TREND OF THE MAJOR PRIMARY OXYGEN ISOTOPE RESERVOIRS IN THE EARLY SOLAR NEBULA INFERRED FROM ALLENDE CV3 METEORITE.

I. Jabeen[1], A. Ali[2] and M. Kusakabe[1,3], [1]Institute for Study of the Earth's Interior (ISEI), Okayama University, Misasa, Tottori 682-0193, Japan (ijabeen67@gmail.com), [2]Earth Sciences Research Centre (ESRC), Sultan Qaboos University, Oman (arshadali@squ.edu.om), [3]University of Toyama, 3190 Gofuku, Toyama-shi, 930-0855, Japan.

.

Introduction: Primitive chondritic meteorites derived from asteroids provide direct constraints on the early solar nebular composition. The slope-1 lines on an oxygen isotope diagram have been reported to describe the primitive oxygen isotope reservoirs based on the analyses of various chondritic materials [1-3]. These lines include equilibrated chondrite line (ECL) [1], Allende anhydrous mineral line (AAML) [2], and primitive chondrule minerals (PCM) line [3]. We used the oxygen isotopic compositions of the nebular gas reservoir in the early solar nebula that has been estimated from the Allende bulk chondrule (ABC) line [4] to propose a slope-1 line termed as gas-solid mixing (GSM) line (Fig.1).

Methodology: A line is constructed from the oxygen isotope values derived by mixing the ^{16}O-rich solid component (i.e., CAIs; $\delta^{17}O$ = -41.9 ‰, $\delta^{18}O$ = -40.6 ‰) analyzed by [2] and ^{16}O-poor gas component (i.e., $\delta^{17}O$ = 23.6 and 24.4‰; $\delta^{18}O$ = 25.0 and 26.5‰) estimated by [4] using the C/O = 0.5 [5] and = 0.8 [6] ratios respectively. Isotopic values were calculated by mixing gas: solid components with 1% increment in the gas component (i.e., 1:99 to 99:1).

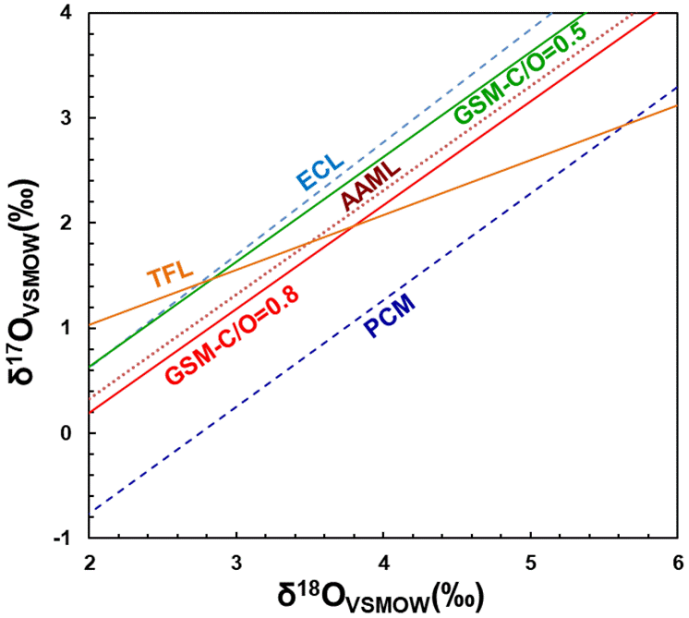

Figure 1. Three oxygen isotope diagram showing ECL [1], AAML [2], PCM [3], and GSM lines. Terrestrial fractionation line (TFL) is shown for reference [7].

Results and Discussion: The lines are almost indistinguishable in terms of their slopes (i.e., AAML = 0.992, PCM = 0.987±0.013, GSM-C/O=0.5 = 0.999, and GSM-C/O=0.8 = 0.998) with the exception of a slightly steeper ECL (e.g., 1.074), however, intercepts are variable among all the lines (i.e., AAML = -1.66‰, PCM = -2.70±0.11‰, GSM-C/O=0.5 = -1.36‰, GSM-C/O=0.8 = -1.78‰, and ECL = -1.53‰). Further, AAML, PCM, ECL, GSM-C/O=0.5, and GSM-C/O=0.8 lines intersect the TFL at $\delta^{17}O$ & $\delta^{18}O$ values of 1.8‰ & 3.5‰, 3.0‰ & 5.8‰, 1.4‰ & 2.8‰, 1.5‰ & 2.8‰, and1.9‰ & 3.7‰ respectively. Note that both GSM-C/O=0.5 (based on carbonaceous meteorite) and ECL (based on non-carbonaceous meteorites) lines insect the TFL at nearly the same point regardless of the difference in their slopes. We interpret our GSM-C/O=0.5 line as the mixing trend of the major primary oxygen isotope reservoirs.

Conclusions: Both carbonaceous and non-carbonaceous chondrite components show a close relationship on the oxygen isotope diagram demonstrating that the primitive oxygen isotopic reservoirs in the early solar nebula probably had nearly identical trend. We interpret GSM-C/O=0.5 line as the mixing trend of extreme primitive reservoirs.

References: [1] Clayton R. N. et al. 1991. *Geochimica et Cosmochimica Acta* 55:2317-2337. [2] Young E. D. and Russell S. S. (1998) *Science* 282:452-455. [3] Ushikubo T. et al. 2012. *Geochimica et Cosmochimica Acta* 90:242-264. [4] Jabeen I. et al. 2018. *Meteoritics & Planetary Science* under review. [5] Prieto C. A. et al. 2002. *The Astrophysical Journal* 573:L137-L140. [6] Onuma N. et al. 1972. *Geochimica et Cosmochimica Acta* 36:169-188. [7] Ali A. et al. (2013) LPS XLIV, Abstract #2873.