How subduction zones make the OIB isotopic array

C. CHAUVEL AND ÉRIC LEWIN

ISTerre, Univ. Grenoble Alpes, CNRS, Grenoble, France

Ocean island basalts sample highly heterogeneous mantle material brought by hot plumes to the surface of the Earth. This material is commonly interpreted to be recycled oceanic basalt accompanied by variable amounts of sediment. However, the isotopic arrays defined by OIB in Sr-Nd-Hf-Pb space do not correspond to simple mixing arrays between ocean basalt composition such as MORB and average subducted sediment such as GLOSS. A decoupling process must occur between subduction and eruption of plume volcanism.

Here we adopt a numerical and statistical approach to reproduce concurrently the Sr-Nd-Hf-Pb ocean island arrays. We use an isotopic growth model since Earth formation associated with a Monte-Carlo simulation similar to that published previously [1]. The model allows us to calculate the present-day isotopic compositions of Sr, Nd, Hf and Pb for materials of variable origin produced at different times in Earth history. Using this general approach, we adjust "subduction factors" for the parent-daughter systems so that the calculated isotopic arrays correspond to the fields measured on worldwide OIB.

Assuming that subducted basalt and sediment are unmodified by subduction zone processes, the model creates a Nd-Hf isotopic array that overlaps the Nd-Hf OIB field [1] but not the Sr and Pb fields. Reproduction of all isotopic systems requires that Pb, Rb and Sr are significantly removed from the subducted basalt and sediment. The best fit is obtained when the subduction zone removes ≈50% of the Rb and Pb in MORB and ≈80% of the Pb, 30% of the Sr and 50% of the Rb in GLOSS. Such "subduction factors" are entirely consistent with observations made on present-day island arc volcanics in which fluid-mobile elements are significantly enriched relative to REE and HFSE.

Our modeling demonstrates that simple tectonic processes such as those operating in modern subduction zones can reproduce the isotopic variability of the mantle. No mysterious reservoir or process is needed to explain OIB isotopic compositions.

[1] Chauvel et al. *Nature Geosci.*, 2008, **1**(**1**): 64-67.