^{210}Pb-^{226}Ra disequilibrium in basalts from Surstsey Island (Iceland) and implications for magma transport time

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Primitive basalts with radioactive disequilibrium between isotopes of the ^{238}U decay chain may provide constraints on the timescales of mantle melt migration. Few results still exist on the ^{210}Pb-^{226}Ra disequilibria. Due to the short half-live of ^{210}Pb (22.3 years), only basalts significantly younger than 100 years old can be studied for ^{210}Pb-^{226}Ra disequilibria generated in the magma pluming system or the mantle. Most lavas measured so far show either ^{210}Pb-^{226}Ra equilibria or ^{210}Pb-deficit which have been attributed to the degassing of ^{222}Rn in shallow magma chambers. Excess ^{210}Pb has also been observed in a few cases and explained by accumulation of ^{222}Rn that decays to ^{210}Pb. Icelandic tholeiites from the last century are in radioactive equilibrium with (^{210}Pb/^{226}Ra) equal to unity. These basalts are fed from shallow magma chambers having residence time exceeding 100 years. In contrast, primitive alkaline basalts (MgO =7-12 %) from Surtsey island had (^{210}Pb/^{226}Ra) ranging from 0.45 ±0.04 to 0.82 ±0.06 at the time of eruption. These large 210Pb deficits are unlikely to result from shallow magma degassing since no magma chamber existed beneath this volcanic island which was born during the 1963-67 eruption. The ^{210}Pb-^{226}Ra disequilibria increase from the beginning towards the end of the eruption when the most primitive basalts were produced, and decrease systematically with increasing Th content. These same basalts show a negative correlation between Pb and Cu abundances which are inconsistent with exsolution of sulfur rich liquid or crystallisation of sulphides as a fractionation mechanism of ^{210}Pb and ^{226}Ra.

The large deficit of ^{210}Pb in Surtsey lavas were thus most likely generated during mantle partial melting. In such a case, the time of melt transport from the source region to surface is constrained to be significantly shorter than 100 years.

Climate changes and volcanic signals during the Bronze Age: A stalagmite record

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In this study we present high-resolution and multi-proxy records of a Holocene stalagmite showing *volcanic signals detected the first time in a stalagmite by REE analyses*. Stable oxygen and carbon isotope data profile along the speleothem deposited during the last 5000 years in the Mecsek Mts. (S-Hungary) suggest relatively stable conditions in most of the studied period. However, a significant d18O decrease (>2 ‰) between approx. 3800 and 3500 years BP occurs in the record. Fluid inclusion water shows also significant D-depletion, supporting cooling. Combined isotope and trace element measurements indicated coupled temperature and precipitation quantity changes occuring in the above period. Rare earth elements (REEs) were also measured by LA-ICP-MS technique, and unlike the longer trends shown by C and O isotopes, the REE and Y distributions indicate sudden changes at the beginning of the cooling period. The La/Y ratio of this segment shows similarities with the volcanic rocks of of the Thera (Santorini) eruption that occurred at about 3650 years BP. As an independent indicator, 87Sr/86Sr ratios show slight decrease at the REE peak, supporting the inferred volcanic signal.

The climatic conditions ameliorated rapidly (within ~100 years) to close to present day conditions as reflected by the C, O and H isotope compositions. However, some of the trace elements show marked changes following the recovery. Elements indicating detrital material within the carbonate matrix (e.g. Si, Al, Th) show marked elevations, along with 87Sr/86Sr increase, suggesting increased amount of silicious material transported by dripwaters. However, the Mg content is also higher at this section part, thus, the increase of detrital material amount may be related to lower carbonate precipitation rate, rather than to stronger weathering of silicate rocks.

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