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Low Temperature Annealing and Cathodoluminescence Studies of Type I Chondrule Compositions. J.M. DeHart and G.E. Lofgren, Mail Code SN2, Johnson Space Center, Houston, TX 77058

INTRODUCTION: Although there are many criteria available to determine if ordinary chondrites have been subjected to moderate and high temperatures during metamorphism, low level thermal alteration has been difficult to assess. It has been shown that the Cathodoluminescence (CL) properties of the minerals and glasses in ordinary chondrites change rapidly in response to low level thermal metamorphism (1). The refractory-rich mesostasis in type I chondrules appears to be especially sensitive to low level thermal alteration. These mesostases emit yellow CL in Semarkona (3.0) but produce white then blue CL in ordinary chondrites of increasing petrologic subtype. We have previously shown that yellow CL of type I chondrule mesostases forms during crystallization (2). It is still uncertain, however, whether the differences in CL properties of type I chondrule mesostases in meteorites of differing metamorphic subtype is a consequence of their metamorphic reheating or due to subtle differences in the chondrules' crystallization history. In order to determine if these types of mesostases can be altered by increasing temperatures, we have conducted a series of annealing experiments at low temperatures.

EXPERIMENTAL: Three series of experiments have been conducted using 1 mm slices of the previous experiments in (2) that produced yellow CL or from charges that have been heated and cooled under the same conditions. The first series of experiments consisted of samples annealed in a Thermolyne oven at 200°C and 500°C for 150 hours. In the second series of experiments, samples were sealed in gold capsules with 45 uL of deionized water and annealed at 100°C, 200°C and 350°C for 250 hours in externally heated pressure vessels. A third series of experiments were conducted with a solution of .1 M sodium metasilicate and annealed at the same conditions as the second series of experiments. CL photographs of the sections were made before and after each experiment using a Nuclide Luminoscope and a 35mm camera.

OBSERVATIONS: CL photos of the mesostases in the sections before annealing all had bright homogeneous regions of bright yellow CL. The first series of experiments failed to change the CL from the glasses. A sample from the second series of experiments did show changes in the CL. In the section annealed at 200°C with distilled water had changed from a bright, homogeneous yellow to a dull yellow to yellow brown luminescence. This sample also had small pockets of mesostases in the altered areas where the bright yellow luminescence remains.

CONCLUSIONS: These preliminary results indicate the yellow luminescing mesostases in type I chondrules can be altered by the effects of low level thermal metamorphism. Although heat alone was insufficient to alter the CL, reheating for geologically relevant periods could have the same results as we obtained in the second series of experiments with water present. It is known that both water and solutions of sodium metasilicate greatly accelerate the devitrification of glasses. The results of the experiments that will be repeated should further clarify how the CL changes with increased thermal alteration.

References: (1) DeHart J. M. and Sears D W G (1986) **LPS XVII**, pp 160-161. (2) DeHart J. M. and Lofgren G. E. (1991) **LPS XXII**, pp 291-292.