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### **Characterizing impactors on the Moon using Ru isotopes**

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Late impactors, which likely delivered siderophile elements to the Earth during late accretion, can be investigated using lunar impactites and the parent body-specific Ru isotope anomalies observed at the bulk meteorite scale [e.g., 1]. As Ru is highly siderophile, it is depleted in planetary crusts, so the Ru isotopic composition in an impactite likely reflects that of the impactor.

Our results for two lunar impactites indicate that the impactor components in them are indistinguishable from the Ru isotopic composition of the bulk silicate Earth, which represents the isotopic composition of its late-accreted material. Thus, the impactors were likely from a similar nebular region to the late-accreted material. If this result is reproduced for other lunar impact melts, then a lunar cataclysm involving isotopically diverse impactors from the asteroid belt [e.g., 2] would not be supported. In this case, the impactor signatures in the lunar impactites may be representative of planetesimals that were left over from the main accretion phase of the terrestrial planets.

[1] Fischer-Gödde and Kleine 2017. *Nature* 541: 525-527,

[2] Bottke and Norman 2017. *Annu. Rev. Earth Planet.*

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