D/H ZONING IN APATITE OF MARTIAN METEORITES QUE 94201 AND LOS ANGELES: IMPLICATIONS FOR WATER ON MARS.

J. P. Greenwood[1], S. Itoh[2], N. Sakamoto[3], E.P. Vicenzi[4], H. Yurimoto[2,3]. [1] Dept. E&ES, Wesleyan University, Middletown, CT 06459 E-mail: jgreenwood@wesleyan.edu. [2]Natural History Sciences, Hokkaido University, Sapporo, Japan, 060-0810, [3]CRIS, Hokkaido University, Sapporo, Japan 060-0810, [4]Museum Conservation Institute, Smithsonian Institution, Suitland, MD 20746.

Introduction: D/H variations in hydrous minerals of SNC meteorites can provide information regarding the history of fluids associated with these rocks, and by extension, can also give insight regarding the history of water on Mars [1-4]. Previously, we found evidence for D/H ratios that evolved to higher D content during magmatic crystallization of apatite in Los Angeles. This isotopic shift was correlated with apatite chemistry in one apatite grain from UCLA 748 from a fluorine-rich core to a more chlorine-rich rim [1]. We also found a grain with pronounced core-to-rim zoning from a fluorine-rich core to a chlorine-rich rim that displayed no such zoning in D/H in Los Angeles UCLA 750. Here we present results of zoning in two more apatite grains in Los Angeles and 2 apatite grains in QUE 94201.

Los Angeles: We studied two grains in Los Angeles UCLA 746 that had obvious core-to-rim zoning when imaged with cathodoluminescence (CL). In order to minimize potential electron beam damage (such as mobilizing H, D, or F), we use CL and BSE imaging prior to ion microprobe analysis, and then using quantitative EPMA after ion microprobe analysis. The two apatite grains of UCLA 746 were found to be zoned in D/H but in the opposite fashion to our previous work on UCLA 748, i.e. they were zoned from high D/H cores to low D/H rims [(UCLA746m8: F-rich core: δD=+4255±72‰; Cl-rich rim: δD=+2912±42‰)(UCLA746m7: F-rich core: δD=+4646±52‰; 'mantle': δD=+3964±62‰; rim: δD=+3554±40‰)]. Thus, we appear to have found evidence for low δD fluids that interacted with the Los Angeles parent magma during late-stage crystallization of apatite. We now see both zoning to D-rich and D-poor rims on apatite, and no zoning of D/H in another apatite grain of Los Angeles.

QUE 94201: We studied two apatite grains in two thin-sections of QUE 94201 (,6 and ,46). The apatite grain in QUE 94201,6 is chlorine-rich and does not display evidence for zoning in CL. The apatite grain in QUE 94201,46 is larger, and has several fluorine-rich areas, suggesting a complex growth history, possibly involving nucleation of several early fluorine-rich grains that later grew into each other to form one large complexly zoned grain. We were able to analyze one fluorine-rich area and two chlorine rich areas in this apatite grain. The fluor-apatite region had a δD = +4222±96‰ (2σ), the highest value we measured in QUE 94201. The two chlor-apatite regions were significantly lower (δD = +3505±72‰ and +3029±60 (2σ)).

Conclusions: We see zoning in QUE 94201 and Los Angeles that supports the idea that low δD fluids interacted with the shergottite magmas during late-stage apatite crystallization. Coupled with our previous work [1], this suggests that D-poor and D-rich fluids were interacting with the shergottite magmas during the latest stages of crystallization.

References: [1] Greenwood J. P. et al., 2008. *GRL* 35:L05203, doi:10.1029/2007GL032721. [2] Watson L. L. et al. 1994. *Science* 265, 86. [3] Leshin L. A. 2000. *GRL* 27:2017. [4] Boctor N. et al. 2003. *GCA* 67: 3971.