Chararcteristics of syn-collision magmatism, NW Iran

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Quaternary lavas from the NW Iran are related to the on-going Arabia-Eurasia collision, which represents continued plate convergence after the end of north-dipping subduction of the Neo-Tethyan ocean at ~35 Ma. The lavas are erupted across the Turkish-Iranian plateau, which ceased crustal thickening before the establishment of a number of volcanic centres within Iran and eastern Turkey, such as Ararat and Tendurek, beginning at ~10 Ma. Local active tectonics involve right-lateral strike-slip faults and pull-apart basins, but there is no simple spatial relation between the basins and volcanic centres. Here we report geochemical and Sm-Nd/Rb-Sr data for 20 samples from a ~200 km long, N-S traverse through the main volcanic centres. Samples are transitional alkali/tholeiitic basalts and basaltic andesites. Samples fall between two end-member compositions, a "depleted", low Nb, low LILE type with $^{143}Nd/^{144}Nd$ ~0.51290 and an "enriched", high Nb, high LILE type with $^{143}Nd/^{144}Nd$ ~0.51265. Depleted compositions occur in the north and enriched compositions in the south. Therefore enrichment decreases with distance from the Arabia-Eurasia suture to the south of the study area. There is petrographic evidence for greater crustal contamination in the southern samples, but this is not reflected in major and trace element compositions. A previous model for similar compositional variation in Anatolian syn-collision magmatism has invoked slab-breakoff beneath the plateau (Keskin, 2003). An alternative explanation is that the degree of melting decreases southwards towards the suture, because of the reduced thickness of mantle wedge above the Tethyan ocean slab.

The impact of Fe isotope fractionation by plants on the isotopic signature of soils

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Plants play an important role in the biogeochemical cycling of iron. Enhanced mineral dissolution by root exudates, Fe uptake by plants, and decomposition of Fe-containing plant material significantly influence the speciation of Fe in soils. We investigated stable Fe isotope fractionation during the cycling of Fe from rock/soil to plants and to soil organic matter in an alpine glacier forefield (Damma glacier, Central Alps, Switzerland). Its rather uniform lithology (Aare granite) and the well-defined soil formation chronosequence (max. 150 years) provide a well-constrained natural setting for our studies. Fresh granite rock and its main Fe-bearing minerals (biotite, magnetite), soil samples, soil organic matter and various plant species were analyzed for their Fe isotopic composition. Plant species under investigation acquire Fe either by Fe(III) reduction (strategy I) or by exudation of siderophores and uptake of Fe(III)-siderophore complexes (strategy II). Iron isotope ratios were measured by MC-ICPMS (Nu Plasma) using a standard-sample bracketing method (IRMM-014). The reproducibility of samples was generally better than ±0.15‰ (2SD) in $\delta^{57}Fe$.

While unaltered granite samples exhibit a heavy isotopic composition (0.3-0.4‰ in $\delta^{57}Fe_{IRMM-14}$), biomass of strategy I plants shows an enrichment of the light isotope of up to -2‰. A clear trend of increasingly lighter composition from roots to stems, leaves and flowers indicates strong fractionation during Fe translocation within strategy I plants. Average $\delta^{57}Fe$ values for whole plants, obtained from Fe elemental and isotope mass balance, are up to 0.8‰ lower than for the lightest and most labile mineral of the granite (biotite: 0.2‰ in $\delta^{57}Fe_{IRMM-14}$), demonstrating a significant fractionation already during uptake. Variations in $\delta^{57}Fe_{IRMM-14}$ of grasses (mainly strategy II) did not exceed ~0.3‰ and mimimum values are around -0.8‰. Nevertheless, the average isotopic composition of the aboveground biomass of grasses is still ~0.4‰ lighter than biotite. This characteristic enrichment in light Fe isotopes in the plant biomass is also reflected in the isotopic signature of organic matter and soils. Organic-rich horizons exhibit up to 0.2‰ lower $\delta^{57}Fe$ values than mineral-dominated horizons. The distinct isotopic composition of Fe associated with organic matter and mineral phases in soils implies that Fe isotopes can be used to assess the impact of plants on the Fe cycle in soils.