Effects of hydrogen on thermal evolution of magma ocean and early surface environment

*Keiko Hamano[1], Hidenori Genda[1], Yutaka Abe[2]

1. Earth-Life Science Institute (ELSI), Tokyo Institute of Technology, 2. Department of Earth and Planetary Science, The University of Tokyo

The standard model of planet formation suggests that terrestrial planets would experience global melting due to giant impacts, i.e. the formation of a magma ocean. Early atmosphere would form through degassing from the interior, and its greenhouse and blanketing effects would be essential to radiative heat balance at the planetary surface, limiting heat flux from the magma ocean.
Recently, several groups have been working on a coupled evolution of early atmosphere and magma ocean, and have investigated the thermal history and volatile budgets on early terrestrial planets(e.g. Elkins-Tanton 2008, Hamano et al. 2013,2015, Lebrun et al. 2013). They have focused on oxidizing atmospheres consisting of water and carbon dioxide, while early atmosphere might have reducing gaseous species. Hydrogen molecule is one of the candidates, since planets could capture nebula gas during formation or it could be produced by chemical reaction between water and metallic iron that could be scattered on giant impact events. In this talk, we would like to discuss contributions of hydrogen on early evolution of terrestrial planets.

Keywords: Magma ocean, Reducing atmospheres, Formation of oceans, early climate and surface environment

