Extremely high H_2O/Ce ratios of the Southwest Indian Ocean Ridge basalts (SWIR 46° E-53° E)

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The H_2O/Ce ratios of basalts are usually believed to reflect the extend of H_2O erichment in their mantle sources relative to other imcompatible trace elements[1]. The H_2O/Ce of the global OIBs and MORBs varies from 50 to ~400, depending on the mantle endmembers involved and geological backgroud[1,2]. Although some melt inclusions hosted in olivine phenocrysts also show rather high H_2O/Ce ratios (up to ~1500), they were laregly suggested to be caused by water rehydration by diffusion[3].

Here, we report the H_2O content and H_2O/Ce ratios of 46 fresh MORB glasses from 46° E-53° E segment of Southwest India Ocean Ridge. The water content and trace element concentrations were measured by FTIR and LA-ICP-MS, respectively. The water contents of these glasses are from 0.06wt.% to 0.57wt.%, which are within the normal range of global MORB. However, the H_2O/Ce ratios vary from ~180 to 1109, most of which are obvioulsy higher than the value of the global MORB glass, even for that had been effected by hot spot (like North Atlatic Ridge near Arozes hot spot, up to 400). The Cl content of these glasses were measured by EPMA with high preccision mode (~200s counting time). The results show that many samples with high H_2O/Ce ratios contain rather low Cl concentrations (less than 50 ppm), which indicates that the high H_2O/Ce ratios could not be caused by assimilation of altered oceanic crust. In addition, the H_2O/Ce ratios are negatively correlated well with Ce/Pb and Sm/Yb ratios. All these observations suggest that the tremendously high H_2O/Ce of the SWIR glasses in this work woule be inheriated from their mantle sources. Thus, the 46° E-53° E segment of SWIR is the most relatively “wet” one in the global MORB system, although its origin still remains to be explored.

[1] Dixon et al., 2002. Nature. 420. 385-389. [2] Michael, 1995. Earth and Planetary Science Letters. 131. 301-320. [3] Hartley et al., 2015. Earth and Planetary Science Letters. 425, 168-178.