P232-004 **Room: 301B** **Time: May 18 11:30-11:45**

SELENE exploration to better and further define the lunar origin and evolution

Tomoko Arai[1]

[1] NIPR

Returned samples by Apollo and Luna missions in 1970's have served as ground truths to test the lunar origin and its magmatic evolution. Later orbital data by Clementine and Lunar Prospector in 1990's have revealed that most of these samples were closely associated with a specific terrane, called Procellarum KREEP Terrane (PKT) with unusually high incompatible trace element (ITE) abundances on the lunar nearside. The growing number of lunar meteorites recovered from Antarctica and hot deserts have also provided several lines of evidences for the presence of crustal rocks and mare basalts with distinct chemical, mineral and isotopic compositions from those of the Apollo/Luna samples. Thus, the proposed scenario of the lunar origin and evolution on the basis of the Apollo/Luna samples needs to be evaluated with a good knowledge of the global properties. In fact, quite a few fundamental questions in lunar science remain unanswered. Newly-available data from the upcoming SELENE mission are expected to resolve these unsolved questions and provide us with better and further understandings on the lunar origin and evolution. Presented here are some fundamental issues to be solved, waiting for the high-resolution data obtained from multiple instruments of SELENE.

(1) Recent studies of lunar meteorites have shed light on the unprecedented features of the farside anorthositic crust [1]. Dhofar 489 includes crystalline anorthosites with higher Mg# than those from the Apollo ferroan anorthosites. The magnesian anorthosite also displays one order of magnitude lower ITE content than the nearside anorthosites and other feldspathic lunar meteorites. These features indicate that the meteorite should be originated from a region remote from PKT, and likely from the farside highland. The discovery of Dhofar 489 infers broader chemical compositions of the anorthositic crust than expected before, and possible distinct differentiation process of the magma ocean on the farside. In order to understand Mg#, mineral compositions, ITE abundances of the global anorthosite crust, the data from XRS, GRS, MI/SP are essential. Further, these data will better define the nearside-farside dichotomy in chemical/mineralogical composition of the crust, duration and composition of the basaltic magmatism, crustal thickness, and impact histories.

(2) The age and composition of mare basalts are keys to understand the thermal history of the Moon. Brecciated mare basalts from lunar meteorites have revealed the presence of the stratiform within the basalt flow, warning that the surface mare basalts, such as Fe-rich basalts from Apollo samples do not represent the true basalt composition [2]. Thus, the real basalt composition needs be elucidated based on the composition of the entire basalt flow units. The vertical variation in chemical and mineralogical compositions within the basalt flow and the thickness / volume of the basalt can be determined utilizing the data from MI/SP, XRS, GRS, TC, LALT and LRS. Crypt-mare basalts buried beneath the surface regolith can also be detected in the similar way.

(3) The PKT is closely connected with the lunar origin, crustal / thermal evolution and impact episodes. A recent study using the data of Lunar Prospector shows that the extremely Th-rich layer exists only at a few hundred of meters of the surface and the Th concentration is extensively diluted with increasing depth [3]. This fact led to an inference that the Th content in the overall lunar crust be much lower than expected by a simple averaging of surface compositions. The vertical variation of the Th content and chemical/mineralogical compositions in the PKT will be resolved with the data from XRS, GRS, and MI/SP.

References: [1] Takeda H. et al. (2005) EPSL, in review. [2] Arai T. et al. (2006) GCA, submitted. [3] Warren P. H. (2001) GRL 28, 2565-2568.