

Identification of Subduction Signatures in the Geologic Record

J.A. PEARCE^{1*}, D.W. PEATE² AND R.H. SMITHIES³

¹ Cardiff University, Cardiff CF10, 3AT, UK
(*correspondence: PearceJA@cf.ac.uk)

² University of Iowa, Iowa City, IA 52242, USA
(david-peate@uiowa.edu)

³ GSWA, Perth, WA 6004, Australia
(Hugh.Smithies@dmp.wa.gov.au)

Unambiguous identification of geochemical subduction signatures in lavas from the Geological Record is less straightforward than it might first appear. One complicating factor is that there is no single subduction signature, but rather a spectrum of signatures, which vary according to geographic location and the time-space development of the arc. A second is that active volcanic arcs impart a long-lived subduction signature into supra-subduction lithosphere, which may be reactivated during subsequent collision-, plume- and rift-related related magmatic events. A third is that processes such as high-grade metamorphism and crust-magma interaction often create geochemical signatures that resemble those generated by subduction. And finally, particularly in relation to the early Earth, there is the possibility that primordial mantle compositions and non-uniformitarian processes such as crustal delamination and sagduction could give plate subduction-like signatures. In an attempt to recognise subduction signatures related to active arc volcanism, we have developed methodologies based on the arguably optimum ‘immobile’ subduction proxy of Th/Nb (a representation of the negative Nb anomaly), but also combined with geochemical stratigraphy and other geochemical proxies to resolve some of the ambiguities. Such proxies include Co and Sc (fractional crystallization), Ti/Yb (garnet; melting depth), Cs/Th (fluid/melt temperature). The results have implications for regional tectonic reconstructions, the identification of SCLM intraplate sources, and the general question of when plate tectonics started on Earth.

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