Local and regional magmatic modulators to mantle signatures in erupted mid-ocean ridge lavas

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Although nearly all mid-ocean ridge magmas are formed in the mantle and inherit local compositional characteristics of the mantle source, a range of processes that occur between melt generation at depth and eruption on the sea-floor modulate the chemical signals of mantle heterogeneity that is sampled by ridge volcanoes. Increased time-integrated magma supply from mantle to crust is one characteristic that dramatically impacts (reduces) true mantle compositional variance in MORB by promoting coupled magma mixing and differentiation in the crust (e.g. [1]) Studies at local and regional spatial scales underscore the importance of geological conditions for interpreting mantle signatures in erupted lavas and provide a means for studying non-steady-state aspects of magma transport and crustal construction on decadal to millennial timescales. The inherent complexity in MORB compositions reflects the processes and rates of magma delivery to and accumulation in the crust, as well as the extent of mixing and heat loss prior to eruption, with implications for the spatial scales of mantle compositional variation thereby recorded in MORB. This talk will discuss global variations in MORB compositions and new results of recently conducted local/regional studies at a range of spreading rates where there are melt supply 'anomalies' along axis (e.g. from hot spots) and clear short-term differences in magma supply and eruptive activity at neighboring ridge segments. In general, these studies demonstrate that short term fluctuations in magma supply are driven by mantle heterogeneity, and that globally inferred linkages between magma supply, mantle compositional variance, and differentiation degree hold at these shorter spatial and temporal scales as well. They also demonstrate the importance of understanding geological context of lava samples, the need to have a sufficiently well sampled eruptive unit, and the preference for less differentiated (generally, high MgO) lavas in order to begin to decipher mantle compositional variation patterns in MORB.

[1] Rubin & Sinton (2007) *EPSL* **260**, 257–276.

Intermediate water $\Delta^{14}C$ off Brazil between 3-40 ka BP

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The Southern Ocean is thought to play a key role in understanding the atmospheric rise of CO_2 at the end of the last glacial period accompanied by a decline of atmospheric $\Delta^{14}C$. Here we present reconstructed marine $\Delta^{14}C$ activities from corals of intermediate depth off Brazil. The corals stem from two new sediment cores in the direct vicinity to our cores already reported in [1]. This new dataset expands the older one and encompasses now the ages from 3-40 ka BP. First measurements validated our $\Delta^{14}C$ findings already published in [1]. The new data show that the continuous $\Delta^{14}C$ decline starting in our previous study with the Younger Dryas (YD) extends to 5 ka BP reaching an absolute minimum with an apparent ventilation age of over 6200 ^{14}C years. These observations are compatible with the scenario suggesting the existence of an abyssal reservoir in the Pacific Ocean that was isolated for several thousand years from the atmosphere before deglaciation. The observed continuous $\Delta^{14}C$ decline during Heinrich Stadial 1 (HS1) and the YD would then suggest a further weakening of ventilation of the deep water and the injection of this old carbon dioxide signature from the deep Pacific reservoir into the Circumpolar Water around Antarctica that is the source of Atlantic Intermediate Water. This follow-up study also attempts to trace back the history of the $\Delta^{14}C$ activity beyond HS1 (HS2, HS3 and HS4). First results lead to the conclusion that even during HS4 (38-35 ka), the water on the continental shelf off Brazil was highly depleted in ^{14}C with apparent ventilation ages of 4.84±1.35 ka (2σ). Recurring events of old water masses advance at intermediate depth off Brazil indicate a coupling between the intensity of deep water formation in the North Atlantic and the ventilation of the deep Pacific Ocean.

[1] Mangini *et al*. (2010) *EPSL* **293**, 269–276