High Sr/Y (HiSY) granitoid magmatism in convergent margins; nomenclature and setting

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Cretaceous plutons of the eastern Peninsular Ranges Batholith (PRB) and the Separation Point Suite of New Zealand represent major fluxes of relatively high Na, Sr and low Y, HREE magmas. They have similarities to Archean Tonalite-Trondhjemite-Granodiorite (TTG) granitoids and Cenozoic adakites, but their genesis in Phanerozoic subduction zone settings is controversial.

We consider that the term *adakite* is inappropriate to describe the Phanerozoic plutonic rocks discussed here because it refers to volcanic rocks, to rocks which have a strong association with a particular origin (slab melting), and because adakites are mafic-intermediate rocks with relatively high Mg-numbers. We also have reservations about using the term *TTG* to describe rocks suites and associations in Phanerozoic batholiths because the acronym was defined from, and carries an association with, Archean rocks for which many models argue for a slab-melting origin. Furthermore, the term TTG does not include dioritic rocks that are a major part of the compositional spectrum in the especially deeply exhumed crustal section in New Zealand. The term *sodic* does not convey many other significant features, such as rock type, trace element chemistry and plutonic nature, nor does it indicate distinction from sodic undersaturated alkaline rocks. The term *BADR* (Basalt-Andesite-Dacite-Rhyolite) to describe the associated relatively low Na, Al, Sr etc rocks is not favoured for use in this context because it emphasises *volcanic* rocks and is not especially definitive. Thus we suggest a non-genetic terminology based on the single most distinctive parameter, Sr/Y:

HiSY for High-Sr/Y, Na, Al, Sr, low Y rocks (Sr/Y > 40 boundary adopted from Drummond and Defant, 1990).

LoSY for the complementary Low Sr/Y etc, rocks.

It is not appropriate to distinguish the LoSY rocks as calc alkaline etc., because HiSY and LoSY suites in any given convergent margin have similar or identical alkali-lime indices. Similarly, because both suites may be major components of Cordilleran batholiths, it is not appropriate to distinguish the LoSY component as "Cordilleran". Adakites and TTG suites could be regarded as particular varieties of HiSY rocks.

The well-documented margin-normal asymmetry of the PRB is similar to that observed in the Median Batholith of New Zealand (Tulloch and Kimbrough, 2003). In both areas similar-sized belts (800-900 km-long) of high Na, Al, Sr and low Y (HiSY) diorite-tonalite-granodiorite plutons developed continental-ward of, and 10-15 m.y. after, parallel belts of (LoSY) gabbro-diorite-granite plutons, the latter representing at least 30-40 my of convergent margin magmatism. In the PRB the HiSY La Posta Suite (~ 99-92 Ma) lies inboard of a western belt of LoSY plutons (~130-104 Ma) over the ~ 800 km length of the batholith. In New Zealand plutons of the HiSY Separation Point Suite (126-105 Ma) mostly lie inboard of the LoSY Median Suite (mostly 170-128 Ma). Chemical and isotopic links between HiSY and LoSY belts indicate genetic relationships between the paired belts within each area.

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Comparative features from both margins support a model that involves underthrusting of the outboard LoSY arc base during shallowing subduction to a deeper, more continental-ward position. The mafic arc base is then partially melted under high pressure conditions resulting in plagioclase-poor or absent, garnet-bearing residual mineral assemblages that produce high Sr/Y partial melts. The La Posta plutons appear to represent mixtures of HiSY magmas and Paleozoic metasedimentary crust.

The widespread occurrence of similar paired rock suites in the Ross Orogen of the Transantarctic Mountains, the Antarctic Peninsular, the Peruvian batholiths and elsewhere, indicate that mafic crust-derived HiSY, and mantle wedge-derived LoSY plutons, represent two major subgroups of magmas in convergent margin batholiths.

References:

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