergence and to extend into the post-tectonic stages. Mafic magmatism is present in the pre-convergent extensional phase, but is observed to continue weakly through the convergent stage. I- and S-type granites form synchronously with deformation. The cessation of deformation is accompanied by abrupt uplift and the onset of bimodal magmatism (A-type granite + contaminated mafic magmas) suggesting a sudden change in crustal buoyancy and influx of hot asthenosphere.

Modelling using isotopic, trace element and zircon inheritance constraints suggests that I- and S-type granites are formed by intra-crustal interaction with mantle melts. I-types involving AFC processes initiated from crustal mafic intrusioins, while S-types are purely intracrustal melts. A-types on the other hand seem to originate from contaminated upper mantle sources suggesting the role of lithospheric delamination. This process has left long-lived mantle contamination and became the source of the Jurassic Tasmanian-Ferrar-Karoo Lo-Ti tholeiite LIP.