Weathering reactivity of young basaltic areas and global implications

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Volcanic rock weathering is responsible for a large proportion of the alkalinity fluxes by silicate weathering and corresponding CO_2 consumption. Past attempts scaled global basalt weathering fluxes often with runoff and temperature. The decrease in weathering fluxes due aging processes of the system and declining geothermal activity and magmatic CO_2 contribution were less in focus of global studies but should influence fluxes.

Comparison of the relative alkalinity fluxes from young volcanic areas (Holocene age) with those from older areas might therefore shed light on the expected differences. Results from 32 mafic volcanic fields covering all climate zones suggest that alkalinity fluxes from younger volcanic areas with active hydrothermal activity are on average eleven times higher than for representative older areas.

The Holocene proportion of the global basalt area is ~1.1%. This would suggest elevated alkalinity fluxes of about 12%. If the temperature dependence of Li et al (2016) is applied together with information on age, the global alkalinity fluxes from basalt weathering might increase by more than 1/3 (for runoff areas with > 74 mm/a) in comparison to former estimates. Therefore, the assessment of the CO_2 consumption potential during periods of large igneous events may need to consider the aging processes of volcanic systems, if consequences for the carbon cycle in the aftermath shall be evaluated.

Reference:
Li, G. et al., 2016. Temperature dependence of basalt weathering. Earth and Planetary Science Letters, 443: 59-69.