Micro-Raman spectroscopic study on Ararki (L5) chondrite

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We present here the Micro Raman spectroscopic characterization of Ararki (L5) Chondrite. The mineralogical and chemical composition data of the Kaprada meteorite have been discussed elsewhere [1]. Laser–Raman spectra of chromites from Ararki chondrites show characteristic peaks of natural chromites in the region 400 to 800 cm^{-1} with A1g mode at 700 cm^{-1} yielding the composition Cr# of about 87, which in excellent agreement with the EPMA data. There is a well known correlation occurs between the A1g mode and the composition of the chromites. Viz., the highest frequency band shifts from 685 cm^{-1} for high chromium content to 770 cm^{-1} for Al-rich end in natural chromites. The equilibration temperature is determined by the composition of the few grains of chromite by adopting the method described by Wlotzka [2]. Ararki meteorite showed the chromite composition with Fe # 100 X{Fe/(Fe+Mg)} = 87 to 89 Cr# 100 X {Cr/(Cr+Al)}= 86 to 87, which yielded the equilibration temperature of be about 730 to 750 °C. Olivine in L6 chondrite is used to determine the residual stress present in the meteorite [3] The residual stress in the olivine is estimated by using the Raman line at 820 cm^{-1}, and is found to be about 300 MPa for the Ararki meteorite.

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[1] Bhandari N, *et al*., 2008, *Meteoritics and Planetary Science* v **43**, 761-770. [2] Wlotzka F , 2005, *Meteoritics and Planetary Science* **40**, 1673. [3] Miyamoto M, 1995, *Geophys. Res. Lett* **22**, 437-440.

Experimental study of solid-state ^{13}C-^{18}O bond reordering in calcite

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The carbonate clumped isotope thermometer is based on the relative abundance of ^{13}C-^{18}O bonds in carbonate minerals, and thus it is important to understand the temperatures and conditions where solid state ^{13}C-^{18}O bond reordering occurs on geologically short timescales. This is relevant to the preservation of primary signals in paleoclimate applications, as well as applications in the intermediate temperature realm (ca. 50 – 300°C) relevant to diagenesis, hydrothermal mineralization, and basin evolution [1]. I present results from heating experiments designed to deduce Arrhenius parameters and 'closure temperatures' for the ^{13}C-^{18}O order/disorder process in calcite. Carrara marble heated at 500°C and 600°C under dry conditions is measurably changed in 'clumped isotope' distribution on timescales of hours to days (Figure 1). The Δ_{47} values of CO_2 extracted from carbonate fail to reach equlibrium values predicted by the theoretical temperature scale of Guo *et al*. [1] (0.26 to 0.25‰), possibly indicating incomplete approach to equlibrium, a non first-order rate law, or other factors. Continuing work will address these questions with additional experiments over an extended the range of temperatures and time durations.

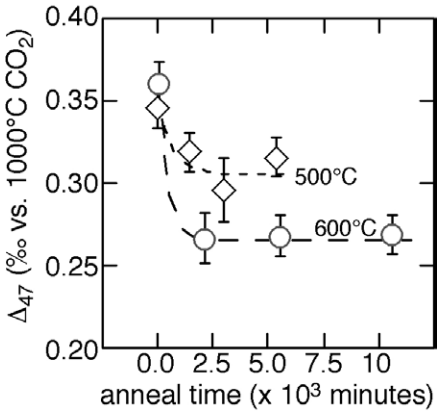

Figure 1: Δ_{47} values of Carrara marble samples heated at 500 and 600°C in the presence of dry CO_2 gas in sealed quartz tubes. Dashed lines are first order reaction progress models. The mean value for unheated Carrara marble is 0.352‰.

[1] Eiler *et al*. 2009 *GCA* **73**, A3222. [2] Guo *et al*. 2009 *GCA* **73**, 7203-7225.