# Carbon Flux at Mid-Ocean Ridges and $CO_2$/Nb Variability in the Mantle

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In order to better characterise mantle $CO_2$/Nb-variability, we obtained and compiled major and trace elements, isotope composition and concentrations of $CO_2$ on two series of mid-ocean ridge basalt (MORB) samples dredged at ~14°N (n = 6) and 34°N (n =11) on the mid-Atlantic ridge. The sample set includes N-, E-MORB and alkali basalts with 15 degassed and one undegassed (i.e. the so-called MORB popping rock) samples; the initial C-contents of the former being reconstructed from their assumed degassing history.

Initial $CO_2$ vary greatly (from 730 to 14700 and from 1400 to 57600 ppm$CO_2$ for samples at 14°N and 34°N respectively) and define broad linear trend with Nb-contents (4.5 to 29.6 ppm). MORB samples at 14°N define a linear relationship over a large range of Nb-contents, from 0 to 25 ppm defining an average $CO_2$/Nb ~475 (n=6, min=217, max=573) and, within uncertainty, includes the undegassed MORB popping-rock ($CO_2$/Nb ~ 571). MORB glasses dredged at 34°N define a rough positive correlation with a slope of ~1130 and an average $CO_2$/Nb-ratio ~724 (n=10, min=205, max=1947). For 14°N samples in particular, little variable $CO_2$/Nb-ratios over a large range of initial $CO_2$-contents from up to 14,700 ppm and Nb-contents, up to 28 ppm, support the accuracy of degassing corrections. The close to zero intercept is in agreement with the idea that carbon behaves similarly to niobium (Saal et al., 2002)

Yet, the two undegassed samples available so far (i.e. the popping rock of the present study and the basaltic glasses from the Siqueiros transform from the study of Saal et al. 2002) show significant variations in $CO_2$/Nb over a factor of 2 and thus questions the constant $CO_2$/Nb previously emphasised for these two samples (Saal et al., 2002). For incomaptible elements including volatile elements, an examination of the geochemical characteristics of transform fault basaltic magmatism at different locations on the MOR system suggests these to be unrepresentative of mantle compositions (as previously emphasised by Michael, 2002). Assuming a more appropriate average MORB $CO_2$/Nb-ratio of ~530 and a mean MORB Nb-content of 3.3 ppm we computed a mantle carbon flux of ~$2.3\times10^{12}$ mol/y, i.e. within the lowest estimates.