Variable carbon degassing from MORB assessed using CO_2/Nb

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Magmatism at mid-oceanic ridges releases an important flux of carbon from the mantle into the ocean/atmosphere. As carbon is poorly soluble in silicate melts, mid-oceanic ridge basalts (MORB) contain little dissolved carbon (170±70 ppm CO_2, 1σ, global dataset of 440 glass samples), and most of the carbon is released as CO_2 in the exsolved gas phase. By comparing the collection pressure (proxy for eruption pressure) with the modeled H_2O-CO_2 saturation pressure, we find that, with the exception of glasses from the Siqueiros Fracture Zone, all MORB samples reached vapor saturation within the crust. This is in good agreement with the presence of gas vesicles (a few % in volume) in MORB samples. Most MORB are also oversaturated with CO_2 at the depth of eruption, with up to 3.5 times the CO_2 content predicted for saturation at the depth of eruption. We infer that the oversaturation is a consequence of kinetic effects that delay bubble formation and/or equilibration of C between the melt and the gas phase. The CO_2/Nb of global MORB vary from 5 to 400. No clear correlation with eruption pressure is found at the global scale. However, there is an overall positive correlation between CO_2/Nb and the amount of oversaturation, indicating that CO_2/Nb variation in MORB records the combined effect of equilibrium degassing and kinetic effects that delay CO_2 release in the vesicles. Interestingly, the lowest CO_2/Nb are associated with the smallest oversaturation rates and are found in MORB from ridge segments near hotspots. We will investigate the link between magma storage conditions, degassing and oversaturation using local examples.