Solar like neon in Icelandic basalt

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The noble gases provide crucial constraints for planet accretion models and understanding mantle structure and dynamics. Recent work based on continental well gases indicates that the MORB source $^{20}Ne/^{22}Ne$ ratio is ~12.25-12.5, i. e. similar to the component Ne-B in chondrites [1, 2]. However, higher $^{20}Ne/^{22}Ne$ ratios of 13.0±0.2 in plume-derived Devonian rocks from the Kola Penninsula have been reported [3]. Here I report high-precision Ne isotopic composition from the Icelandic basaltic glass DICE that has been previously studied (e.g. [4]).

I analyzed 5 separate 2-3 gram aliquots of fresh glass by in-vacuo crushing, with each measurement yielding 5-10 separate crushing steps. All of the measurements define the same slope in a Ne three isotope plot as previously determined [4]. However, in one of the aliquots we observed $^{20}Ne/^{22}Ne$ ratios of up to 12.92. The measurements demonstrate the extremely heterogeneous distribution of air contamination in basalt glass. The highest measured $^{20}Ne/^{22}Ne$ ratios from Iceland are very similar to values in the Kola plume, but quite distinct from the convecting upper mantle as constrainted from the well gases [1, 2]. Currently, we have no reason to doubt that well gases are relevant to the convecting mantle. Hence, the Icelandic and Kola plume data indicate that OIBs and MORBs have different $^{20}Ne/^{22}Ne$ ratios. Since $^{20}Ne/^{22}Ne$ ratios in the mantle cannot change, Earth must have accreted volatiles from at least two separate reservoirs.

The solar-like Ne is characteristic of the OIB mantle source and not likely to be diffusing in from the core or some other boundary layer. Other than being ad-hoc, such a suggestion provides no explanation for why the most primitive He and Ne isotopic signatures are always associated with Sr, Nd, Pb, and Os isotopic signatures that are internal to the mantle isotopic arrays. Therefore, differences in $^{20}Ne/^{22}Ne$ ratios between OIBs and MORBs indicate that heterogeneities in the Earth's mantle have not been completely wiped away by 4.5 Gyrs of mantle convection. Consequently, $^{20}Ne/^{22}Ne$ ratios provide powerful evidence for limited mixing between the MORB and OIB mantle sources over Earth history.

[1] Ballentine *et al*. *Nature* **433**, 33–38, (2005). [2] Holland & Ballentine, *Nature* **441**, 186–191, (2006). [3] Yokochi & Marty, *EPSL* **225**, 77–88, (2004). [4] Trieloff *et al*. *Science* **288**, 1036–1038, (2000).

Detection of aliphatic amines in the marine environment

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Field sample collection

Aerosol samples were taken using a high volume sampler (PM_{10}) and a five stage Berner type impactor during a field campaign at the Cape Verde Islands. Surface seawater was collected at the pier of Heiligendamm located on the Baltic Sea coast. The samples were collected from 2 m depth. Both aerosol and seawater samples were analysed for their aliphatic amine concentrations.

Results and discussion

The analysis of aerosol samples showed the highest amine concentrations in submicrometer particles. This implies the formation of aminium sulfate salts [1] and supports the assumption that amines play a role in the SOA formation process [2]. Furthermore we found a connection between the marine bioproductivity and the particulate phase amines in the subtropical North Atlantic region [3]. In addition, the observed high winter bioproductivity was supported by local upwelling or Saharan dust deposition.

The analysis of seawater from Baltic Sea showed similar alkyl amines to those in the aerosol samples collected in the Cape Verde Islands. Moreover, morpholine, which was first identified as an aerosol sampling artefact [3], was also found in the surface water. To obtain more information about the amine origins and their particle phase transformation, parallel sampling for water, gas and aerosol is necessary.

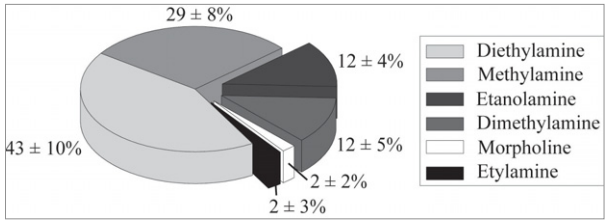

Figure 1: Percentage distribution of aliphatic amines in seawater.

[1] Facchini *et al*. (2008) Environ. Sci. Technol. **42** 9116-9121 [2] Barsanti *et al*. (2009) Atmos. Chem. Phys. **9** 2949-2956 [3] Müller *et al*. (2009) ACP **9** 9587-9597