Highly siderophile elements in Hadean-Eoarchean rocks of the Acasta region

CHUNHUI LI[1], HARRY BECKER[1], PETER SPRUNG[2], ERIK SCHERER[3] AND WOUTER BLEEKER[4]

[1]Institut für Geologische Wissenschaften, Freie Universität Berlin, Germany.
[2]Institut für Planetologie, Universität Münster, Germany
[3]Institut für Mineralogie, Universität Münster, Germany
[4]Geological Survey of Canada, Ottawa
([1] Email: chunhui@zedat.fu-berlin.de)

Highly siderophile element (HSE) abundances in some of Earth's oldest known rocks, the Acasta Gneisses (Slave Craton, Canada), may provide insights on the timing of late accretion and the modification of the Hadean and Eoarchean crust by late planetesimal bombardment. New data on 3.7 Ga metagabbros from the Acasta area have HSE patterns and S, Se, Te abundances that are indistinguishable from those of young rocks of the lower oceanic crust. One of the layered metagabbros with cumulate features (high PGE, Te, Cr, Ni, low S, Se) and low Re/Os yielded a Re-Os model age of 4.30±0.01Ga. An iron-rich garnet amphibolite displays very low PGE abundances (except Pd, 60 ng/g) and high Au, Re, Te, Se and S contents. Felsic rocks from the Acasta region, which range from intermediate to granitic composition (including a sample with a Sm-Nd isochron age of 4 Ga [1]) have very low abundances of non-radiogenic Os isotopes, Ir, Ru and Rh. Abundances of other HSE and S, Se, Te are within range of those in young intermediate to felsic upper crustal rocks. Thus, the data on a spectrum of rock types indicate HSE, S, Se and Te systematics that are indistinguishable from those of modern crustal rocks. In-spite of a complex polyphase magmatic and metamorphic history, different rock types appear to have retained primary chemical characteristics. HSE, S, Se and Te contents of an ultramafic rock enclosed in gneisses resemble those of post-Archean mantle peridotites. We conclude that Acasta crustal rocks show no evidence for an excess in HSE, S, Se, and Te contents. Furthermore, these elements occur in non-chondritic ratios and hence show no indication of an extraterrestrial provenance associated with putative large basin-forming impacts at 4.0 to 3.7 Ga. The data for metagabbros and the ultramafic sample indicate derivation from domains in Earth's mantle that had an HSE composition similar to the modern mantle. Our results support the view that the late veneer and the recycling of HSE-contaminated early crust into the mantle must have significantly predated 4.0 Ga.

[1] Scherer, EE., Sprung, P, Bleeker, W, and Mezger, K (2010) Abstr. V44B-01 Fall Meeting AGU.