Upper-crust heat-producing element abundance inferred from surface heat flux

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Geoneutrino measurements constrain compositional models of the bulk silicate Earth as they specifically establish the amount and distribution of heat-producing elements (HPE) U, Th, and K in the crust and mantle. To validate or reject BSE models it is necessary to quantify the mantle contribution to the geoneutrino signal, which requires estimation of the HPE abundance and distribution, and therefore geoneutrino signal, in the readily accessible crust. Huang et al. [1] created an 8-layer, global reference earth model for the lithosphere that compares Vp from Crust 2.0 to endmember Vp and HPE abundances for mafic and felsic amphibolite (assumed MCC) and granulite (assumed LCC). For the UCC they adopted a uniform HPE abundance. In this way the Huang et al. [1] model has lateral variations in HPE abundance in the LCC and MCC, but constant HPE abundances within the UCC.

We adopt Huang et al. [1] HPE abundances for the LCC and MCC. For the UCC, we use surface heat flow values from Davies [2](Q0) in conjunction with calculated heat flux from the MCC + LCC (Q2) and a Moho heat flux of 15 mW/m2 (Q3) to form a simple relationship for the UCC heat flux (Q1): Q1 = Q0 – Q2 – Q3. Using these calculated values of Q1, with assumed Th/U and K/U ratios, we calculate the HPE abundance of Earth's UCC in 1x1 degree voxels.

Our results for the upper crust show a factor of 1.5 to 3 enrichment in HPE relative to similar models of the UCC for a significant percentage of the UCC voxels. This enrichment suggests that our assumed uniform Moho heat flux of 15 ± 3 mW/m2 is not realistic and/or that our method of estimating HPE abundance in the deep crust is not accurate. We tested small variations in LCC + MCC HPE abundance and found no drastic change in calculated UCC HPE abundances. Moreover, geotherms calculated from mantle xenoliths predict Moho heat flux between 15-25 mW/m2. We conclude that a constant Moho heat flux for shields and cratons is most likely underestimated by heat flow studies.

[1] Huang *et al.* (2013) *Geochem. Geophys. Geosyst.* **14(6)**, 2003-2029. [2] Davies (2013) *Geochem. Geophys. Geosyst.* **14(10)**, 4608-4622.