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^{187}Re - ^{187}Os nuclear geochronometry: age dating with permil precision

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Recently, ^{187}Re - ^{187}Os nuclear geochronometry, a new dating method combining ideas of nuclear astrophysics with geochronology, has successfully been used to calculate two-point-isochron (TPI) ages for Devonian black gas shales using the isotopic signature of an r-process geochronometer as one data point in a TPI diagram [1]. Based upon a nuclear production ratio ^{187}Re/^{188}Os = 5.873, TPI ages were calculated for 12 SDO-1 (Devonian Ohio Shale, Appalachian Basin) aliquants, for which repeated Re-Os measurements are reported in the literature [2]. TPI ages range from 384.5 $\pm$ 2.7 Ma (^{187}Os/^{188}Os$_i$ = 0.29413 $\pm$ 0.00023) to 387.7 $\pm$ 2.1 Ma (^{187}Os/^{188}Os$_i$ = 0.29407 $\pm$ 0.00019) with a mean of 386.67 $\pm$ 1.79 Ma). The result is consistent with the isochronous age from the 12 aliquants alone (386 $\pm$ 16 Ma, ^{187}Os/^{188}Os$_i$ = 0.31$\pm$0.31), which is bracketed by U-Pb ages for the Belpre Ash (381.1 $\pm$ 3.3 Ma) and the Tioga Ash bed (390.0 $\pm$ 2.5 Ma) [3] from the Appalachian Basin. Hence, SDO-1 can be assigned to the Givetian stage (*varcus*-zone) of the Middle Devonian, close to the Eifelian/Givetian boundary (using the time-scale of [3] or [4]). If an age is calculated from an isochron diagram for the 12 aliquants including the nuclear geochronometer, a permil precision can be achieved, an interesting feature with respect to any effort towards calibrating the Geologic Timescale. Additionally, a Th/U evolution (or: Th/U-time) diagram can be plotted using U-Pb zircon age data and Th/U ratios from volcanic rocks and ashes reported in the literature [3] for specific Devonian samples from the Appalachian Basin. Since the Re-Os age obtained for SDO-1 can also be connected to its Th/U ratio, it turns out, that Th/U ratios might be helpful age indicators, as demonstrated for the Devonian using the U-Pb and Re-Os datasets.

[1] Roller (2015), *GSA Abstr. with Programs* **47**, #248-14. [2] Du Vivier *et al.* (2014), *Earth Planet. Sci. Lett.* **389**, 23 – 33. [3] Tucker *et al.* (1998), *Earth Planet. Sci. Lett.* **158**, 175 – 186. [4] Kaufmann (2006), *Earth-Sci. Revs.* **76**, 175 – 190.