Low temperature alteration carbonates in the ocean crust and their importance for CO_2 uptake and the global Ca cycle

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Calcium carbonate precipitated in vugs, veins and vesicles of basaltic rocks of the ocean crust constitutes an important sink for Ca and CO_2 in seawater-lithosphere exchange budgets. The current estimates of the rates of uptake are based on observations from a small number of ocean drill sites. DSDP, ODP and IODP sites have penetrated ocean crust sections of a wide range of ages and of crust formed at slow and fast spreading ridges. A systematic evaluation of the available cores should help to better constrain $CaCO_3$ uptake rates and their temporal evolution. We have therefore recently started to log and sample $CaCO_3$ filled vugs, veins and vesicles in cores from a range of ocean crust drill sites. First results point to variations of the carbonate vein abundances that are related to tectonic setting and crustal age.

The total calcium flux into basaltic ocean crust has been estimated previously at about 10 % of the total calcium output flux from the oceans [1]. First results from a study of the calcium isotopic composition of carbonate precipitates in the ocean crust [2] point to a significant fractionation during precipitation. Therefore, these low temperature alteration (LTA) carbonates probably represent a significant factor in the global ocean calcium isotope budget. They may help to explain discrepancies in the Neogene calcium isotope budget that have recently been pointed out by [3]. LTA carbonates may further be used as recorders of the ocean water calcium isotope composition and its variations during the last 100 to 150 million years, complementing and testing exisiting records based on biogenic carbonates and phosphates [4].

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Magmatic processes and timescales revealed by plagioclase textural and *in situ* chemical data

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A combination of crystal size distribution (CSD), Nomarski textural, and *in situ* chemical data has been used to describe magmatic processes and timescales associated with historical Mt. Etna (Sicily), the 1915 Lassen Peak eruption (CA) and basaltic lavas from Pisgah Crater (CA). *In situ* $^{87}Sr/^{86}Sr$ of plagioclase coupled with interpretations of CSD at Etna suggest that crystal residence times are on the order of decades to centuries. For most single crystals, core and rim are in Sr isotope equilibrium, indicating that crystals are exposed to relatively "simple" magmatic environments. The magma storage/transport system is envisioned as a plexus of small volume, poorly connected domains; the plagioclase crystal populations do not appear to be shared extensively among batches of magmas. Like Etna, Pisgah Crater *in situ* Sr isotope plagioclase data also suggest that the storage/transport system was a plexus of sills and dikes. At Pisgah, the data indicate time-progressive crustal contamination by relatively homogeneous-composition wallrock. Nomarski data identify crystals that have relatively simple zoning patterns, suggesting that recharge was not significant. In contrast, the 1915 Lassen Peak eruption is hypothesized to have been catalyzed by recharge of basaltic andesite into a dacitic chamber. CSD, Nomarski, and *in situ* elemental and Sr isotope data for plagioclase define 3 crystal populations. Phenocrysts, with average residence times of centuries to millennia, are hypothesized to form in a relatively isolated dacitic magma chamber, whereas microphenocrysts formed in a hybrid layer that represents mixing between the dacite and the recharge magma. Average microphenocryst crystal residence times are on the order of months. Microlites may have formed in response to decompression and/or syn-eruptive degassing. All of these data highlight the rich potential that integrated textural and *in situ* studies have for developing detailed models of how magma chambers evolve.