CRYSTALLIZATION OF LUNAR MARE METEORITE LAP 02205. E. Koizumi, J. Chokai, T. Mikouchi, J. Makishima and M. Miyamoto. Dept. of Earth and Planet. Sci., Universtiy of Tokyo, Hongo, Tokyo 113-0033, Japan. E-mail: koi@eps.s.u-tokyo.ac.jp

Introduction: LAP 02205 (LAP) is the newest member of crystalline lunar mare meteorites mainly consisting of pyroxene, plagioclase and olivine. Pyroxenes are extensively zoned from Mg-rich pigeonite cores ($En_{55}Fs_{30}Wo_{15}$) to nearly Mg-free rims via augite mantles ($En_{40}Fs_{25}Wo_{35}$). Rare olivine grains are zoned from Fo_{67} cores to Fo_{48} rims. Since LAP does not show a typical cumulate texture, its bulk composition might retain its parent melt composition. In this study, we investigated the crystallization history of LAP by using MELTS calculation and performing crystallization experiments.

MELTS calculation: We calculated equilibrium mineral assemblages by the MELTS program with the LAP bulk composition [1]. The calculation results show that the liquidus phase is olivine (Fo_{55}) at 1137 ^{o}C. Then, olivine immediately disappears and pigeonite ($En_{53}Fs_{36}Wo_{11}$) starts crystallizing at 1134 ^{o}C. Olivine composition is more Fe-rich than that of the olivine core in LAP, although pigeonite compositions are similar between calculated and pigeonite core in LAP. This result shows that the core composition of olivine in LAP is too magnesian to be crystallized from the LAP bulk composition, and Mg-rich olivine cores are xenocrysts.

Crystallization experiments: We performed crystallization experiments with the LAP bulk composition in 1 atm vertical furnaces [2]. Homogenized starting glass was cooled from 1155 ^{o}C to 1000 ^{o}C at various cooling rates (1, 2.5, 5, 10, and 20 ^{o}C/hr) under logfO_2=IW-1. All run products contained olivine, pyroxene, plagioclase and ilmenite. The textures and pyroxene compositions of run products from 1 to 10 ^{o}C/hr cooling runs were generally similar to those of LAP. However, the run product from 20 ^{o}C/hr cooling run showed a different texture (skeletal olivine, acicular plagioclase) and pyroxene composition was more Ca-rich. The largest difference among each cooling run is in olivine petrology. In slower cooling experiments, the amount and grain size of olivine were smaller and their compositional ranges were narrower. The core compositions of these olivines are Fo_{58}. This composition is more Fe-rich than that of LAP, indicating the xenocryst origin of Mg-rich olivine in LAP. We also performed 1 ^{o}C/hr cooling experiment quenched at 1130 ^{o}C. There were many large olivine grains ($Fo_{57\text{-}49}$) in the run product in contrast to the 1 ^{o}C/hr cooling run down to 1000 ^{o}C. These results show that olivine melted with the pyroxene crystallization as MELTS calculation predicts.

Discussion and conclusion: Although the Mg-rich cores of olivine could be xenocrysts, the amount of olivine is small and has little influence on the LAP bulk composition. Probably, the LAP bulk composition is similar to its parent melt composition. The crystallization experiment shows that LAP should have been cooled fast enough to preserve olivine from complete melting. Thus, the pyroxene and olivine mineralogy of experimental charges suggest 1-5 ^{o}C/hr cooling rate during the crystallization of the LAP magma.

References: [1] Ghiorso M. S. and Sack R. O. 1995. *Contribution to Mineralogy and Petrology* 119:197-212. [2] McKay G. et al. 1994. *Geochimica et Cosmochimica Acta 58*:2911-2919.