PPS21-04 会場:A02 時間:5 月 24 日 09:45-10:00

月マグマオーシャン化学進化：密度逆転構造形成の再評価
Chemical evolution of lunar magma ocean: evaluation of density overturn

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Hess and Parmentier (1995) discussed gravitational instability of a highly fractionated heavy layer and proposed a mantle overturn model, which well explains the role as a source for high-TiO2 mare basalts erupted several hundred millions years later. However, Hess and Parmentier (1995) themselves pointed out that the timescales for the IBC layer formation is longer than the onset of gravitationally instability between the IBC layer and underlying mantle, so the density instability should have resolved during LMO differentiation with small scale overturn. We constructed a model that describes differentiation of interstitial melt trapped in the cumulate layer with three parameters, critical crystal fraction, porosity of the cumulate layer, and grain size, and the percolation is evaluated as the time to the onset of instability between lighter trapped melt and the overlying heavier residual melt in the magma ocean body.

The results show that the density contrast between LMO and the trapped melt becomes significantly large once plagioclase appears, on the other hand viscosity of the melt is. The percolation time varies by up to about two orders of magnitude for the variation of porosity by two times, whereas it varies by up to about 5 orders of magnitude for the variation of grain size by one orders of magnitude, and the effect of X is not essentially. Comparing the percolation time at the critical crystal fraction for each step of differentiation calculation and the duration of the whole LMO crystallization, we can conclude that the percolation time is much shorter than the crystallization time if the grain size is larger than 1.0 cm. If we assume that the grain size of crystallizing grains in LMO is 0.1 to 1 cm in order, which is the average size in terrestrial magmas, melt overturn between LMO and trapped melt takes place easily during crystallization of LMO, which would make formation of extremely dense layer below the anorthosite crust at the final stage of LMO crystallization difficult.

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