

## Biogeochemical investigation of asphalt seepage at the Chapapote Knoll in the southern Gulf of Mexico

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Seepage of asphalt-laden heavy oils in 3000 meter water depth is fueling a unique cold seep habitat at the Campeche Knolls in the Southern Gulf of Mexico (MacDonald *et al.*, 2004). We studied the Chapapote Knoll, one of the various salt domes in this area, which is covered with asphalt beds that extend over more than 1 km<sup>2</sup>.

During the expedition of RV Meteor M72/2 in 2006, we recovered a diverse set of asphalt samples and benthic organisms inhabiting this extreme environment to further explore mechanistic details of asphalt leakage and accumulation and its role for fueling benthic ecosystems.

The asphalt samples are highly diverse in terms of their content of gaseous hydrocarbons. Maximum concentrations of gaseous hydrocarbons were associated with methane hydrate. Samples with very low concentrations of methane and higher gaseous hydrocarbons have a brittle and porous structure, which we interpret as signs of postdepositional alteration. The relative distribution of individual hydrocarbons in the C<sub>1</sub>-C<sub>5</sub> range is highly diverse in the asphalts. We interpret this diversity to be reflective of the postdepositional history, which could be due to outgassing, leaching or biodegradation.

Oily sediments recovered by gravity coring show evidence of a sulfate/methane transition zone at several meters subseafloor depth due to sulfate-dependent turnover of hydrocarbons. Stable carbon isotope analysis of methane in these cores indicate biological activity close to sulfate methane interfaces at 6m depth.

Ongoing work is aimed at the investigation of the biodegradation state of the asphalt samples at the seafloor. Incubation experiments with <sup>13</sup>C-labeled aromatic and aliphatic compounds are being carried out to assess the importance of biologically induced postdepositional alteration processes.

### References

MacDonald I.R., Borhmann G., Escobar E., Abegg F., Blanchon P., Blinova V., Brückmann W., Drews M., Eisenhauer A., Han X., Heeschen K., Meier F., Mortera C., Naehr T., Orcutt B., Bernahrd B., Brooks J., de Faragó M., (2004), *Science* **304**, 999-1002.

## Iron isotope fractionation during the volcanic evolution of Hekla, Iceland

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The aim of this study is to systematically investigate potential iron isotope fractionation in the Earth's crust by magmatic processes. High precision iron isotope analysis by high resolution MC-ICP-MS were performed on a suite of rock samples representative for the volcanic evolution of the Hekla volcano (Iceland).

The whole series of Hekla's rocks results from several processes [1]. (i) Basaltic magmas rise and induce partial melting of meta-basalts in the lower part of the Icelandic crust. The resulting dacitic magma evolves to rhyolitic composition through crystal fractionation. (ii) The basaltic magma itself differentiates by crystal fractionation forming a basaltic andesite magma. (iii) Andesites are produced by mixing of basaltic with dacitic melts. These processes were traced by iron isotopes: (i) During the differentiation from the dacites to the rhyolites the  $\delta^{56/54}\text{Fe}$  value increases successively. This increase (e.g., 0.15‰ for the 4000 B.P. eruption) can be described by a Rayleigh fractionation model using a constant bulk fractionation factor between the silicate liquid (L) and all mineral phases (M) of  $\Delta^{56/54}\text{Fe}_{\text{M-L}} = -0.1\text{‰}$ . (ii) No isotopic fractionation was found between the basalts and the basaltic andesites which have an average  $\delta^{56/54}\text{Fe}_{\text{IRMM-014}}$  value of  $0.068 \pm 0.057$  (2SD), identical to mean basaltic values reported by other studies [2-5]. This observation is consistent with the limited change in iron concentration in the remaining silicate liquid during crystal fractionation and small mineral-melt Fe isotope fractionation factors expected at high temperatures. (iii) The iron isotope composition of the andesites is matching the basaltic andesites and the less evolved dacites, compatible with a mixing process.

The observations suggest that the iron isotope composition of the crust can be slightly modified by magmatic processes and that magma differentiation processes are reflected in the iron isotope composition of some evolved silicic rocks.

### References

- [1] Sigmarsson *et al.* (1992) *Contrib. Min. Pet.* **112**(1), 20-34.
- [2] Beard *et al.* (2003) *Chem. Geol.* **195**(1-4) 87-117.
- [3] Poitrasson *et al.* (2004) *EPSL* **223**(3-4), 253-266.
- [4] Weyer *et al.* (2005) *EPSL* **240**(2) 251-264.
- [5] Schoenberg and von Blanckenburg (2006) *EPSL* **252**(3-4) 342-359.