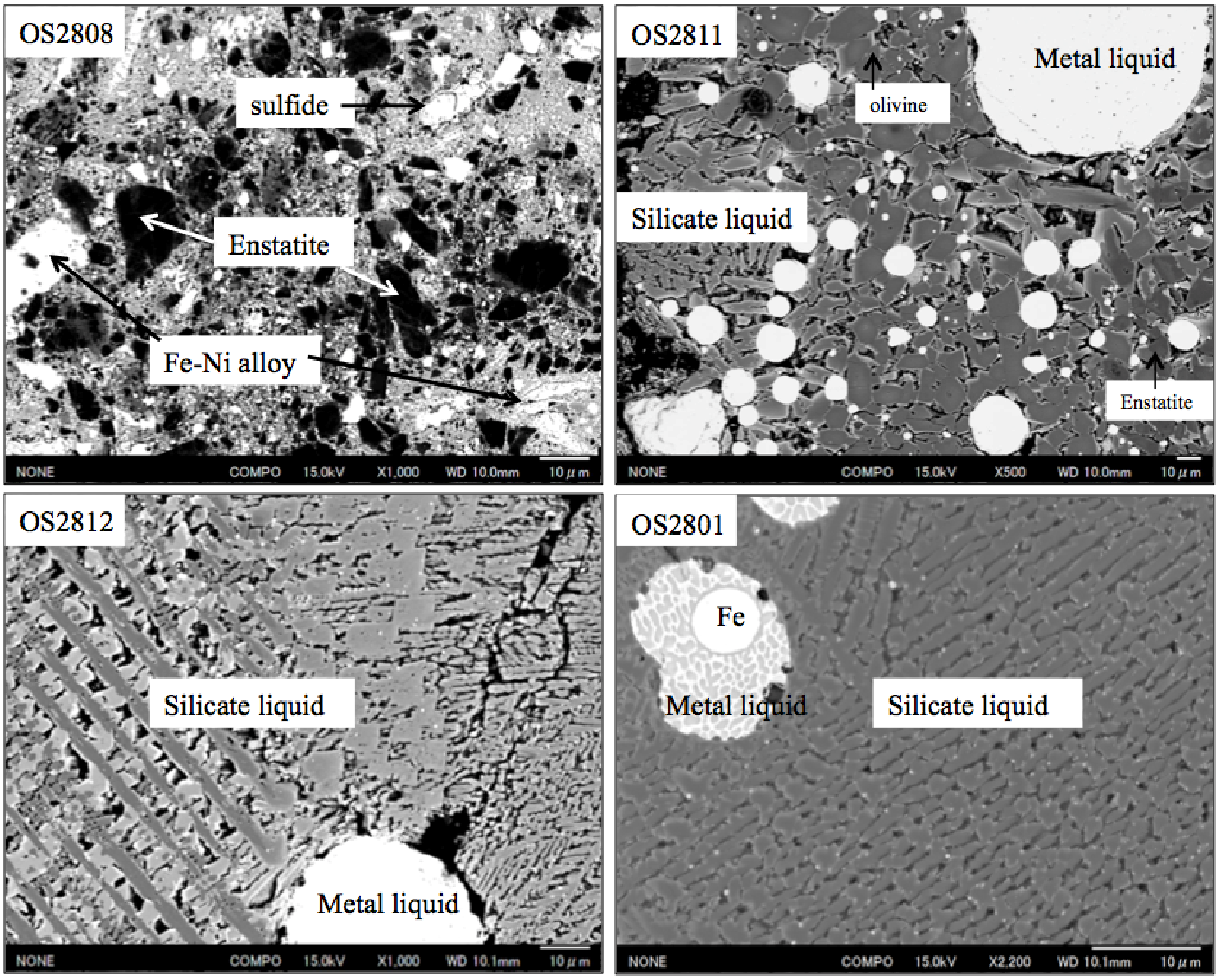
A textural and chemical view of melting of the Sahara 97072 (EH3) meteorite at 5 GPa and different temperatures

*WEI DU[1,2,3], Vincenzo Stagno[2,3], Hiroaki Ohfuji[2], Masayuki Nishi[2,3], Tetsuo Irifune[2,3]

1. School of Earth and Space Sciences, Peking University, Beijing 100871, China, 2. Geodynamic Research Center, Ehime University, Matsuyama 790-8577, Japan, 3. Earth-Life Science Institute, Tokyo Institute of Technology, Tokyo 152-8550, Japan

Melting interval of (Fe, Ni)-sulfide and silicate was studied with heating experiments on the Sahara 97072 (EH3) meteorite at 5 GPa and 1000-1700˚C using multi-anvil apparatus. Results from our experiments show that: (1) (Fe, Ni)-bearing sulfide is completely molten at 1200˚C; (2) partial melting of silicate begins at 1400˚C; and (3) the Sahara 97072 meteorite is completely melted at 1600˚C. At 5 GPa, both pyroxene and olivine appear to be stable near the liquidus as the first liquidus phase, indicating that 1600˚C and 5 GPa is very close to the pyroxene-olivine cotectic.
Overheating the Sahara 97072 meteorite sample to 1650 and 1700˚C causes (Fe, Ni)-alloy exsolved from (Fe, Ni)-sulfide, and the spherical shape of the (Fe, Ni)-alloy indicating that the exsolution happened during heating rather than quenching. The coexisting of (Fe, Ni)-alloy and S-rich metallic phase at higher heating temperature could be results of the decrease of portioning coefficient of S between metallic liquid and silicate liquid with temperature or the volatility loss of S at overheating conditions. The silicate liquid in these two experiments shows smaller $Mg^{\#}$ than the completely melt condition, indicating a relatively larger Fe content in the silicate liquid, which is consistent with the decreased bulk content of metallic liquid. Results from these experiments suggest that the relatively small planetary bodies with elevated sulfur content would have likely experienced sizable core stratification during early melting event as a result of the segregation of (Fe, Ni)-alloy from (Fe, Ni)-sulfide.

Keywords: enstatite chondrite, partial melting, core formation


OS2808
sulfide
Enstatite
Fe-Ni alloy
NONE COMPO 15.0kV X1,000 WD 10.0mm 10 μm
OS2811
Metal liquid
olivine
Silicate liquid
Enstatite
NONE COMPO 15.0kV X500 WD 10.0mm 10 μm
OS2812
Silicate liquid
Metal liquid
NONE COMPO 15.0kV X1,000 WD 10.1mm 10 μm
OS2801
Fe
Metal liquid
Silicate liquid
NONE COMPO 15.0kV X2,200 WD 10.1mm 10 μm