

Sr-poor Nyerereite and Gregoryite in ashes from Oldoinyo Lengai (Tanzania)

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Two distinct populations of both nyerereite and gregoryite are found in mixed carbonatite-silicate ashes from the explosive September 2007 eruption. Na, K and Ca contents measured in both populations are in agreement with previously published data [1, 2], whereas the two populations differ significantly in their Sr content. The Sr-rich variety of both minerals is common to the lavas erupted in the period of 1992 to 2000 [2]. The Sr-poor one, however, is unique to the early ashes of the 2007 explosive event.

Gregoryite occurs as well-rounded crystals identical to that described by [1, 2]. Crystal shapes for nyerereite varies from the typical lath shape to well-rounded crystals resembling gregoryite. The different crystal shapes are independent of the mineral compositions.

During effusive activity prior to the September 2007 eruption a significant volume of natrocarbonatitic magma was stored in small interconnected magma reservoirs at shallow depth below the crater floor [3]. As shown by crystallization experiments at atmospheric pressure elemental diffusion is very rapid in natrocarbonatitic magmas. Thus, the shallow storage provides sufficient time for reequilibration of phenocryst phases. This may explain the rather restricted variation of Sr in the main phenocryst phases of the lava flows [1, 2].

The origin of the Sr-poor mineral varieties is unclear. One possible explanation may be that it crystallized in a deeper-seated natrocarbonatitic magma which was rapidly pushed to the surface and erupted simultaneously with the shallow carbonatites and the nephelinitic magma.

- [1] Peterson (1990) *Contrib. Mineral. Petrol.* **105**, 143-155.
[2] Zaitsev *et al.* (2008) *Proc. Russ. Mineral. Soc.* **137(4)**, 101-111. [3] Kervyn *et al.* (2008) *Bull. Volcanol.* **70(9)**, 1069-1086.

Monitoring $\delta^{13}\text{C}$ of TCE to evaluate microbial degradation in a fractured sedimentary rock aquifer, New Jersey, USA

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Chlorinated solvents, such as trichloroethene (TCE) are common contaminants of groundwater in industrial and urban settings. In order to investigate the fate and transport of these contaminants, it is important to evaluate the physical, chemical, and biological processes that effect changes in the concentration of these compounds. Microbial degradation can alter the isotopic ratio ($^{13}\text{C}/^{12}\text{C}$) of carbon in TCE, whereas, the isotopic ratio remains nearly constant for other processes, such as adsorption, dispersion and diffusion. Different microorganisms yield different kinetic isotopic fractionation factors (α); consequently, field evaluation of α is essential in evaluating the impact of microbial degradation. Monitoring of the concentration and isotopic ratio ($^{13}\text{C}/^{12}\text{C}$) of TCE in groundwater at a low-permeability borehole provided an in situ estimate of $\alpha = 0.99345$. The borehole acted as a batch reactor where there was little inflow or outflow because of the local low permeability in the rock. At other boreholes completed in more permeable sections of the same aquifer, deviations from the value of α estimated in the low-permeability zones indicates other hydrogeochemical processes are occurring. For example, estimates of α at other boreholes indicated the addition of un-degraded, free-phase TCE in the aquifer.

The original amount of TCE present in the aquifer, prior to microbial degradation, was estimated from the Raleigh equation using the established kinetic fractionation factor. Additionally, rates of natural bioremediation can be estimated. In areas of sparse sampling and complex subsurface geology, such as fractured-rock aquifers, this information is extremely useful in the characterization of TCE contamination.