Assessing natural attenuation of gasoline range hydrocarbons using a multicomponental model

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The effective remediation of hydrocarbon contaminations is largely dependent on natural attenuation processes and volatilization rates in soil venting, air sparging and soil vapor extraction systems. A laboratory model was developed for simulating multicomponental transport of volatilized compounds in unsaturated media. For modeling purpose eight special glass columns were used, with four types of height. In volatilization experiments clay, sand and liquid hydrocarbon mixture were used. Due to stagnant experimental conditions and considerable media homogeneity, it was possible to define volatilization rates and to investigate sorption processes.

Volatilization rates of 29 hydrocarbon compound were determined using results of GC-FID analyses. Lighter hydrocarbons suffered losses, heavier ones signed relative enrichments, as it was expected. Some component showed altering volatilization tendencies. Composition of the liquid phase changed significantly after 640 days. Individual properties of investigated components and thickness of filling material proved to be determinative factor of volatilization. ATD-GC/MS and Rock-Eval analyses show that the sorbed phase of sand and clay is different in quantity and distribution. Large amount of hydrocarbon components can be determined using free gas analysis. Mainly heavier components can be measured in sorbed phase (e.g. toluene, xylenes, C_8-C_{13}), than as free hydrocarbons (e.g. C_5-C_7, methylcyclopentane, cyclohexane, benzene). On grounds of XRD results the volatilized components are adsorbed on surfaces of minerals or staying in the pores as free hydrocarbons.

New ^{146}Sm-^{142}Nd data for lunar rocks

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The timescale of lunar differentiation and the Nd isotope composition of the Moon have been widely investigated using the coupled ^{147,146}Sm-^{143,142}Nd systematics of lunar samples [1-3]. Available datasets yield consistent ages for Nd isotopic closure within the lunar magma ocean (LMO) of ~200 Myr after CAI formation but different estimates of the ^{142}Nd abundance for the Moon, ranging from chondritic [2] to superchondritic [1, 3]. Furthermore, ε^{142}Nd vs. ^{147}Sm/^{144}Nd correlation for lunar samples might also potentially reflects mixing processes within the lunar mantle and hence be chronologically meaningless. Here, we present new Sm-Nd data for a high-Ti mare basalt (70135), two low-Ti mare basalt meteorites (LAP 02205 and MIL 05035) and a KREEPy low-Ti mare basalt meteorite (NWA 2977), that are used to evaluate the age of lunar differentiation and the bulk Nd isotope composition of the Moon. While showing an offset relative to the regression derived by Rakenburg *et al*. [2], the linear ε^{142}Nd vs. ^{147}Sm/^{144}Nd correlation defined by our new Sm-Nd data is identical within errors to those derived by [1, 3] and passes significantly above the chondritic reference. If the correlation is interpreted as an isochron, its slope corresponds to a lunar differentiation age of ~218 Myr after CAI formation. The ε^{142}Nd of the LMO at ~218Myr as given by the intersept of the correlation with y-axis is 10ppm higher than the chondritic ε^{142}Nd at the same time. This could reflect the presence of a hidden reservoir with low ^{147}Sm/^{144}Nd ratio complementary to the LMO within the lunar mantle. Nevertheless, it more likely indicates that the bulk Moon has a superchondritic ^{147}Sm/^{144}Nd ratio. For instance, assuming a formation at ~50 Myr after CAIs from a chondritic reservoir, the ε^{142}Nd anomaly of +10 ppm at 218 Myr requires a bulk Moon with a ^{147}Sm/^{144}Nd ratio of 0.213, consistent with the superchondritic bulk composition of the Earth and Mars as proposed previously [4]. This is only the lowest estimate as ~50 Myr is the earliest time the Moon can have formed [5].

[1] Nyquist *et al*. (1995) *GCA* **59**, 2817-2837. [2] Boyet *et al*. (2006) *EPSL* **250,** 254-268. [3] Rankenburg *et al*. (2006) *Science* **312**, 1369-1372. [4] Bourdon *et al*. (2008) *Phil. Trans. R. Soc. A* **366**, 4105-4128.[5] Touboul *et al*. (2007) *Nature* **450**, 1206-1209.