DEPLETION OF VOLATILES AND TIMING OF HEATING RECORDED IN THERMALLY METAMORPHOSED HYDROUS CARBONACEOUS CHONDRITES.

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Introduction: Many hydrous carbonaceous chondrites experienced heating and dehydration (e.g., [1]) while others, such as Murchison (CM) seem not to have been heated. The carbonaceous chondrites PCA02012 [2], B7904 [3], and Dho735 [4] belong to the former group. We carried out: mineralogical observations of the three meteorites; INAA of PCA02012; stepwise-heating noble gas analysis of PCA02012 and Dho735; and ⁴⁰Ar/⁴⁰Ar analyses of all three meteorites. The purpose was to understand effects of heating on the abundance of mobile elements and noble gases and on the K-Ar and Ar-Ar age dating.

Results and discussion: SEM observation indicates that all three meteorites experienced aqueous alteration, but the degree of alteration varies among the meteorites. Dho735 is the most altered with most parts of chondrules replaced by phyllosilicates; PCA02012 and B7904 retain chondrules almost unaltered. Synchrotron XRD analysis indicates that matrices of the three meteorites consist mainly of secondary olivine and low-Ca pyroxene that were produced from phyllosilicates by heating at 700-900°C [1, 2]. INAA gave concentrations of 27 elements in PC02012: refractory and moderately volatile elements are similar to those in unheated CM samples, but some volatile elements such as Na, Zn, and Br are depleted. Step-heating noble gas analysis of PCA02012 and Dho735 showed that concentrations of heavy primordial noble gases such as ³⁶Ar, ⁸⁴Kr and ¹³²Xe released at temperatures lower than 910°C are very low, suggesting degassing by heating on asteroids at ~900°C. The integrated ⁴⁰Ar/³⁹Ar ages for B7904, PCA02012 and Dho735 are ~2.08 Ga, ~1.59 Ga, and 1.21 Ga, respectively. They are similar to those of other CM chondrites, but younger than that of Murchison (3.12 Ga, [5]). All three samples lost some radiogenic ⁴⁰Ar and have similar Ar age spectra: as release temperatures increase, the apparent ages mostly decrease steadily from maxima of 2-4 Ga to minima of 0.4-0.7 Ga. This may be from either that ⁴⁰Ar was degassed (or reset) during heating event, then later supplemented by terrestrial weathering, or that ⁴⁰Ar was re-distributed from higher temperature release materials to those of low temperature without any ⁴⁰Ar loss.