

## H2O distribution and signature in MORB glasses

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Many studies have investigated H<sub>2</sub>O content in MORB and demonstrated its important impact on the physical and chemical properties of oceanic mantle. Thus, the H<sub>2</sub>O content dissolved in MORB melt can bring new constraints on mantle composition, melting and evolution.

Here we report the global variation of H<sub>2</sub>O content dissolved in MORB glasses from worldwide locations (EPR, MAR, CIR and SEIR). This has been studied at different scales: global scale (inter- and intra-oceanic comparison), macroscale (within a population of melt inclusions trapped in olivine from FAMOUS zone) and microscale (concentration profiles into melt inclusions). H<sub>2</sub>O content was measured by microRaman spectroscopy. Simple sample preparation (one-side polishing) and high spatial resolution (1 micron) make microRaman spectroscopy a very appropriate technique for this study. The method has been improved in order to lower the detection limit, from around 3000 ppm in mafic glasses, down to 500 ppm, which is more appropriate to MORB glasses. H<sub>2</sub>O concentration data have been coupled with major, trace and isotopic analysis to study the effects of mantle source heterogeneity.

We identified large global H<sub>2</sub>O heterogeneity ranging from 0.14 to 0.47 (wt. percent) in both Atlantic and Pacific MORB samples with an average around 0.25 (wt. percent). However Indian MORBs samples are statistically more enriched with an average around 0.30 (wt. percent) and a more restricted range (from 0.20 to 0.38 wt percent). The analyses performed on melt inclusions yielded homogeneous H<sub>2</sub>O content at both macro and microscale. Hence the previously observed heterogeneity at global scale is not due to sampling artefact but reflect resolvable regional variations. Based on the positive correlations between water and incompatible elements (Rb, Th) and the solubility models into basaltic melts, we infer that H<sub>2</sub>O variations cannot result from degassing processes or seawater contamination, but must instead reflect magmatic processes. Furthermore, the observed positive correlation ( $R^2= 0.70$ ) between H<sub>2</sub>O and <sup>87</sup>Sr/<sup>86</sup>Sr led to suggest that the observed variations is likely due to mantle source heterogeneity rather to a variation of partial melting degree.

Using the H<sub>2</sub>O/Ce ratio as a mantle source tracer (H<sub>2</sub>O having the same behavior as Ce in MORB) we identified specific signatures for each ocean basin: high and homogeneous ratio for the Indian Ocean samples (average value of 260), low and homogeneous ratio for the Pacific Ocean samples (average of 176) and highly dispersed values for the Atlantic Ocean samples (from 150 to 350). While the spread of Atlantic data is probably due to the influence of mantle plumes along the ridge, the data show that Pacific and Indian mantle have contrasted H<sub>2</sub>O/Ce ratios, with little, if no overlap. High H<sub>2</sub>O/Ce, thus appears as a robust fingerprint of Indian mantle, in the same manner as its peculiar Pb isotope signature.