Water storage in the Earth's mantle

N. BOLFAN-CASANOVA[1] AND ANAIS FÉROT

[1]Laboratoire Magmas et Volcans, CNRS, Université Blaise-Pascal, OPGC, Clermont-Ferrand France,
* correspondance : N.Bolfan@opgc.univ-bcpclermont.fr

Experiments were performed under water-saturated conditions in the MFSH and MFASH systems as a function of pressure and temperature from 2.5 to 13.5 GPa covering the whole depth range of the upper mantle. Water contents were analysed by Fourier transform infrared spectroscopy [1] and water values reported here use the new extinction coefficient for olivine [2]. The incorporation of Al enhances water incorporation in olivine and pyroxene, but only at pressures of 2.5 and 5 GPa. The partitioning of water between pyroxene and olivine is very high (4.4) at 2.5 GPa and below 1250°C, but decreases to an average value of 1.2+/-0.4 for higher pressures and temperatures. At 13.5 GPa and 1400°C, the water content of olivine is 1100±200 ppm wt H_2O. We conclude that the water storage capacity of the upper mantle just above the 410 km discontinuity can be anchored to ~900 ppm wt H_2O. If we interpret that the Low Velocity Layer observed near 350 km is due to mantle melting, we can constrain the water content of the mantle at that depth to be ~650±150 ppm wt H_2O. This new value is twice higher than previous estimates for the mantle source of Mid Oceanic Ridge Basalts but within the range of OIB sources.

[1] Férot A. and Bolfan-Casanova N.(2012), EPSL **349-350**:218-230. [2] Withers *et al*. (2012) Chem. Geol. **334**, 92-98.

Gujba age formation revisited : a possible use as time anchor

J. BOLLARD[1], J.N. CONNELLY[1] AND M. BIZZARRO[1]

[1]Centre for Star and Planet Formation, University of Copenhagen, Øster Voldgade 5-7, Copenhagen K, 1350 Denmark

The meteorite Gujba is a primitive CBa carbonaceous chondrite (Bencubbin-type) that differs markedly from common chondrites. It displays a high metal abundance (metal/silicate ~1.7-3), a depletion in volatile elements, a quasi absence of CAIs and matrix, and large silicate chondrules (up to one cm) [1]. Metal and silicates are proposed to have both formed by condensation in a high temperature environnement, as completely molten droplets and both exhibit quench textures. These features suggest a formation from a vapour-melt plume produced by a giant impact between planetary embryos after dust in the protoplanteray disk had largely dissipated [2]. This supposed formation in a single event followed by a rapid cooling predicts that all chronometric systems closed at the same time such that Gujba is an ideal candidate to anchor the short-lived chronometers onto an absolute timescale.

We have undertaken a project to date individual Gujba chondrules, using the precise assumption-free U-corrected Pb-Pb dating method [4,5] to first confirm the single-event formation model and refine its absolute age.

Five cm-sized chondrules from a single slab of Gujba have been extracted and characterized by SEM. Three of them have been processed by a stepwise dissolution method [4]. Using a ^{202}Pb-^{205}Pb double spike, we analyzed the Pb isotopic composition by thermal ionization mass spectrometry to obtain well-constrained internal isochrons on single chondrules. For now, ages were calculated using the $^{238}U/^{235}U$ ratio of 137.786±0.013 that was determined by [5] for inner solar system materials except CAIs.

Three chondrules have been dated with ages that range from 4562.61±0.28 to 4562.32±0.48 Myr, with a weighted average of 4562.52±0.44Myr. This is ca 1 Myr older than previously published absolute Pb-Pb age [2], when it is adjusted for a U isotopic composition of 137.786. If the adjusted-age from [2] is correct, this discrepency could suggest different populations of chondrules within Gujba, which, in turn, requires a new formation model.

[1] Rubin A.E. (2003) *GCA*, **67**, 3283 [2] Krot A.N. *et al*. (2005) *Nature*, **436**, 989 [3] Yamashita K. *et al*. (2010) *APJ*, **723**, 20 [4] Connelly J.N. & Bizzarro M. (2009) *Chem. Geol*., **259**, 143 [5] Connelly *et al*. (2012) *Science*, **358**, 651.

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