

OXYGEN ISOTOPES OF AL-RICH CHONDRULES FROM UNEQUILIBRATED ORDINARY CHONDRITES.

W. Hsu¹, Y. Guan², Y. Jiang¹, and Y. Wang¹. ¹Purple Mountain Observatory, Nanjing, China. E-mail: wbxu@pmo.ac.cn. ²GPS, Caltech, Pasadena, CA 91125.

Al-rich chondrules (ARCs) are a rare constituent of chondrites. They have relatively high bulk Al_2O_3 content (> 10 wt%), which is due to the presence of Al-rich phases, such as plagioclase, spinel, Al-rich glass etc. [1]. ARCs share some chemical and petrologic characteristics with Ca, Al-rich inclusions (CAIs), and may represent a genetic link between ferromagnesian chondrules and CAIs.

Twelve ARCs were found in unequilibrated ordinary chondrites (UOCs) GRV 022410 (H4), GRV 052722 (H3.7), GRV 020104 (H3.4), GRV 050016 (H3.7), GRV 050009 (H3.6), and Julesburg (L3.6) [2]. They contain bulk $\text{Al}_2\text{O}_3 \sim 16$ -33 wt% and exhibit igneous textures comprised of olivine, diopside, plagioclase, spinel, and glass. *In situ* SIMS analyses show that ARCs have oxygen isotopic compositions ($\delta^{18}\text{O} -6.1\text{‰} \sim 7.1\text{‰}$; $\delta^{17}\text{O} -4.5\text{‰} \sim 5.1\text{‰}$) close to ferromagnesian chondrules but far more depleted in ^{16}O than CAIs ($\delta^{18}\text{O} \sim -40\text{‰}$; $\delta^{17}\text{O} \sim -40\text{‰}$). Most ARCs plot close to the TF line, and a few between the TF and CCAM lines. All ARCs define a line with a slope of $\sim 0.79 \pm 0.07$. They are ^{16}O -poor relative to their counterparts in [3] but similar to those in [4]. The oxygen isotope data indicate that ARCs from UOCs do not represent a simple mixing product of ferromagnesian chondrules and CAIs. Instead, they probably experienced higher-degree oxygen isotopes exchange with ^{16}O -poor nebular gas reservoir during multiple heating events.

References: [1] MacPherson G. J. and Huss G. R. 2005. *Geochim. Cosmochim. Acta* 69:3099-3127. [2] Jiang Y. and Hsu W. 2009. *Chinese J. Polar Sci.*, 20:135-150. [3] Russell S. S. et al. 2000. *Earth Planet. Sci. Lett.* 184:57-74. [4] Nagahara H., et al. 2009. *Geochim. Cosmochim. Acta* 72:1442-1465.

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