MINERALOGICAL DESCRIPTION OF PRE 95404: A RUMURUTI CHONDRITE THAT INCLUDES A LARGE UNEQUILIBRATED CLAST. N. Imae[1] and M. E. Zolensky[2], [1]Antarctic Meteorite Research Center, National Institute of Polar Research, 9-10 Kaga 1-chome, Tokyo 173-8515, Japan, [2]NASA JSC, SN2, Houston, Texas 77058, USA.

Introduction: Rumuruti chondrites (R chondrites) are characterized by highly oxidized olivines [e.g., 1-3]. However, R chondrites are distinguished from CK chondrites, which are also oxidized chondrites, because there are no magnetites in R chondrites. Since the number of Rumuruti chondrites is limited, the understanding of the petrogenesis of these materials is limited (e.g., formation in an oxidized nebula or parent body oxidation). A limited number of unequilibrated R chondrites or clasts have been previously reported [3]. In the present study, we describe the mineralogy and petrology of a new Antarctic unequilibrated R chondrite, PRE 95404.

Experiments and results: We used an optical microscope and JXA-8800 EPMA for the present study. A polished thin section (PTS) of PRE 95404 indicates that it is a breccia consisting of two lithologies; unequilibrated (3) and equilibrated (>4).

We obtained the chondrule size distribution (range: 110~900 μm) and the volumetric chondrule/matrix ratio from the PTS. The average chondrule diameter is ~300 μm and it is larger than that of CO3 and smaller than that of ordinary chondrites [4]. The abundance of chondrules (chondrule/matrix ratio) for R chondrites is lowest among chondrites. Fa composition of olivines in chondrules in the R3 clast ranges from Fa_5 to Fa_{40}. On the other hand, that in the R>4 clast is nearly homogeneous, $Fa_{38\text{-}40}$. Olivines include variable proportions of NiO 0~0.3 (wt%). Low Ca pyroxenes and high Ca pyroxenes are both present. Sulfides consist of pyrrhotite ($Fe_{1-\delta}S$; $\delta = 0.01\sim0.10$) and pentlandite, and mainly occur as opaque chondrules. Opaque chondrules are commonly smaller than silicate chondrules. No metals are present in the PTS.

Discussions: The fact that no metals can be found, and both Fa and Fs contents are higher in the rims of individual mineral grains than those in ordinary chondrites suggests that PRE 95404 experienced higher oxygen fugacity than the ordinary chondrites. Where did these materials experience higher oxygen fugacities: in the nebula, on the parent body, or in both locations? On the parent body, oxidation may occur just in the lithification processes in order to form breccia. Alternatively, the existence of the unequilibrated R chondrites may suggest a high oxygen fugacity in the nebula. There is no evidence for reduction following oxidation on the parent body. We suggest that the oxidized condition was attained in both locations. In the oxidized solar nebula, Fe(-Ni) sulfides may directly condense from the nebula. Kozasa and Hasegawa [5] showed the possibility of direct condensation of FeS instead of Fe from the solar nebula gas using the time dependent homogeneous nucleation theory in a rapidly cooling solar nebula. The low abundance of chondrule may suggest that the formation region of R chondrites had a larger heliocentric distance compared with ordinary chondrites [2]. It seems that these are qualitatively consistent with each other.

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