MINERALOGICAL COMPARISONS ON THE BASIC PROCESSES OF FORMATION AND EVOLUTION OF DIFFERENTIATED METEORITE PARENT BODIES AND LUNAR HIGHLAND CRUST.

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Introduction: To elucidate basic processes of formation and evolution of planetary crusts, starting from the primitive solar system materials, to partly molten planetessimals, to the Vesta-like protoplanet, to the Moon, basic mineralogy and crystallography of important planet-forming minerals such as pyroxenes, plagioclase, olivine and spinel have been employed. Exsolution and polymorphic transition phenomena during subsolidus cooling, were used to deduce crystallization sequences and their cooling histories of these minerals in the planetary crusts.

Partialy Differetiated Bodies of the Primitive Source Materials: Eucrites were believed to be a partial melt of the chondritic (CV) source materials. Our studies on the silicate inclusions in the IAB [1] and IIE irons, showed that partial melt of the chondritic materials is an andesitic rock with albite and diopside. This material is the first andesite found in the solar system other than Earth. Models of formation of other differentiated meteorites, such as lodranites, have been proposed. Ureilites are rare ultramafic silicates, which still preserve records of a primitive materials and oxygen isotope anomalies as in some CV chondrites. On the basis of our mineralogical studies on a new type of Antarctic ureilites [2], including orthopyroxene-pigeonite magnesian ureilites and augite-bearing ureilites, we succeeded in showing a way to make a mineral assemblage, which lost low temperature partial melts, and recrystallized and annealed. The proposed processes including internal heating and collisional heating are what we expect to take place when planetessimals grow by collision and coagulation to a small protoplanet.

Comparisons of the HED-Vesta Parent Body and the Lunar Crusts: In this context, we compared formation and evolution of primitive crusts of the Moon and asteroid 4Vesta [3]. Eucritic melts can be produced by loss of Na from the andesitic partial melt. On the basis of mineralogy and chemistry of pyroxene polymorphs, we identified the true components of the primitive Moon 's crusts of [4] and the HED parent body, and demonstrated that the HED crust kept the record of their initial crystallization more than those of the lunar highland crust. Dhofar 489 was identified as a sample from the primitive farside crust [5].

Summary: An important goal of our comprehensive, comparative researches on lunar samples and achondrites is to reconstruct their primordial crusts and to elucidate basic processes of formation and evolution of planetary materials. Such study is simply expressed by titles of the books written by Takeda "Evolution of Planetary Materials" [6].

References: [1] Takeda H. et al. 2000. *Geochimica et Cosmochimica Acta* 64:1311-1327. [2] Takeda H. 1987. *Earth & Planetary Science Letters* 81:358-370. [3] Takeda H. 1997. *Meteoritics & Planetary Science* 32:841-853. [4] Takeda H. et al. 1976. 7th Lunar and Planetary Science Conference. pp. 3535-3548. [5] Takeda H. et al. 2006. *Earth & Planetary Science Letters* 247:171-184. [6] Takeda H. 2009. Gendaitosyo Publ., 131pp, Sagamihara.