

ABUNDANT ANOMOLOUS CHONDRULES IN AN UNGROUPED CARBONACEOUS CHONDRITE, Y-82094.

M. Kimura¹, A. Yamaguchi², N. Imae², T. Mikouchi³, and M. K. Weisberg^{4,5}. ¹Ibaraki University, Japan, e-mail: makotoki@mx.ibaraki.ac.jp, ²National Institute of Polar Research, Japan, ³ University of Tokyo, Japan, ⁴Kingsborough College and Graduate Center of the City University of New York, ⁵American Museum of Natural History, USA.

Introduction: Yamato-82094 contains abundant chondrules (78 vol.%), much higher than any C chondrites. However, refractory inclusions are common (8 %), and the bulk composition resembles those of CO chondrites, except for the volatile elements. The oxygen isotopic composition of Y-82094 is within the range of CO and CV chondrites. Therefore, Y-82094 is an ungrouped C chondrite with unusual features, and the petrologic type is 3.2 [1]. Here we report chondrules in Y-82094, showing anomalous features.

Results and discussion: Porphyritic chondrules (mainly type I) are the most abundant (97.5 %) chondrule type. Type II chondrules are much rare (0.9 %), compared with other C chondrites. Another characteristic feature is the common occurrence of silica grains in the mesostases of many Type I chondrules. They are cristobalite. Several porphyritic chondrules contain aluminian low-Ca pyroxene (ALPx) as phenocrysts, containing up to 14.1 wt.% Al₂O₃. They occur with olivine, low-Ca pyroxene and spinel surrounded by an anorthitic devitrified mesostasis. A porphyritic chondrule contains cordierite (based on its composition), occurring with ALPx and spinel surrounded by an anorthitic mesostasis. Its chemical formula is Na_{0.19}Mg_{1.95}Fe_{0.02}Al_{3.66}Si_{5.19}O₁₈. We are going to identify this phase by EBSD. Type I chondrules contain 0.3-4.2 wt.% FeO in bulk composition. Some chondrules, often containing ALPx and cordierite, have >10 wt.% Al₂O₃. They are Al-rich chondrules.

We observed no any evidence for the secondary reduction on the parent body. Therefore, the low abundance of Type II chondrule is a primary feature resulting from chondrule formation in a reducing nebular reservoir. Cristobalite is encountered even in chondrules containing normative olivine in bulk composition. Thus, it crystallized during extreme fractional crystallization. ALPx is a metastable phase, because protoenstatite contains <1.75 wt.% Al₂O₃ under low-pressure conditions [2]. It should have formed without equilibrium anorthite crystallization [3]. It is probable that the abundant chondrules in Y-82094 formed during rapid cooling under reducing conditions. Abundant anomalous chondrules in Y-82094 may indicate that the formation conditions for chondrules vary widely among chondrite groups.

References: [1] Kimura M. et al. 2012. *Meteoritics & Planetary Science* 47: 5084.pdf. [2] Onuma K. and Arima M. 1975. *Jour. Japan. Assoc. Min. Pet. Econ. Geol.* 70: 53-60. [3] Rubin A. E. 2004. *American Mineralogist* 89: 867-872.