Reforestation of Collier Cone lava flow, central Oregon Cascades

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Lava flows re-surface a landscape instantaneously; eventually, plants will colonize the fresh surface. Re-vegetation is dictated by a variety of factors, including geographic location and climate. Fundamentally, vegetation will develop once there is suitable soil and access to water.

We present preliminary work on the reforestation of a lava flow in the central Oregon Cascades. Collier Cone erupted 1600 ybp [1] and the entire eruption likely lasted under a year [2]. The associated lava flow (basaltic andesite to andesite in composition [3]) travelled 14 km west of the vent across several climatic regions, going from an alpine climate at the vent (2150 m elevation) to a humid temperate climate at the flow toe (900 m elevation). We construct a high-resolution canopy map using the difference between unfiltered and filtered 1 m LiDAR. We use the resulting map to quantify vegetation density on and adjacent to the flow. We find that (1) trees on the lava flow are consistently shorter than nearby trees, (2) tree density is considerably sparser on the lava flow relative to the surrounding area, (3) reforestation appears to start on the flow margins and work inward, although there is high vegetation density along a stream within the flow, (4) there is high vegetation density where alluvium has been deposited on top of the flow, and (5) at moderate elevation, vegetation is concentrated along flow levees, while at high elevation, vegetation is concentrated in the flow interior. This last observation suggests that reforestation processes are different at different elevations, due either to the dominance of different tree species at different elevations or different climatic conditions. Overall, this work suggests that in addition to the anticipated effects of local climate and elevation, reforestation appears to be controlled by lava flow morphology, local geography, and proximity of colonizing species.

[1] Sherrod *et al*. (2004) *USGS Geologic Investigation Series* **I-2683**. [2] Deardorff & Cashman (2009) *GSA* Abstracts with Programs **41**, 432. [3] Schick (1994) MS Thesis, University of Oregon.

Surface precipitation at the Al_2O_3/ uranyl phosphate solution interface

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The study presents new *in situ* electrophoretic, ATR-FTIR and TRLFS data on the surface species controlling the co-sorption of uranyl (U) and phosphate (P) ions in α-Al_2O_3 suspensions at acidic pH. It was shown that U sorption was promoted in presence of phosphate, induced significant changes in zeta potential of P-loaded alumina, and was governed by two mechanisms, surface complexation and surface precipitation, with predominant species being mainly dependent on phosphate surface coverage.

Formation of surface precipitates of uranyl phosphate at high phosphate surface coverage was inferred from

(i) the high negative charges imparted to surface by U and P (co)sorption,
(ii) the assignment of IR bands at 1107, 1024 and 971 cm-1 to P-O stretching vibrations for P coordinated to U, at alumina surface, and
(iii) the independence of the fluorescence emission spectra and lifetimes of sorbed U on the aqueous and surface concentrations of U and P.

The ATR-FTIR study showed that the precipitates of uranyl phosphate formed at surface of α-Al_2O_3 for aqueous concentration of uranyl at trace level. It also evidenced that the surface precipitation of U-phosphate was occurring along with the transformation of alumina into secondary surface precipitates of Al-phosphate.

These findings are relevant to the mechanisms of adsorption of trace uranyl on naturally occurring oxide surfaces, in soils with low pH where co-sorption of phosphate and uranyl ions is known to play a crucial role in the long-term retention of U.