

## Combined FIB and TEM analysis of tubular alteration textures in pillow lavas from the 2.0 Ga Pechenga Greenstone Belt, Russia

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Focused ion beam milling in combination with TEM analysis was used to gain insights into the genesis of tubular textures in glassy rims of pillow lava from the 2.0 Ga old Pechenga Greenstone Belt, Kola peninsula, Russia. Detailed morphological and chemical analysis using energy dispersive X-ray analysis (EDX), electron diffraction and HRTEM analysis points towards a multi stage genesis. This process involves as initial stage a hollow and comparted tube which was mineralized in a second stage by pumpellyite. The third stage involves the re-mineralization of the compartments by an Fe rich fluid and in the last stage of the model the pumpellyite is partly dissolved during greenschist metamorphism and replaced by now neighbouring chlorite. This multistage model of the genesis of these textures agrees with the model proposed by Staudigel *et al.* [1] for the formation of tubular bioalteration textures in pillow basalts<sup>1</sup>. Staudigel's models involve etching of glass by microorganisms which leaves annulated tunnels in the host rock. These tunnels are then filled by an authigenic mineral phase. This process continues until the locular tube is mineralized completely.

Therefore, we postulate that the pumpellyite mineralized tubular textures in the Pechenga Greenstone Belt are bio generated textures, similar to those mineralized by titanite and described in the Archean Barberton and Pilbara Greenstone Belts [2, 3].

[1] Staudigel *et al.* (2008) *Earth-Science Reviews* **89**, 156-176.

[2] Furnes *et al.* (2004) *Science* **304**, 578-581. [3] Banerjee *et al.* *Geology* **35**, 487-490 (2007).

## Rainwater-induced leaching of selenium, arsenic and vanadium from Etnean volcanic soils.

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Active volcanoes emit considerable amounts of contaminants such as As, Se and V. Mount Etna is the biggest volcano of Europe and an excellent geochemical site to study water-soil processes. Due to its volcanic activity, the rainwater has a strong compositional gradient, both in time and space. At present, the behaviour of trace elements in the soils around Mt Etna is poorly understood. To determine the influence of the rainwater pH on the potential mobilization of geogenic pollutants, batch experiments have been performed with synthetic rainwater for 25 soils collected along the flanks of the volcano. Our results show that:

- i) The maximum concentrations in the leaching solutions are higher for acid rain than for neutral rain (e.g. 7.7 vs 1.3 mg/L for Se).
- ii) With neutral rain conditions the soils upwind from the volcano have higher concentrations of Se than those downwind (up to 1.3 mg/L compared to  $\leq 0.3$  mg/L for the other samples). This trend is less clear for As and V.
- iii) For soils collected from 2 to 10 km downwind of the craters, Se concentrations in acid rain leachates decrease one order of magnitude with increasing distance. A similar pattern is also observed upwind from the volcano. For As and V no clear relationship between concentrations and location with respect to the volcanic craters is observed.

Both i) and ii) result in a low pH dependence for samples upwind from the volcano. The biggest difference between acid and neutral leaching for As and V is observed for a sample 2 km downwind from the craters. The observed patterns are influenced by potential controlling factors, such as organic matter content, total concentrations, mineralogy, influence of the volcanic plume, etc. Our results have implications for the chemical composition of the Etnean aquifer, the only water resource to the one million inhabitants around Mt Etna, as well as for the bioavailability and potential toxicity through agricultural activities, essential to the local economy.