PERSPECTIVES OF SOLAR SYSTEM EVOLUTION BY COMPARISONS OF ASTEROIDAL MATERIALS AND MINERALOGY OF SOME EVOLVED METEORITES.

H. Takeda[1], H. Nagaoka[2], A. Yamaguchi[3], Y. Karouji[4] and Y. Yazawa[5]. [1]Univ. of Tokyo, Graduate School of Sci. & Chiba Inst. of Tech., Forum Res. E-mail: takeda.hiroshi@it-chiba.ac.jp. [2]Waseda Univ., Res. Inst. for Sci. & Engn., [3]Natnl. Inst. of Polar Res., [4]JAXA/ISAS, [5]Chiba Inst. of Tech.(CIT), Dept. of Life & Environm. Sci.

Introduction: Because of the recent investigations on the returned dusts from the Itokawa by the Hayabusa Mission [1], we have a renewed interest in the LL chondrite parent body, in order to better understand the evolutional processes on an asteroidal body. It is generally understood that the chondritic materials preserve the chemical records of primitive solar system materials, because their parent bodies are mostly small. This statement is not supported if we recognize the presence of a Vest-like asteroid larger than 500 km in diameter [2]. We will compare the degree of differentiation of the Vesta-like body with those of the LL chondrite parent body. We already pointed out that zoning profiles of pyroxenes in totally molten LL chondrites including Y-790964 [3] are comparable with one grain in the Itokawa dusts [1]. In this paper, we will report other partly molten LL chondrites, to discuss evolution of the LL body with respect to Vesta.

Samples and Methods: We reexamined two PTSs (polished thin sections) of LL chondrites Y-981971,51-1, Y-793214,92-1 (LL5), and a new PTS Y-790782,91-2 prepared at the NIPR was observed by a petrographic microscope and EPMA. Y-981971,51-1 and Y-790782,91-2 were analyzed with a JEOL JXA-8900 EPMA at AORI (Atomosph. Ocean Res. Inst.).

Results: We found the first evidence of a product of partial melting of the chondritic primitive solar system materials with albite and diopside assemblage in Y-74160 [4] and similar materials were recognized in other LL with granulitic texture. Y-790782,91-2 (0.9X0.8 mm in size) consists of dark fine-grained mafic silicates with opaque spherules up to 7 mm in diameter distributed throughout the PTS. There is no metallic vein in this PTS, but the spherules (Fe,Ni,S) indicate melting.

Discussion: In-situ observation and sample return from asteroid Itokawa by Hayabusa Mission, are revealing data which cannot be obtained either from ground-based observations or meteorite studies to unravel the origin of the solar system. However, the presence of the product of a partial melt in a chondrite parent body suggests that even the primitive solar system material, such as chondrites experienced strong thermal events.

Products of high temperature episodes. The mineralogy of Vesta, based on data obtained by the Dawn mission [5], is consistent with HED achondrites, and confirmed the presence of the proposed layered crust model [3]. This largest asteroid is the largest protoplanet visited to date, and thereby provides a direct link to materials of the smallest terrestrial planet and basic mode of planetary evolution of the solar system.

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