The late veneer derives from bodies not sampled by meteorites

M. FISCHER-GÖDDE[1], C. BURKHARDT[1] AND T. KLEINE[1]

[1]Institut für Planetologie, Westfälische Universität Münster, 48149,Münster, Germany (m.fischer-goedde@wwu.de).

Excess abundances of highly siderophile elements (HSE) in the Earth's mantle probably reflect the addition of a late veneer of primitive meteorites to the mantle after core formation was complete. Previous studies have used Os isotopes as well as relative HSE and chalcogen abundances to establish a link between the late veneer and a specific group of meteorites. However, no single group of meteorites is consistent with the composition of the late veneer as inferred from the composition of Earth's primitive mantle. For instance, Os isotopes would indicate an ordinary or enstatite chondrite-like late veneer, but S-Se-Te systematics suggest a carbonaceous chondrite-like composition.

Here we use nucleosynthetic Ru isotope anomalies to assess whether the late veneer can be linked to specific group of meteorites or, alternatively, derives from a population of bodies distinct from meteorite parent bodies. Our approach makes use of the fact that most meteorites investigated so far show nucleosynthetic Ru isotope anomalies and that almost the entire Ru in the Earth's mantle derives from the late veneer. Thus, only meteorites (or a combination thereof) having a terrestrial Ru isotope composition can be source of the late veneer. We find that ordinary and carbonaceous chondrites display a deficit in *s*-process Ru nuclides relative to terrestrial Ru and, therefore,. cannot be the source of the late veneer. Enstatite chondrites display only small Ru isotope anomalies, which are not well resolved. However, based on their chemical composition, it seems unlikely that enstatite chondrites are the source of the late veneer. Thus, our new Ru isotope data combined with compositional constraints from HSE and S-Se-Te systematics indicate that the late veneer did not derive from a carbonaceous, ordinary or enstatite chondrite reservoir. Moreover, because all meteorites investigated so far exhibit an *s*-deficit in Ru isotopes relative to the Earth's mantle, a combination of meteorites (e.g., carbonaceous chondrites + iron meteorites) also cannot be the source of the late veneer. Thus, the late veneer derives from a population of objects, which has not been sampled by meteorites and perhaps represents the left-over material from the main accretion phase of the Earth.