The stable Si isotope composition of eastern Atlantic Ocean seawater

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We have analysed the stable isotope composition of dissolved silicon (Si) in seawater samples from the eastern Atlantic Ocean. These samples were collected on board the R/V *Polarstern* during cruise ANT XXIII/1 and have been analysed by high-resolution MC-ICPMS (*NuPlasma 1700*). The stable isotope composition of silicon is reported as δ^{30}Si in the standard delta notation of deviations in the ^{30}Si/^{28}Si ratio from the standard reference material NBS 28.

Deepwater δ^{30}Si (>2000m water depth) varies between water masses and increases both from south to north as well as upward in the water column, which appears to reflect mixing of an isotopically light southern water component with a heavier northern component. The linear mixing trend of δ^{30}Si against 1/[Si] in the deepwaters ($r^2 = 0.97$) indicates that the northern component endmember has a δ^{30}Si value of +1.5‰ to +1.7‰.

Thermocline waters show an upward increase in δ^{30}Si to values in excess of +2‰. Isotopically heavy values in near-surface waters are produced by the biological fractionation of Si isotopes by diatoms [1]. Estimates of the fractionation factor ε related to this utilisation based on both Rayleigh-type and steady-state ("multi-box" [2]) models are significantly lower than the experimentally determined value of -1.1‰ [1]. This discrepancy could be due to vertical mixing or lateral advection of waters that reduces the gradient of δ^{30}Si with depth in the water column.

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Epidote forming reactions in calc-alkaline rocks monitored by trace elements

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Epidote is a common magmatic mineral in intermediate plutonic rocks. Experiments performed at different pressure establish a minimum pressure of crystallisation of epidote around 0.3-0.7 GPa depending mainly on bulk composition and on oxygen fugacity. However, few data are available on epidote stability in gabbroic rocks at H_2O-undersaturated conditions and in volcanic dykes.

Rare examples of epidote phenocrysts known in volcanic rocks of dacitic to rhyodacitic composition show complex and fine oscillatory zoning as well as many dissolution and recrystallisation features. 3D images, performed with micro-X-Ray tomography, show that the core of the phenocryst is often composed by a nucleation centre associated with a complex irregular zoning pattern. Relics of quartz in the core and the vermicular aspect of the zoning resemble to what could be observed in epidote found in plutonic rocks.

Magmatic epidote in mafic rocks is widespread in the lower part of the Kohistan Arc Complex in Northern Pakistan. The Jijal Complex is one of the few places in the world with epidote bearing mafic plutonic rocks in a K-poor natural system and to understand the phase relations involving epidote in gabbroic rocks. Epidote occurs as primary phase in garnet hornblende bearing gabbros and in some pegmatites together with quartz, rutile and paragonite. Preliminary trace element geochemistry demonstrates important variations in epidote. In the core, the pattern shows a strong enrichment in LREE compared to HREE ($(La/Yb)_N = 14.8$) with a large positive europium anomaly (Eu* = 5.3) whereas the trend in the rim is rather flat ($(La/Yb)_N = 1.1$) or even depleted in LREE ($(La/Yb)_N = 0.29$) with a weak europium anomaly (Eu* = 1.6). We will present chemical and oxygen stable isotope data on epidote bearing pegmatites to constrain the composition of interstitial liquids in mafic systems at high pressure.