Two- and three-dimensional imaging of platinum-group minerals at submicrometer scale with synchrotron X-ray

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Platinum-group elements (PGE) in the Earth's mantle are key tracers for understanding the differentiation history of the Earth. PGE in mantle peridotite are strongly concentrated in Fe-Ni-Cu sulfides [1], whereas platinum-group minerals (PGM) are also potential phases that host significant amounts of PGE in the mantle [2, 3]. PGM are too small to be detected with conventional analytical methods, and therefore it is difficult to know how abundantly and where PGM exist in the mantle. PGM ever found in peridotite samples are mostly associated with Fe-Ni-Cu sulfides [3, 4], implying that those PGM had exsolved from the Fe-Ni-Cu sulfides [1]. On the other hand, discrete PGM grains have been found from a sulfide-free harzburgite [5], but these PGM are interpreted to be residues formed in response to the complete consumption of Fe-Ni-Cu sulfides during partial melting of peridotite. Textural and morphological investigation of PGM in peridotites at submicrometer scale could be a powerful method to know whether PGM found in peridotites had originally existed as discrete grains in the mantle.

We did two- and three-dimensional imaging of PGM in peridotite samples using synchrotron X-ray at SPring-8 to reveal morphology of PGM and their textural relationship with surrounding minerals. Tho-dimensional mapping of PGM-bearing Fe-Ni-Cu sulfides with micro-XRF [4] demonstrated that PGM distributed near the rims of the slufide grains. Three-dimensional imaging of them with X-ray computed tomography and laminography revealed that some PGM grains are included within the sulfide grain. These observation suggests that not all of the PGM are exolusion products from the Fe-Ni-Cu slufides.

[1] Alard *et al.* (2000) *Nature* **407**, 891–894. [2] Keays *et al.* (1981) *Nature* **294**, 646–648. [3] Lorand *et al.* (2010) *EPSL* **289**, 298–310. [4] Kogiso *et al.* (2008) *G-cubed* **9**, 10.1029/2007GC001888. [5] Luguet *et al.* (2007) *GCA* **71**, 3082–3097.

Trends in buffer capacity, pH and Al at the Swedish integrated monitoring sites

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The lumped parameter model MAGIC [1] was applied to four Swedish long-term integrated monitoring sites. The largest part of the uncertainty in the model outcome was driven by the underlying deposition scenario, assumptions about sulphate (SO_4^{2-}) adsorption and soil mass. Estimated weathering rates varied in a relatively narrow range between 47-62 or (42-47) meq m^{-2} $year^{-1}$ depending on the choice of available soil cation exchange capacity (CEC). Varying Aluminium (Al) solubility or introducing a dynamic weathering feedback that allowed BC release to increase at more acidic pH had a systematic effect on predicted changes in acid neutralizing capacity (ANC; ca. 10-41 ueq L^{-1}) and pH (ca. 0.1 -0.6 pH units) at all sites. Uncertainties about weathering and modelled temporal changes in pools and respective fluxes of Al between compartments may lead to systematic differences for projected changes in pH and ANC and warrant further systematic study [2].

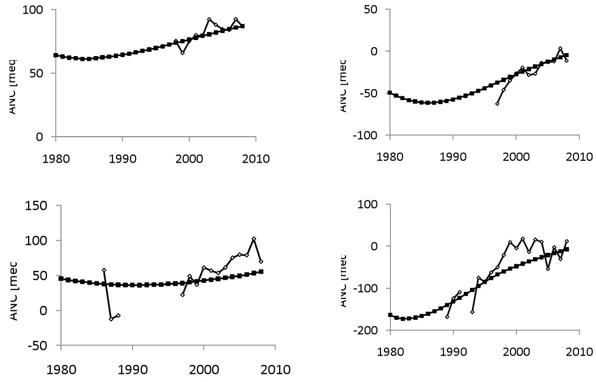

Figure 1: Time series of modelled and measured time series of ANC at each of the four sites.

[1] Cosby *et al.* (2001) *HESS* **5**, 499-517. [2] Köhler *et al.* (under review).