**Increased North Atlantic dust deposition linked to Holocene Icelandic glacier fluctuations**

**Supplementary material: Analytical methods for Sr and Nd isotope analysis.**

**Helena Stewart, Tom Bradwell, Joanna Bullard, Robert D McCulloch, Ian Millar**

**Dissolution and column chemistry**

Mineral samples (typically 5 – 100 mg) isolated from the peat using a Sulphuric and Nitric acid digestion technique (Dugmore et al., 1992) were weighed into 10 ml Savillex teflon beakers and spiked with 150Nd and 84Sr isotope tracers. 1-2 ml of 2x quartz-distilled 16M HNO3 and 5-6 ml of uPa-grade 29M HF were added, and the sample beakers were left closed on a hotplate at 110°C overnight. After evaporating to dryness, a further 1-2 ml of HNO3 were added, and the samples were left on the hotplate to evaporate to dryness overnight. The samples were then converted to chloride form using 10 ml of Teflon-distilled HCl. The samples were then dissolved in c. 2 ml of calibrated 2.5M HCl in preparation for column chemistry, and centrifuged.

Separation of Sr and bulk REE

Samples were taken up in c. 2 ml of 2.5M HCl and pipetted onto quartz-glass columns containing 4 ml of AG50x8 cation exchange resin. Matrix elements were washed off the column using calibrated 2.5M HCl and discarded. Sr was then collected in 2.5M HCl and evaporated to dryness. A bulk rare-earth element fraction was collected in 6M HCl and evaporated to dryness.

Separation of Nd from the bulk REE fraction

Sm and Nd were separated using 2 ml of EICHROM LN-SPEC ion exchange resin packed into 10 ml Biorad Poly-Prep columns. The bulk REE fraction was dissolved in 200 µl of 0.2M HCl and loaded onto the columns. La, Ce and Pr were eluted using a total of 14 ml of 0.2M HCl. Nd was collected in 3 ml of 0.3M HCl.

**Mass spectrometry**

Nd analysis

Nd fractions were dissolved in 1 ml of 2% HNO3 prior to analysis on a Thermo Scientific Neptune Plus mass spectrometer operated in static multicollection mode. Drift within each analytical session is monitored using multiple analyses of reference materials, and is negligible.  Data are normalised to 146Nd/144Nd = 0.7219. 10 analyses of JNd-I gave a mean value of 0.512071 ± 0.000004 (1-sigma). Results are quoted relative to a value of 0.512115 for this standard.

Sr analysis

Sr fractions were loaded onto outgassed single Re filaments using a TaO activator solution, and analysed in a Thermo-Electron Triton mass spectrometer in multi-dynamic mode. For the Sr analysis, correction for drift is not required because the protocol used for analysis on the Triton mass spectrometer (multidynamic collection using thermal ionisation mass spectrometry) cancels out any drift in individual faraday cups, and virtual amplifiers are rotated throughout the measurement cycle. Data are normalised to 86Sr/88Sr = 0.1194. Fifteen analyses of NBS987 gave a value of 0.710249 ± 0.000007 (1-sigma). Sample data are normalised using a preferred value of 0.710250 for this standard.

Across the time of analysis, multiple analyses of the BCR-2 reference material gave a mean 87Sr/86Sr ratio of 0.705044 ± 0.000043 (2sd, n=18), and a mean 143nd/144Nd ratio of 0.512620 ± 0.000032 (2sd, n=28).

**References**

Dugmore AJ, Larsen G, Newton AJ and Sugden DE (1992) Geochemical stability of fine- grained silicic tephra layers in Iceland and Scotland. *Journal of Quaternary Science* 7: 173-83.