# Formation of high alumina phases in sediments and soils of different ages without inherited weathering products

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We investigated the mineralogy and geochemistry of moraine forest soils in the former ice-covered granitic areas in Kings Canyon and Yosemite National Parks (Sierra Nevada, California), soils on sand dunes at the Pacific coast in Oregon (USA), as well as moraine profiles in the Dry Valley (Antarctica). The profiles did not contain any inherited weathered phases. So the neoformed phases represent the weathering products and help us decipher the weathering processes. Grain sizes of <0.2µm and 0.2-2µm were separated and analyzed by X-ray diffraction and electron microprobe. The solution to separate the clay size fraction was filtered with a 0.1µm filter and analyzed by ICP-AES, to determine the colloid and dissolved element chemistry.

**Results:**

1. In the soils of the Sierra Nevada with soil solution pHs around 6, the fraction 0.2-2µm has fairly high $Al_2O_3/SiO_2$ ratios close to 1, which are approximately factor 5 higher than the ratios of the source material. Vermiculite is the main clay minerals formed during the last 10-20ky. The 60-80ky old soils in Kings Canyon additionally may contain gibbsite. Mobile nutrient elements such as K, Mn, Mg, and Ca are enriched in the uppermost horizons, because of mobilization by plant roots and accumulation in the humic rich upper soil section by plant debris. This trend is more pronounced in the older profile.

2. In the 120ka old soil profile of the sand dune in Oregon (pH around 5), the 0.2-2µm fractions in the 0-90cm section show $Al_2O_3/SiO_2$ ratios close to 1, 20 times higher than that of the bulk material. In the section below 90cm, the $Al_2O_3/SiO_2$ ratios increases to 4. Inverse to that is the trend of the Al/Si ratio in the separation solutions (0-90cm: $Al_2O_3$/ $SiO_2$ ratio of ~11, below 90cm: ~3). We suppose, that dis-solved or colloidal organic complexes extremely enriched in alumina are translocated from the upper soil horizon into the deeper profile facilitated by the enormous pore space. On the way down the organic ligands are oxidized leading to preci-pitation of Al-rich phases such as allophane and gibbsite.

3. The composition of the clay fraction of the profile from Dry Valley has low $Al_2O_3/SiO_2$ ratios close to 0.3, which are close to that of the parent rock. The separation solution is higher in Si (0.7-5.1ppm $SiO_2$) and lower in Al (0.0-0.7ppm $Al_2O_3$). No trends of the element contents with age (20ka, 200ka, 2000ka) are discernible. Although the soil solution has pH-values between 8.8 and 10.2, the chemical weathering is insignificant, presumably because of lacking plant material which promotes chemical weathering.

# $^{238}U$-$^{230}Th$ and $^{226}Ra$-$^{230}Th$ crystal ages at Volcán Quizapu: A prime location for studying magma mixing processes on short time scales

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Despite significant innovation in textural, crystal-chemical analysis as well as U-series and diffusion age dating of igneous materials, the physical processes associated with measured time scales are unclear. For example, there is often discordance between diffusion ages and absolute ages of mineral separates derived from U-series ($^{238}U$-$^{230}Th$ and $^{226}Ra$-$^{230}Th$) disequilibria, and the two techniques may be measuring different processes. A simple system with well defined boundary conditions is necessary to understanding the information contained in ages measured by different techniques. We present U-series data for the historic eruptions of Volcán Quizapu, Chile, (5 $km^3$ of lava in 1846/47 and 4 $km^3$ of pumice in 1932). Both dacitic eruptions of Volcán Quizapu were accompanied by andesitic recharge magma. The lavas of the earlier eruption show extensive but incomplete mixing and mingling, while the plinian eruption of 1932 displays less interaction between the recharge and host magmas.

$^{238}U$-$^{230}Th$ ages industinguishable from the eruption age and Ra-Th ages of 2-3.5 ka for plagioclase and hornblende separates indicate a relatively short and simple magmatic evolution of Volcán Quizapu that stresses the dominance of short time scales processes associated with the magma mixing. This simplicity, along with the well-constrained repose time between the two major eruptions, makes Volcán Quizapu a perfect location to further investigate the information provided by diffusion and short-lived radioactive isotopic clocks. $^{226}Ra$-$^{230}Th$ dating of selected populations from the recharge and host magmas will allow us to integrate textural and crystal-chemical information with crystal ages. In addition, tracking changes in phenocrysts from recharge magma that were not evacuated during the first eruption, but remained in the reservoir and subsequently erupted in the second pulse has the potenital to unravel the interplay between diffusion, crystal growth and resorption during a simple magma overturn.