

## Dynamics of secondary plumes

C.G. FARNETANI<sup>1</sup>, L. FOUREL<sup>1</sup> AND C. CLASS<sup>2</sup>

<sup>1</sup>Institut de Physique du Globe, 75252 Paris, France

(cinzia@ipgp.jussieu.fr, fourel@ipgp.jussieu.fr)

<sup>2</sup>Lamont-Doherty Earth Observatory of Columbia University, Palisades, NY 10964, USA (class@ldeo.columbia.edu)

Previous numerical models of thermo-chemical plumes have shown the possible stalling of hot material beneath the phase transition at 660 km depth. The subsequent upwelling in the upper mantle can take different forms: (i) a large plume head followed by a high buoyancy flux conduit, or (ii) only a narrow conduit with a buoyancy flux one order of magnitude lower. While the first case fits the classical 'head and tail' plume model, the second does not and it may provide a dynamically consistent framework to interpret weak intraplate volcanism.

Here we investigate in detail the dynamics of ponded plume material to elucidate the conditions leading to the formation of only one, or several plume conduits simultaneously fed by hot material ponding beneath the phase transition at 660 km depth. We use a three dimensional mantle convection model that allows us to vary relevant parameters, such as the plume excess temperature, its intrinsic compositional density and the radius of the ponded material. At the surface we simulate a moving oceanic lithosphere that induces a simple mantle wind. We can then predict the surface effects (e.g., dynamic uplift, timing and extent of volcanism) induced by these secondary plumes.

The results of our numerical models will be compared with geophysical and geochemical observations in the South Atlantic. The Tristan plume formed an initial LIP and subsequent age-progressive volcanism along the Rio Grande Rise-Walvis Ridge. However, recent volcanism is volumetrically minor and spread over about twice the area than typical for such plume tracks. In addition, geochemical signatures are paralleled in the Discovery Seamounts and the purported Shona plume track, both lacking an initial LIP. Our model tests the viability of multiple plumes rising from what might be a common plume source zone.

## Using a hydrous manganese oxide doped gel probe to measure *in situ* rates of reductive dissolution

C.E. FARNSWORTH<sup>1,2\*</sup>, S. GRIFFIS<sup>1</sup> AND J.G. HERING<sup>1,2</sup>

<sup>1</sup>California Institute of Technology, Pasadena, CA 91125,

USA (\*correspondence: farnswor@caltech.edu)

<sup>2</sup>Swiss Federal Institute of Aquatic Science and Technology, CH-8600 Duebendorf, Switzerland

Reductive dissolution of redox-sensitive minerals such as manganese (Mn) oxides in natural sediments is an important mechanism for trace element mobilization into groundwater [1, 2]. A gel probe sampler has been constructed to study *in situ* reductive dissolution of Mn-oxides. The gel consists of a polyacrylamide polymer matrix doped with hydrous Mn oxide (HMO). It is cut into slabs and placed into slots etched into a Plexiglas probe, and covered with a membrane filter. The probe is designed to be inserted into sediments and allowed to equilibrate with sediment porewater. The amount of Mn reductively dissolved from the gel is measured by comparing the amount of Mn initially embedded into the gel with the amount remaining in the gel after exposure to a reducing agent.

In this study, the gel probes were used to compare the rates of reduction by ascorbic acid, manganese reducing bacteria *Shewanella oniedensis* strain MR1, and natural sediments in a laboratory microcosm. In addition, modeling was used to relate the reaction rates observed for HMO doped in gels to the reaction rate observed for 'free' HMO. The probes were then deployed in the sediments of Lake Tegel (Berlin, Germany). Subsequent reduction rates as a function of sediment depth were correlated with the solid-phase composition, as measured by sequential extractions of sediment cores [3], and porewater chemistry, as measured by DET gels [4]. Conclusions about field deployment of this gel probe method will also be presented.

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