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The FeO content of the lunar mantle – insights from geophysical and petrological constraints.

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The FeO/MgO ratio of the bulk silicate Moon (BSM) is poorly constrained. To address this issue, we explored the effects of changing FeO/MgO ratios on the chemical reservoirs that formed during lunar magma ocean (LMO) crystallization and the implications for the physical properties of today's BSM.

By simulating LMO crystallization we found that LMO FeO contents control the abundance of late formed, Fe- and Ti-rich, ilmenite-bearing cumulates (IBC). Due to their high density, IBC sink towards the lower mantle, where they partially melt and cause the attenuation of seismic waves observed in the deep lunar mantle [1]. The efficiency of this IBC overturn affects not only the thickness of the partial melt zone but also the BSM moment of inertia (MoI). We modeled the BSM properties for different FeO contents, overturn scenarios, core sizes and interior temperatures and demonstrate that the BSM FeO content can be constrained by fitting the observed BSM physical properties.

[1] Matsumoto, K. et al. (2015) GRL 42(18), 7351-7358.

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