

500+ Million Years of Volcanism in Australe

The roughly circular collection of mare deposits in the "Mare Australe" region (38.9°S, 93°E) is ~900 km in diameter. The maria erupted into post-basin impact craters but are generally disconnected from each other. The distribution of maria could reflect what might have been the early stages of other basin filling mare eruptions, but which are preserved in Australe and some farside locations [1-3]. Topographic data fail to indicate a 900-km basin, but gravity and topographic data suggest a 600-km basin in the northern part of Australe [6]. The relationship between the basin and the wider-spread mare deposits is unclear, particularly outside the basin. We utilized images, gravity, topography, and composition to investigate the timing of volcanism in "Mare Australe" to interpret the evolution of magmatism in Australe and how it might relate to other mare sources. Humboldt crater (~3.6 Ga) makes an excellent stratigraphic marker that can be traced across much of the deposits and serves as a stratigraphic calibration for absolute model ages (AMAs) derived from crater size-frequency distributions (CSFDs). We found a range of AMAs from ~3.3 to 3.8 Ga in north Australe, similar to previous studies [4], and there is also evidence for multiple deposits of older cryptomaria. The age range, however, is narrower than for maria in other basins (e.g., Imbrium and South Pole-Aitken [4-5]), suggesting different magmatism in Australe. Most of the mare deposits are >3.5 Ga; younger deposits are co-located in the north basin. The basin may have provided additional pathways for rising magma to the surface over time. We also found evidence of a several interconnected deposits within the north basin. Other, smaller deposits, however, clearly show distinct age differences between units within a single topographic depression (e.g., Lyot crater) and likely represent discrete eruptions. Additionally, there are no floor fractured craters other than Humboldt [6], suggesting that magma generally did not stall out near the surface, also consistent with gravity and (lack of) magnetic anomalies (in contrast to Marius Hills and South Pole-Aitken basin [7-8]).

Citations: [1] Whitford-Stark 1979 [2] Haruyama et al. 2009 [3] Pasckert et al. 2018 [4] Hiesinger et al. 2011 [5] Pasckert et al. 2018 [6] Jozwiak et al. 2015 [7] Purucker et al. 2012 [8] Deutsch et al. 2019