Remnants of ancient Australia in Vanuatu: Implications for crustal evolution in island arcs

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Intra-oceanic arcs that are far removed from large continental masses are considered ideal sites to study growth of new continental crust, as most arc crust additions are thought to derive from magmas sourced from the underlying subduction-modified mantle, rather than any pre-existing crust. Here, we report new geochemical and geochronological data on igneous rocks of the Western Belt of the Vanuatu intra-oceanic arc. Ar-Ar dating of hornblende from hornblende andesites and U-Pb dating of igneous zircon from a tonalite place formation of these rocks in the late Eocene to Miocene. In most respects, these are typical arc igneous rocks, except they contain inherited zircon grains with significant age populations at ca. 2.8-2.5 Ga, 2.0-1.8 Ga, 1.75-1.5 Ga, 850-700 Ma, 530-430 Ma and 330-220 Ma. This inheritance signature is unlike anything recognized from the oceanic realm of the southwest Pacific, but in general does match the age of the major crustal blocks of the Australian continent. An exception is the significant proportion (~20%) of zircons of Rodinia breakup age (~800 Ma), which previously has not been found in eastern Australia or the southwest Pacific.

We propose that part of the Vanuatu arc basement comprises continental material transported 1000s of kms from northern Australia prior to the late Eocene. The presence of ancient continental material within the Vanuatu island arc may help reconcile the relatively large thickness and low density of the crust of Vanuatu, and provides an alternative source for the crustal trace element and isotopic signature of island-arc magmas. In particular it may help explain the anomalous composition of lavas from central Vanuatu that have previously been attributed to inflow of Indian-MORB mantle beneath the arc [1].

[1] Peate, Pearce, Hawkesworth, Colley, Edwards & Hirose (1997), *Journal of Petrology* **38**, 1331-1358