THE VALENCE STATE OF IRON IN CM2 CHONDRITE SERPENTINE

M. Zolensky[1*], T. Mikouchi[2], W. Satake[2], L. Le[3], [1]Astromaterials Research and Exploration Science, KT, NASA Johnson Space Center, Houston, TX 77058, USA. [2]Department of Earth and Planetary Science, University of Tokyo, Tokyo 113-0033, Japan. [3]Jacobs ESCG, Houston, TX, 77068 USA. [*]E-mail: michael.e.zolensky@nasa.gov

Introduction: Iron-bearing phyllosilicates are the dominant product of aqueous alteration in meteorites, and serpentine is the most abundant phyllosilicate in the most abundant carbonaceous chondrite – the CM2 chondrites [1,2]. Exact knowledge of the valance state of iron in chondrite serpentine will shed new light on the conditions attending aqueous alteration in the early solar system. Thus in proposing her alteration index for CM chondrites, Browning made predictions of the ratios of ferric to ferrous iron that would be found in CM chondrite serpentine, and the manner in which this ratio should change with progressive alteration [3]. We have begun our long-term investigation with three CMs that span a large portion of the range of observed aqueous alteration– Murray (moderate alteration), Nogoya (moderate to heavy alteration), and ALH 84019 (nearly complete alteration). Murray and Nogoya are falls, and ALH84029 is a find exhibiting minimal terrestrial alteration. We located typical serpentine crystals in each chondrite which were (1) Mg rich and (2) others that were Fe rich, using the electron microprobe. We then obtained synchrotron XANES analyses of the $Fe^{3+}/\Sigma Fe$ ratios of each of these serpentines for the three chondrites, at Beamline 4A of the KEK Photon Factory in Tsukuba, Japan. We currently have only the initial results of the first XANES dataset.

Results and Discussions: Browning predicted increasing Fe^{2+} in serpentine with progressive aqueous alteration, and that is only roughly what we observe. Preliminary analysis of the XANES spectra suggest that 80-90% of the iron in serpentine in both Murray and Nogoya is Fe^{3+}, compared with 20-90% in ALH 84029 (these preliminary values are +/-10%). As expected, the most Mg-rich serpentine in ALH 84029 has the lowest $Fe^{3+}/\Sigma Fe$. We do not yet see a significant difference between Murray and Nogoya serpentine, and we probably should. It is also unexpected that the value of $Fe^{3+}/\Sigma Fe$ in Murray and Nogoya serpentine does not depend on the Fe/Mg ratio. However, we are at a preliminary stage of the investigation; we expect that once we examine many more CMs, including the CM1 lithology in Kaidun, and the minimally altered CM Kivesvaara, more definite trends will emerge.

References: [1] McSween H. 1987. *Geochimica et Cosmochimica Acta* **51**, 2469-2477. [2] Zolensky M. et al. 1993. *Geochimica et Cosmochimica Acta* **57**, 3123-3148. [3] Browning L. et al. 1996. *Geochimica et Cosmochimica Acta* **60**, 2621-2633.