Plate-tectonic controls on intraplate volcanism in New Zealand

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Cretaceous to recent intraplate volcanism in the New Zealand microcontinent provides an ideal case to explore possible factors that exert control on this type of volcanism. Located in the vicinity of the active Australian-Pacific plate boundary, the New Zealand microcontinent exhibits intraplate volcanic activity that is associated with various tectonic regimes: behind an active arc, in domains with predominant strike-slip motion, and in areas that are virtually unaffected by recent plate-tectonic activity.

Based on major-, trace-element-, and Hf-Nd-Pb-Sr isotope compositions of a representative set of near-primitive samples, distinct end member compositions corresponding to different tectonic regimes can be recognized: (1) HIMU-like signatures ($^{206}Pb/^{204}Pb$ up to 20.57, “decoupled” Hf-Nd systematics; e.g., Chatham Islands), (2) dilute HIMU-like trace element signatures and depleted, asthenospheric isotope compositions (εHf: + 9.9, εNd: + 7.0; North Island), and (3) compositions having affinities to subducted sediments ($^{87}Sr/^{86}Sr$: 0.7037, $^{206}Pb/^{204}Pb$: 18.99, $^{207}Pb/^{204}Pb$: 15.67; South Island). The HIMU- and sediment-like signatures are interpreted to originate from a veined lithosperic mantle, reflecting a variable overprint by an ancient, possibly Cretaceous mantle plume and by Phanerozoic subduction zone enrichment.

Variations in the average melting depths of the magmas are manifested in a variable impact of residual garnet (e.g., Gd_N/Yb_N: 1.84 - 4.74). Changes in relative melting depths reflect variations in lithospheric thickness [1]. The geodynamic setting (lithospheric thickness, heat flow, degree of extension) controls the proportions of asthenospheric and lithospheric source components. For the South Island, magma compositions provide “snapshots” of a decreasing lithospheric thickness beneath active volcanic fields since ~20 Ma. This finding is in agreement with recent geophysical data that suggest the presence of thickened, dense lithospheric mantle beneath the Southern Alps (collision zone) but not beneath the intraplate volcanic fields east of the plate boundary [2]. It has been proposed that the regional thickening of the lithospheric mantle is a result of ongoing oblique convergence and strike-slip motion [e.g., 2]. We propose that the same processes also caused regional transtension and thinning of adjoining parts of the lithospheric mantle, thus controlling the composition of the intraplate volcanic rocks.

References

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The Podili alkaline complex, Prakasam alkaline province, Andhra Pradesh, southern India

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The Podili alkaline complex in Prakasam alkaline province of Andhra Pradesh, in the southern India, is one among the cluster of alkaline complexes with a near NE-SW disposition pervading the cratonic corridor that is terminated by intracratonic sedimentary Cuddapah Basin in the west and Eastern Ghat Mobile belt in the east.

This N-S trending complex (12 km^2) has a close spatial and temporal association with granites and gabbros that represents the manifestations of basic, acidic and alkaline magmatism.

Alkali syenite, and subordinate quartz syenite constitute the important lithounits of the complex.

The syenites are leucocratic dominated by microcline mesoperthite, plagioclase feldspar, ±quartz. The mafic minerals are alkali pyriboles and biotite with subordinate magnetite, sphene and apatite. The mafic minerals attribute to the alkaline and hydrous nature of parental liquids.

The syenites are of different degrees of silica saturation, and alkali syenites in particular carry normative nepheline and acmite, an indication of the peralkaline trait possibly inherited from the parental alkaline magma.either by prolongoued differentiation or lowest degress of partial melting of an enriched/fertile mantle source.