

A post K-T boundary age for Deccan-type feeder dykes, Goa, India

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Goa state lies between those of Maharashtra and Karnataka on the west coast of India. A few tens of kilometers to the north and east lies the southern margin of the immense Deccan Traps CFB province covering much of NW peninsular India. The Deccan succession has been the subject of much detailed chemostratigraphic study (Mitchell and Widdowson 1991 and references therein), and the structure and stratigraphy (Table 1) of the southern region of the province is now well established. In the south this succession can be considered essentially lensoid in character with the greatest thicknesses exposed inland of the coast along the Western Ghats escarpment. It thins noticeably eastward and southward and displays a southerly overstep of older formations with the stratigraphically youngest basalts occurring at the southernmost edge. These latter cap the Western Ghats escarpment and inland of Goa.

Geological background

The geology of Goa consists of a complex combining Archaean Peninsular gneiss and the Dharwar supracrustals of the Goa Group. This, in turn, intruded by Proterozoic granitic masses. A series of mafic dyke suites cut through this complex, but since these intrude the Precambrian rocks any determination of their actual ages, as based upon available field

relationships, has been necessarily speculative. The dykes are best exposed in coastal sections because Tertiary age laterite and modern weathering products obscure field relationships further inland.

Basic dyke swarms are common in south-western Peninsular India (Murthy 1995), with Archaean and Proterozoic examples being most the prolific, though Phanerozoic examples are also documented. It is clear from field relationships of the Goan examples that this region has also been subject to a series of dyke injection phases. Although these phases are apparently widely separated in time, they have nevertheless exploited similar structural and compositional heterogeneities within the Archaean and Proterozoic basement. In the absence of accurate radiometric dates, the younger cross-cutting suites have been attributed to the complex Mesozoic rift history of western India (e.g. Sinha-Roy and Radhakrishna 1983): This includes, the splitting of India-Madagascar *c.* 89 Ma (Storey *et al.*, 1995) and the subsequent separation of the Seychelles micro-continent *c.* 65Ma and associated Deccan eruptions.

Geochemical and $^{40}\text{Ar}/^{39}\text{Ar}$ age determinations

We report the first $^{40}\text{Ar}/^{39}\text{Ar}$ ages for four samples from a suite of dykes exposed along the Goan coast

TABLE 1. Summary of geochemical criteria used to define Deccan basalt stratigraphy

Southern Deccan Traps Succession	Formation	Sr (ppm)	Ba (ppm)	Ba/Y	Zr/Nb
Wai Subgroup	Panhala Fm	<200	<90	n/d	>13
	Mahabaleshwar Fm	>250	>100	>4	<10.5
	Ambenali Fm	200–250	<100	<3.5	10.5–15
	Poladpur Fm	<240	>100	>3.5	15–20

TABLE 2. Summary of $^{40}\text{Ar}/^{39}\text{Ar}$ for Goan dyke samples

Dyke sample	Age (Ma)	Age \pm Ma (1 sd)	Isochron summary		1 sd
			Sums n-2	$^{40}\text{Ar}/^{39}\text{Ar}$ Intercept	
IND 2A	62.97	\pm 1.02	24.27	295.0	\pm 10.8
IND 3A	66.15	\pm 1.61	7.93	273.0	\pm 15.2
IND 5A	62.50	\pm 0.37	8.04	308.2	\pm 2.2
IND 125A	63.20	\pm 0.24	0.59	312.0	\pm 1.8
Weighted Mean Average	63.00	\pm 0.23	2.10		

representing the youngest of the different mafic suites intruding the Precambrian complex of this area. The geochemical signatures (i.e. Sr and Ba contents, and Zr/Nb and Ba/Y ratios) of these dykes are consistent with those characteristic of basalt flows comprising the uppermost Wai Subgroup of the Deccan basalt sequences. Since these age determinations yield a weighted mean average 63.00 ± 0.23 Ma (Table 2), these dykes are clearly significantly younger than the currently accepted estimate of 67.4 ± 0.7 Ma for the major pulse of Deccan Traps volcanism (Duncan and Pyle, 1988). Moreover, these age data demonstrate that Deccan-type eruption continued to affect western India for at least 1Ma after the K-T boundary 65 Ma and, therefore, their emplacement places important constraints upon the timing and evolution of this

much debated CFB province.

References

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