# Recycling of water between the mantle and crust/hydrosphere

MICHAEL TURNER[1] SIMON TURNER[1] TREVOR IRELAND[2] AND JOHN ADAM[1]

[1] Department of Earth and Planetary Sciences, Macquarie University, NSW, Australia
[2] Research School of Earth Sciences, Australian National University, ACT, Australia

Water is added to the mantle via subduction where, due to the break down of hydrous mineral phases, water is released from the subducting slab. Conversely volcanism expels water from the mantle.

To help constrain the water flux of the mantle, we present data from mantle pryoxenes of sub-arc xenoliths and therefore providing estimates of the amount of water recharging the mantle. We have measured the concentration of water within pyroxene phenocrysts from Azores lavas (OIB setting) and the andesitic volcanoes of New Zealand (arc setting).

Preliminary data from pyroxenes of sub-arc metasomatised harzburgite xenoliths reveal varied water concentrations from relatively dry sub-arc mantle regions (Mexico and Kamchatka ~150 ppm) to relatively wet areas (New Ireland and Phillipines >500 ppm). This variation may reflect differences in the petrogenetic history of the xenoliths such as various degrees of metasomatism.

The water content of pyroxenes from Azores lavas vary between 100 and 400 ppm, with the notable exception of relatively hydrous pyroxene cores from Sao Miguel that contain up to 800 ppm.

Preliminary data from pyroxene phenocrysts of Mt Ruapehu and Taranaki (New Zealand) suggest that they also contain a similar variation in water concentrations to that seen within the Azores pyroxenes (between 100 and 450 ppm water). Differences between each andesitic system are also possible with Mt Taranaki (amphibole bearing, back-arc volcanic system) pyroxenes containing relatively low water concentrations (100-250 ppm) compared to the pryoxenes from the volcanic front-arc system of Mt Ruapehu (>300 ppm).

Interestingly pyroxene phenocrysts from OIB and arc magmatism contain a similar range of water contents to pyroxenes from the sub arc mantle.

# Extremely young melt infiltration of the continental lithospheric mantle

SIMON TURNER[1]* AND MICHAEL TURNER[1]

[1]Department of Earth and Planetary Sciences, Macquarie University, Sydney 2109, Australia (*simon.turner@mq.edu.au)

It has long been inferred that mantle metasomatism and the incompatible element enrichment of the continents require melts formed by low degree melting of the mantle. Yet establishing the presence of these melts and whether this metasomatism is ongoing and continuous, or spatially and temporally restricted, has proved difficult. Here we report large U-Th-Ra disequilibria in metasomatised, mantle xenoliths from the Newer Volcanics Province in southeastern Australia. The infiltration and passage of carbonatitic ± hydrous silicic melts, combined with crystallization of pargasite can account for the observations. The half-lives of the nuclides indicate that metasomatism was extremely young (≤ 10 kyr) and probably on-going at the time of incorporation in the magmas that transported the xenoliths to the surface. This provides unique evidence for the presence and continuing migration of small melt fractions (~0.02%) in the upper convecting mantle and provides a likely explanation for the seismic low velocity zone. These melts cannot, themselves, be responsible for average continental crust but they could provide an important component for ocean island basalts if returned to the convecting mantle.

www.minersoc.org
DOI:10.1180/minmag.2013.077.5.20