

# Pyroxene/melt partition coefficients and their impact on models of Lunar Magma Ocean evolution

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Partition coefficients (D) are not constant values but depend on temperature, pressure, redox conditions, and on the chemical composition of the liquid and the solid [1,2]. Recent computational models of the chemical evolution of the Lunar Magma Ocean (LMO) [e.g., 3] rely on accurate partition coefficients [4]. Experimentally produced mineral-melt D's are extremely valuable to assess and model natural processes, as P-T-fO<sub>2</sub> conditions of the experiments are usually well constrained. Computational models can be enhanced and developed, based on experimental observation and predictions.

In order to better constrain the solidification history and thermo-chemical evolution of the Moon, we conducted 1-atm vertical tube furnace experiments and piston cylinder experiments with lunar compositions, following [5]. Starting materials are doped with a variety of trace elements (e.g., REE, transition metals, large ion lithophile and high field strength elements). The experiments cover a range of fO<sub>2</sub> conditions and temperatures relevant for the Moon. Run products contain large and homogeneous minerals (i.e., pyroxene, olivine, plagioclase) and quenched melts, and were characterized with SEM and analyzed by EPMA. Trace element concentrations of minerals and glasses were determined with LA-ICP-MS.

The highly accurate new trace element mineral-melt partition coefficients were implemented into geochemical and petrological models to predict isotopic signatures of LMO cumulates and other compositional reservoirs in the lunar mantle. Our data show that existing models need to be refined to explain isotope signature of natural lunar samples.

References:

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