Improved boron isotope pH proxy calibration for the deep sea coral *Desmophyllum dianthus* through sub-sampling of fibrous aragonite

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The isotopic composition of boron ($\delta^{11}B$) in marine carbonates is well established as a proxy for past ocean pH [1,2]; however, its robust application to palaeo-environments relies on the generation of species-specific calibrations. Existing calibrations utilising the deep sea coral *Desmophyllum dianthus* highlight the potential application of $\delta^{11}B$ measurements of this species to pH reconstructions of intermediate depth waters [3,4]. However considerable uncertainty remains regarding the estimation of seawater pH from these bulk $\delta^{11}B$ measurements, resulting from sub-structural heterogeneities in $\delta^{11}B$ of *D. dianthus*. To circumvent this problem, thus improving the reliability of the *D. dianthus* $\delta^{11}B$ calibration, we present a new $\delta^{11}B$ calibration of micro-sampled fibrous aragonite from *D. dianthus*. Modern coral specimens recovered from the Atlantic, Pacific and Southern Oceans (depth range of 274-1470 m) were micro-sampled using a MicroMill (New Wave), analysed using multi-collector ICP-MS (Neptune) and the measured $\delta^{11}B$ was regressed against ambient pH taken from hydrographic data sets (pH range 7.4 to 8.0). $\delta^{11}B$ values from this new fibre calibration are generally lower than bulk septal measurements [e.g. 3] and suggest a stronger and better-defined dependence on ambient seawater pH. This study confirms the utility of *D. dianthus* as an archive of palaeo-pH, provided suitable sampling strategies are applied.

[1] Sanyal *et al*. (2001) Paleoceanography 16, 515-519, [2] Hönisch *et al*. (2004) EPSL 68, 3675-3685, [3] Anagnostou *et al*. (2012) EPSL 349–350, 251-260, [4] McCulloch *et al*. (2012) GCA 87, 21-34.

Dual sources for early Taranaki magmas: The Sr isotope story

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Mount Taranaki, located 140 km west of the Taupo Volcanic Zone (TVZ), lies 180 km above the Wadati-Benioff Zone and is the most westerly subduction-related volcanism in New Zealand. Compositions are basaltic andesite to andesite with minor dacite and basalt. Taranaki has erupted episodically for more than 130 ka, generating debris avalanche deposits by catastrophic failure of the edifice. These deposits provide a record of the early magmatic evolution of the Taranaki volcanic system. K_2O and LILE are enriched with time, culminating in Holocene high-K andesites [1]. Pre-100 ka magmas include primitive basalts and basaltic andesites with higher silica compositions in progressively younger units and the appearance of late-stage low pressure mineral phases (high-Ti hornblende, biotite and Fe-rich orthopyroxene) confirms a gradual shift to more evolved magmas with time.

Sr isotope compostions have been constant at around 0.7046; similar to the least radiogenic compositions at Ruapehu, a long-lived active andesite volcano in the TVZ, suggesting a common mantle wedge composition for both Taranaki and the TVZ. However, the Taranaki isotope data set contains evidence for the presence prior to 100 ka of an even less radiogenic source with $^{87}Sr/^{86}Sr$ compositions of < 0.7040, mostly in primitive basalts with < 50% SiO_2. Trace element data for these samples have only weak arc signatures. A similar dual Sr isotope source is evident in the older Pouakai volcano in Taranaki. We suggest that in the early Taranaki magma systems a component of relatively unmodified mantle was present that was eclipsed after c. 100 ka by subduction-modified material.The slab under Taranaki is near-vertical and this slab configuration might allow edge flow to contribute to the Taranaki magma source.

[1] Zernack *et al*. (2012) J Pet 53, 325-363.

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