Is the isotope composition of Reunion plume really homogeneous?

F. NAURET, M. ARIGOT, P. LOUVAT AND M. MOREIRA

Equipe de Geochimie-Cosmochimie. Institut de Physique du Glode de Paris. Tour 14, 3 Etage. (nauret@ipgp.jussieu.frnauret)

Réunion Island, Indian Ocean, is the present signature on the Earth surface of the Réunion hotspot. The island is composed by two volcanoes: the inactive Piton des Neiges and the active Piton de la Fournaise. The isotope compositions of Réunion lavas are usually described as homogeneous. This homogeneity is remarkable compared to other hotspot volcanism. However, a fine study of the Réunion database reveals that the large majority of the available data comes from analyzed lavas produced by Piton de la Fournaise. Furthermore, the few available Pb isotope data have been published before 1972. Consequently, the apparent homogeneity of Reunion lavas is potentially due to analytical or sample bias.

With the intention of testing this homogeneity, we have recently sampled the Piton des Neiges. The sample collection (n=47) covers temporally and geographically this volcano.

Taking advantage of recent analytical development, Pb isotope compositions were measured using a MC-ICP-MS (Neptune) and mass fractionation is corrected using a Tl spike. The Pb isotope composition range from $^{206}Pb/^{204}Pb$: 18.79-18.90, $^{207}Pb/^{204}Pb$: 15.56-15.60 and $^{208}Pb/^{204}Pb$: 38.79-39.04. These ranges overlap these given for the Piton de la Fournaise ($^{206}Pb/^{204}Pb$: 18.55-18.91, $^{207}Pb/^{204}Pb$: 15.58-15.65 and $^{208}Pb/^{204}Pb$: 38.74-39.01 from 71 samples). Based on these preliminary results, we suggest that lavas from both volcanoes plot on same lines in Pb isotope spaces. However, it seems that Piton des Neiges lavas might extend Pb isotopes ranges given for Reunion plume.

Pb isotopes and trace element concentration analyses currently in progress will help further constrain the geochemical composition of the Piton des Neiges, the chemical structure of the Réunion hotspot and the influence of the Reunion hotspot on the regional magmatism.

Influence of porosity on basalt weathering rates from the clast to watershed scale

A. NAVARRE-SITCHLER[1], C. STEEFEL[2], E. HAUSRATH[1] AND S. BRANTLEY[3]

[1]Department of Geosciences, The Pennsylvania State University, (anavarre@geosc.psu.edu)
[2]Lawrence Berkeley National Laboratory, Berkeley CA
[3]Earth and Environmental Systems Institute and Center for Environmental Kinetics Analysis, The Pennsylvania State University

Production of saprolite from bedrock is an important source of both mineral detritus and dissolved ions. The rates at which saprolite is produced have far reaching impacts on important processes such as global flux of dissolved material to oceans, nutrient cycling in soils, sedimentation that ultimately leads to oil and gas generation, and the fate of atmospheric CO_2 over geologic time scales. Despite their importance, saprolite production rates cannot currently be predicted. In low porosity rocks, like basalt, rates of saprolite production are dependent upon the ability of water to infiltrate the parent rock. Fracturing of these rocks by either physical or chemical mechanisms is one way of increasing available water. However, not all rocks fracture during weathering and in these systems porosity can be enhanced through the dissolution of primary phases.

We are currently using weathering rinds developed on un-fractured basalt clasts as a natural system where we can study processes and rates of saprolite formation over long time periods (35-250 ka). Across a weathering interface approximately 2 mm wide parent basalt weathers to form saprolite that is completely depleted in Ca, Na, Si and Mg. Associated with the weathering is an increase in porosity from 3-50%. Theoretical calculations of diffusion limited weathering predict that the weathering rind will grow as a function of the square-root of time ($t^{0.5}$). However, these calculations are for constant porosity systems and many studies of weathering rinds indicate a $t^{0.8}$ dependence. By including dissolution enhanced porosity in reactive transport models of the basalt clasts, we are able to predict both the geometry of the weathering interface and time dependence of rind formation.

Given similar lithology and climate, the knowledge we have gained by studying saprolite production on basalt clasts should provide insight into weathering of basalt watersheds. However, making comparisions between watershed denudation rates and weathering rind advance rates is complicated due to the difference in methods used to measure surface area. We compare weathering advance rates (mm yr^{-1}) calculated from laboratory, clast, soil profile and watershed studies using fractal theory in an attempt to reconcile basalt weathering rates across scales.