TOP-DOWN SOLIDIFACATION OF THE LUNAR MAGMA OCEAN. Yingkui Xu[1], Dan Zhu[2] and Mingming Zhang[1] [1]Lunar and Planetary Science Research Center, Institute of Geochemistry, Chinese Academy of Sciences, Lincheng Road NO.99, Guiyang 550081, China, [2]State Key Laboratory of Ore Deposit Geochemistry, Institute of Geochemistry, Chinese Academy of Sciences, Guiyang 550081, China, zhudan@vip.gyig.ac.cn

Introduction: The early state of the Moon is thought to be Lunar Magma Ocean (LMO). Studies of LMO not only have significant meaning for recognizing the internal composition and structure of the Moon, but also can be indicative for the origin and evolution of the Earth and other planets. The dominated model of the LMO suggests that after 80% of the LMO solidified, plagioclase starts to crystallize and floats to the surface to form anorthositic crust[1]. However, the dominated model predictions have several discrepancies with the observations[2].

Here we propose a new model suggesting the solidification of the LMO is top-down. Our model considers that olivine, pyroxene and plagioclase would crystalize at the region between the initial lid and the interior of the LMO at the very beginning. Then the crystallized plagioclase floated and formed an anorthositic crust; while the mafic minerals would descend to deep and remelt because the LMO interior is superliquidus[3]. The overall result of our model is that plagioclase existed stably prior to olivine and pyroxene, rather than it crystallized after ~80% LMO solidification. So, the model here is fundamentally different from previous models [4]. The plagioclase can crystallize from the very beginning to the end of the LMO, that is consistent with the ancient anorthosite age and long anorthosite-crystallization span which is over 200 Myr[5]. Importantly, our model can explain the nearly constant composition of calcic plagioclase (An95–98) in the anorthositic crust[6], and the coexistence of ferroan and magnesian anorthosite[2]. In addition, that the whole lunar mantle is enriched in FeO and depleted in Eu is also understandable.

This work was financially supported by the Natural Science Foundation of China (Grants 41503065 and 41573040)

References: Use the brief numbered style common in many abstracts, e.g., [1], [2], etc. References should then appear in numerical order in the reference list, and should use the following abbreviated style:

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