

Variable magmatic and eruptive cycles at arc volcanoes; Taranaki (New Zealand) and Lopevi (Vanuatu)

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Construction of very detailed eruption records at different arc volcanoes indicate that eruption frequency and magmatic processes operate in cycles that vary in timescale. Comparison of a 10,000 year lake core and volcanic deposit record obtained from Mt Taranaki, New Zealand, and a record of eruptions spanning approximately the last 80 years from Lopevi volcano, Vanuatu, shows that the eruptive activity is periodic, with decadal (Lopevi) up to millennial (Taranaki) cycles. Each cycle begins with a recharge of a hotter, more mafic component, often comprising olivine-bearing basaltic andesites. Subsequent activity in the cycle is then driven by compositionally similar melts interacting in higher level magma storage systems. Compositional profiles and zoning textures in plagioclase, amphibole and clinopyroxene phenocrysts from eruptions during the initiation of a volcanic activity cycle all provide evidence of polythermal mixing just prior to the initiation of the eruption sequence. At Mt Taranaki, titanomagnetite grain morphology and Ti variation suggest that these mixing events occur within a few days to weeks before eruptions commence. The millennial timescale magmatic processes at Taranaki appear to relate to source processes whereas Lopevi cycles reflect high level recharge events.

Identifying and quantifying these rates of magmatic generation and subsequent evolution, and their influence on volcanic activity, contributes to better magmatic modelling and results in more accurate volcanic hazard assessment.

Kinetics of Se release in mine waste from the Meade Peak Phosphatic Shale, Phosphoria Formation, Wooley Valley, ID, USA

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Phosphorite from the Meade Peak Phosphatic Shale member of the Permian Phosphoria Fm has been mined in SE Idaho since 1906. Waste rock from mining contains high concentrations of Se which readily leach into nearby streams and wetlands. While the most common host of Se in the phosphatic shale is native Se, Se is also an integral component of sulfide phases (pyrite, sphalerite and vaesite-pyrite_{ss}) in the waste rock. It may also be present as adsorbed selenate and/or selenite, and/or as selenides.

Se release from the waste rock has been observed in field and laboratory experiments. Rates describe the net, overall Se release from the 5 possible sources of Se listed above. In field studies, Se concentration, [Se], in seepage water (pH 7.4-7.8) from the dump ranges from 520 µg/L in May to 10 µg/L by Sept. Surface water flow, Q, from the seep also declines over the summer, from 2 L/s in May to 0.03 L/s in Sept. Se flux ([Se]*Q) reaches a steady-state of ~200 mg/day in 1-4 months, depending upon the volume of Q. Se release (mg/L) follows a first order reaction with $k=1.5e-3 \text{ hr}^{-1}$.

Laboratory column experiments with the waste rock, saturated flow of $8.3e-6 \text{ L/s}$, (outlet pH=7.5), show [Se] decreases from 246 µg/L at t=0, to 1.5 µg/L at t=168 hrs. Se release also follows a first order reaction with $k=2.8-6.4e-3 \text{ hr}^{-1}$.

Similarities between field and laboratory are the reaction order and magnitude of the rate constants. Discrepancies included the change of Se flux over time, likely due to decreasing and episodic water flow in the field.