EVIDENCE FOR DISTINCT OXYGEN ISOTOPIC RESERVOIRS ON THE L CHONDRITE PARENT BODY.

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The oxygen isotopic compositions ($\delta^{17}O$ and $\delta^{18}O$) of water in two ordinary chondrites of similar composition and petrologic type, Bjurböle (L/LL4) and ALHA77216 (L3.7-3.9), have been measured and are presented here.

Methods: Water was extracted by vacuum pyrolysis from samples of the Bjurböle and ALHA77216 meteorites on a low volume, ultra low blank system that was built specifically for these measurements. Each crushed rock sample was pumped overnight on a vacuum line to remove adsorbed terrestrial water before heating step-wise to 150, 350, 600 and 1000°C. While heating, evaporated volatiles were collected in a liquid nitrogen cold trap. Water was quantitatively converted to molecular oxygen with bromine pentafluoride. Isotopic abundances were measured on a double-collecting isotope ratio mass spectrometer.

Discussion: Previous studies involving direct fluorination of whole rock samples of L chondrites have revealed their oxygen isotopic compositions possess a narrow range of $\delta^{17}O$ and $\delta^{18}O$ values [1]. Water contained in Bjurböle and ALHA77216 possesses $\delta^{17}O$ and $\delta^{18}O$ values dissimilar to the surrounding rock, indicating water and rock did not equilibrate [2]. The $\Delta^{17}O$ values of bulk rock and water in Bjurböle and ALHA77216 are similar and could reflect processing subsequent to formation that fractionated isotopes similarly. The proximity of $\Delta^{17}O$ values of water extracted at lower temperatures to zero and the deviation of $\Delta^{17}O$ values of higher temperature water fractions from zero indicates low-temperature heating effectively removes adsorbed terrestrial water and higher temperature heat steps liberate extraterrestrial water. The isotopic similarity of water liberated by low temperature heating to that of terrestrial water also confirms the experimental procedure induces no non-mass-dependent fractionation of oxygen isotopes and confirms the water containing non-mass-dependently fractionated oxygen ($\Delta^{17}O \neq 0$) extracted with higher temperature heating is extraterrestrial. Distinct $\delta^{17}O$ and $\delta^{18}O$ values of the bulk rock and water in Bjurböle and ALHA77216 imply the L chondrite parent body possessed at least two oxygen isotopic reservoirs.

References: [1] Clayton R. N. et al. 1991 *GCA* 55:2317-2337. [2] Nunn M., Thiemens M. H. 2011 Abstract #5438. 74th Annual Meteoritical Society Meeting.