Trace element partitioning between immsicible silicate and carbonate melts, based on natural melt inclusions from Kerimasi volcano, Tanzania

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Although trace element partitioning between immiscible silicate and carbonate melts has been studied experimentally [1, 2], the reason for enrichment of calciocarbonatites in HFSE (=high field strength elements), REE (=rare earth elements) and Y is still controversial.

We have carried out LA-ICP-MS analyses of silicate and carbonate melt inclusions as well as rock forming minerals from two plutonic rocks (afrikandite and calciocarbonatite) from Kerimasi volcano. Melt inclusions show that immiscibility between silicate and carbonate melts occurred from a parental carbonated nephelinite magma. During liquid immiscibility Li, Na, Pb, Ca, Sr, Ba, B, REE, Y, U, V, Nb, P, Mo, W and S are partitioned into the carbonate melt whereas, Mg, Mn, Fe, Co, Ni, Cu, Zn, Al, Sc, Si, Ti, Hf, Zr and Th are partitioned into the silicate melt. Potassium, Rb, Cs, and Ta show almost no preferential partitioning. Strong distribution of sulfur (as SO_4^{2-}) and P (as PO_4^{3-}) into the carbonate melt (relative to silicate melt) could result in partitioning of Nb, Pb and all REE into the same melt. In perovskites compatibility of MREE, LREE, Ti, Zr, Nb, Ta and U increases; in magnetite that of Nb and Zn also increases during evolution of carbonate melts from afrikandite to calciocarbonatite.

We demonstrate that enrichment of calciocarbonatite rocks in LREE, Nb, Zr, Zn, Th and U is determined by both the fractionation of elements during silicate-carbonate liquid immiscibility prior to formation of these rocks and the significant changes in $D_{\text{MINERAL-CARBONATE MELT}}$ values during subsequent evolution of the physically separated carbonate melt.

[1] Martin *et al*. (2012) Chem. Geol. **320-321**, 96-112. [2]Veksler *et al*. (2012) Geochim. Cosmochim. Acta **79**, 20-40.

Effects of volcanic CO_2 vents on a freshwater environment, the Laacher See

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The Laacher See volcanic centre, located in the middle of the East Eifel volcanic field (Germany) discharges about 5 000 t of CO_2 per year. The CO_2 is released from multiple gas vents at the bottom of the lake. Natural CO_2 sources like Laacher See allow the determination of CO_2-induced biogeochemical alterations of ecosystems.

Therefore, biogeochemical parameters as well as microbial metabolisms, abundance and diversity were studied to assess potential effects of elevated CO_2 concentrations on that freshwater sediment ecosystem.

CO_2 seeps at the lake bottom and reference areas were localised using different hydroacoustic measurements. The flux rates and the composition of seeping gases were verified with divers and a small remotely operated vehicle (ROV). For the investigation of active metabolic pathways, cultivation experiments under aerobic and anaerobic conditions were conducted and the formation of e.g. CO_2 and CH_4 was analyzed by gas chromatography. The microbial population was characterized using quantitative real time PCR (qPCR) for 16S rRNA and functional genes, TRFLP and sequencing.

Dissolved CO_2 in bottom water as well as in sediment pore water samples had a carbon isotopic signature close to that in the gas bubbles, both confirming a magmatic origin of the gas. Analysis of water samples collected close to intensive CO_2 seeps showed a low pH and an increase of dissolved CO_2. Furthermore, geochemical and microbiological analyses of deep sediment cores from CO_2-affected and reference sites showed alterations in the carbon isotopic signature, pH, microbial activity and populations. 16S rRNA gene copy numbers of Bacteria and Archaea from CO_2 induced and reference sites varied by four orders of magnitude. Similar results could be detected for the analyzed microbial CO_2 and CH_4 turnover. Our results illustrate a CO_2 impact on the geochemistry, microbial activity and community composition caused by the increasingly anaerobic and acidic environmental conditions.

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