Sm-Nd systematics of lunar ferroan-anorthosite: Constraints on Moon formation and its early evolution

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In the Lunar Magma Ocean model (LMO), ferroan anorthosites (FANs) are thought to represent the first crust formed by plagioclase flotation during LMO crystallization (e.g. Wood *et al*., 1970). We have measured 146,147Sm-142,143Nd systematics in FAN whole rocks (15415, 62236, 62255, 65315, 60025). Most of these samples, except 62236, have not been exposed to galactic comic rays for a long period and thus require minimal correction to their 142Nd isotope composition. These samples do not define a single isochron in either 146Sm-142Nd or 147Sm-143Nd systematics, suggesting that they have different crystallization ages, come from different sources, or have suffered isotopic disturbance. All FANs have measured deficits in 142Nd relative to the JNdi-1terrestrial standard in the range -45 to -16 ppm. We explore the implications of their initial isotopic compositions for possible crystallisation ages in the range of 50-300 Ma after solar system formation, an interval covering all the ages determined for FANs as well as different estimates for the crystallization of the LMO. The range in initial isotopic compositions at any given age suggest that most FANs are not a primary product of the LMO, but were formed by a more complicated and prolonged petrogenetic mechanism. 62255 has the largest deficit in 142Nd and does not appear to have followed the same differentiation path as the other FANs. The large deficit in 142Nd of FAN 62255 may suggest a crystallization age around 60-100 Ma after solar system formation. If the Sm-Nd systematics for this sample have not been significantly disturbed, this sample could be the only FAN studied here that might have formed by plagioclase flotation during the crystallization of the lunar magma ocean.

[1] Wood *et al* Lunar anorthosites and a geophysical model of the *Moon*. *Proc*. *Apollo* **11** *Lunar Sci*. Conf. **1**, 965-988