

## Volatile release from crustal-xenolith during subvolcanic magma transport

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Magma-crust interaction in magma reservoirs and conduits is a crucial process during magma evolution and ascent. This interaction is recorded by crustal xenoliths that frequently show partial melting, inflation and disintegration textures. Frothy xenoliths are widespread in volcanic deposits from all types of geological settings and indicate crustal gas liberation. To unravel the observed phenomena of frothy xenolith formation we experimentally simulated the behaviour of crustal lithologies in volcanic conduits. We subjected various sandstones to elevated temperature (from 810 to 916 °C) and pressure (from 100 MPa to 160 MPa) in closed-system autoclaves. Experimental conditions were held constant for 24h up to 5 days, then controlled decompression simulated xenolith ascent. Pressure release was a function of temperature decline in our setup. Temperature lapse rate proceeded exponentially; the first 20 minutes experienced an enhanced decline of 24-20°C/min, whereafter 6-8 hours of slow cooling followed towards room temperature. The experimental xenoliths have been analysed by synchrotron X-ray  $\mu$ -CT at a resolution of 3.4 – 9 microns/pixel. This method permits visualisation and quantification of internal vesicle volumes, -networks and -connectivity in 3D.

Experimental products closely reproduced the textures of natural frothy xenoliths in 3D and define an evolutionary sequence from partial melting to gas exsolution and bubble nucleation that eventually leads to the development of three-dimensional bubble networks. The lithology proved decisive for degassing behaviour and ensuing bubble nucleation during decompression. Increased volatile content (chiefly water) and amount of relict crystals in the partial melt promote bubble nucleation and subsequent bubble coalescence to form interconnected bubble networks. This, in turn, enables efficient gas liberation. Our results attest to significant potential of even very common crustal rock types to liberate volatiles and develop interconnected bubble networks upon heating and decompression. Volatile input from xenoliths may therefore considerably affect explosive eruptive behaviour, and our experiments offer a detailed mechanism of how such crustal volatile liberation is accomplished.

## Cr-isotopes and REE variations in a laterite profile: Implication for redox processes and element mobility during weathering

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The isotope composition of redox sensitive elements are a powerful tool to reconstruct transport of elements depending on their oxidation state. One major application is the study of element transfer from weathering to redeposition. However, the understanding of the “output” during weathering requires insights to processes during erosion and soil development. In this context, the mineralogy and oxidate state of certain elements in weathering profile are key informations.

We will give some insights into a modern laterite profile of Madagascar. The profile is taken in an quarry near RN7 south of Antsirabe, including bed rock, saprolith and top soil. The fresh rock are a Panafrican tonalite. The sample site is characterized by minor topography and groundwater flow is controlled by small rivers. The fresh rock is dominated by two feldspars, quartz, biotite, hornblende, ilmenite, magnetite, apatite, allanite and chevkinite. Weathering starts along cracks and is accompanied by change mineralogy and major elements abundances. Trace element concentrations and Pb isotopes indicate no or only minor solid mass transport. The profile reflects an *in situ* weathering profile with a water level horizon above the saprolith. The water flow horizon includes a change in Ce concentrations related to deposition of ceriate. This is most likely related to insoluble Ce(IV) in this part of the profile. In contrast, transformation during weathering from allanite/chevkinite to rhabdophane did not change the REE whole rock pattern. Cr is strongly depleted in the soil and in the saprolith and reflects mobilization of Cr by oxidation to the hexavalent state. This change of oxidation change is corroborated by fractionated Cr isotopes in the saprolith ( $\delta^{53}\text{Cr}$  -0.4 – -0.5‰), relative to the  $\delta^{53}\text{Cr}$  value of ~0.15‰ of the tonalite

The different behaviour of the redox sensitive elements Ce and Cr is either related to the redox potential of the elements and/or is kinetically controlled by the respective host minerals. The REE's are predominantly hosted by accessory minerals (chevkinite, allanite, apatite), whereas Cr are incorporated rock forming silicates and oxides. Comparison of Ce anomalies and Cr isotopes provide important insights to the behaviour of these elements during weathering and consequently to the relative concentrations in the solvent.