Constraints on the depth of origin of impact basin rings and the composition of the lunar crust using the Kaguya Multiband Imager

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The composition of the lunar crust across the entire surface and at a wide range of depths can be inferred from remote sensing observations of complex craters and impact basins on the Moon. In this study we conduct a comprehensive study of the mineralogy of the innermost ring of 13 basins using the Kaguya Multiband Imager (MI) data, compare their mineralogy to that of the central peaks studied by Lemelin et al. [1], and use iSALE-2D hydrocode models to better constrain the depth of origin of the material exposed by the basin's innermost ring.

We find that the basins' innermost ring we study are all dominated by anorthositic rock types (plagioclase content ≥77.5 wt.%), except for Imbrium and Serenitatis basins which are dominated by anorthositic norite or gabbro (60-77.5 wt% plagioclase). The innermost ring of near side basins are more heterogeneous and generally contain more mafic rock types, which supports the hypothesis that mantle material might be exposed [2], although we do not identify highly mafic lithologies at the scale (~62 m per pixel) of the MI data. iSALE-2D modelling suggests that the largest contribution to the basins' innermost ring material comes from both a "shallow" and a "deep" component. A depth of origin of ~0.10D (D = transient crater diameter) for the "deep" component allows to reconcile the composition of the basins and central peak populations. Our results also indicate that the "shallow" component largely dominates the material exposed on the innermost rings, with a proportion of ~0.95D.

[1] Lemelin et al. (2015) *JGR* **120**, 869-887. [2] Miljković et al. (2015) *EPSL* **409**, 243-251.