OXYGEN ISOTOPE VARIATION AT NANOMOLAR CARBONATE IN THE CM2 CARBONACEOUS CHONDRITES. Shin TSUTSUI[1] and Hiroshi NARAOKA[1]. [1]Department of Earth and Planetary Sciences, Kyushu University, Japan. E-mail: stsutsui@geo.kyushu-u.ac.jp.

Introduction: Carbonaceous chondrite is one of the most primitive meteorites that had experienced aqueous alteration on the parent body. During aqueous alteration, carbonates have been formed as a secondary product from other carbon-bearing materials. Carbonates in carbonaceous chondrites occur by up to ~0.3 wt% of the whole-rock sample with the ^{13}C-enriched composition (+20 to +80‰, VPDB: [1]). Although the aqueous temperature on the parent body alteration is estimated from δ^{18}O value of carbonate, the δ^{18}O value of carbonate in meteorites is highly heterogeneous. As the carbonate is likely to occur in different mineral textures in carbonaceous chondrites [2], we have measured amount and isotope distributions of carbonate in different textures for sub-mm scale in this study to discuss the carbonate occurrence with respect to textural and environmental conditions of the meteorite parent body.

Sample and Analytical Procedures: A piece of three CM2 carbonaceous chondrites (Murchison, Murray and A881458) was drilled to obtain powder samples (~0.5 to ~2.0 mg) selectively from multi-points of the following three texture types under microscope: 1) black area (mainly matrix), 2) white area (mainly CAI and/or chondrule), 3) boundary area between 1) and 2). The samples were reacted with 100% phosphoric acid at 25 °C for 18 hours to extract CO_2 from carbonate (calcite). After cryogenic purification, carbon and oxygen isotopic analyses of the CO_2 were conducted by gas chromatography/isotope ratio mass spectrometry. Our developed isotope analysis gives analytical error (1σ) of oxygen isotope ratios of ±0.7‰ at more than 0.8 nmol of CO_2 gas.

Results and Discussion: The carbonate content in Murchison ranges from 3 to 90 ppm C with the δ^{18}O value of +32 to +40‰ (VSMOW) in this study. This range of carbonate content is lower than that of previous reports (80 to 2260 ppmC, [1] [3] [4]). This result suggests different extent of aqueous alteration or heterogeneity of precursor materials of the carbonates in the meteorite. Although there is no significant δ^{18}O difference between three texture types, the δ^{18}O value has an apparent correlation with δ^{13}C value. Using an isotopic fractionation factor between calcite and water [5], the alteration temperature is estimated about 20 to 70 °C for Murchison, which is consistent with the previous study [6]. As it seems unlikely that such a large temperature difference (~50 °C) had been subjected at the same time for mm scale, this result may indicate lateral change in aqueous temperature during carbonate precipitation or isotopic heterogeneity resulting from brecciation of different source materials in mm scale.

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