Tellurium stable isotopes and the composition of the late veneer

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Experimental metal-silicate equilibration studies suggest that siderophile Tellurium (Te) strongly partitions into the Earth's core [1]. The higher than predicted Te abundance in the silicate Earth may then be due to late veneer addition following core formation [e.g. 1, 2]. Terrestrial sediments and geochemical exploration reference samples show mass-dependent Te isotope fractionation ranging over 0.9‰ in $\delta^{130/125}$Te [3]. If representative of the bulk silicate Earth (BSE), such variations indicate the late addition of CI- or CM-chondrite like material [3], in agreement with one interpretation of chondritic S-Se-Te ratios of mantle rocks [4]. However, these ratios can also be explained by refertilisation models [5], which together with the non-chondritic S isotopic signature of the upper mantle [6], remain difficult to reconcile. Moreover, nucleosynthetic Ru isotope data suggest an enstatite chondrite-like late veneer [7]. To shed light on these contradictions, this study aims to constrain the Te isotope composition of BSE using a wide range of mantle rocks, mantle-derived basalts and sediments.

An improved multi-stage anion-exchange separation procedure following [3] is used for Te purification. Isotope measurements are performed on a Neptune Plus MC-ICPMS using a ^{125}Te-^{128}Te double spike for mass bias correction to obtain mass-dependent Te isotope data [3]. Repeated analyses of the SRM 3156 Te Std relative to the Alfa Aesar metal Te Std performed at 10 ppb give $\delta^{130/125}$Te of -0.14 ± 0.09 (2SD, n = 11). Methods for analyses of small quantities of natural Te from geological samples are tested using sediments. Tellurium isotope data obtained on 4 – 26 ng Te for the Ohio Shale SDO-1 and manganese nodule Nod-A-1 agree within uncertainties with those previously reported [3]. Additional Te isotope data for magmatic rocks will be obtained to further characterise the composition of BSE and constrain the composition of the late veneer.

[1] Rose-Weston *et al*. (2009) *GCA* 73, 4598-4615. [2] Yi *et al*. (2000) *J. Geophys. Res.* 105, 18,927-18,948. [3] Fehr et al. (2018) *GCA* 222, 17-33. [4] Wang & Becker (2013) *Nature* 499, 328-331. [5] König *et al*. (2014) *EPSL* 385, 110-121. [6] Labidi *et al.* (2013) *Nature* 501, 208-211. [7] Fischer-Gödde & Kleine (2017) *Nature* 541, 525-527.