

Age and duration of the Deccan Traps, India: A review of radiometric and paleomagnetic constraints

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A review of the available radiometric and paleomagnetic data from the Deccan Flood Basalt Province (DFBP) suggests that the volcanism was episodic in nature and probably continued over an extended duration from 69 Ma to 63 Ma between 31R and 28N. It is likely that the most intense pulse of volcanism at 66.9 ± 0.2 Ma preceded the Cretaceous Tertiary Boundary (KTB, 65.2 ± 0.2 Ma) events by ~ 1.7 Ma. The magnetostratigraphic record in the Deccan lava pile is incomplete and it is therefore possible that the lava flows constituting the reverse polarity sequence were erupted in more than one reversed magnetic chron.

1. Introduction

The voluminous ($\sim 1.5 \times 10^6$ km³) Deccan Traps of western and central India comprise a thick sequence of sub-aerially erupted basaltic flows that presently cover an area $\sim 1.5 \times 10^6$ km² which may originally have been much greater (figure 1). It has been hypothesised that the flood basalts marked the first eruption of lava related to the Reunion hotspot followed shortly afterwards by rifting apart of the Arabian Sea (Morgan 1981; Richards *et al* 1989). Moreover, it has been argued that the voluminous Deccan lavas erupted very rapidly in a rather short interval of less than 1 m.y. at the Cretaceous-Tertiary Boundary (KTB) leading to several biological and geological anomalies at the KTB (Courtillet *et al* 1986, 1988; Duncan and Pyle 1988). Both these proposals generated immense interest among the scientists to obtain the precise age and duration of the volcanism but dating of the Deccan traps have proved to be difficult. Attempts, however, have been made, using paleontological, radiometric and paleomagnetic dating methods (Baksi 1987, 1994; Jaeger *et al* 1989; Vandamme *et al* 1991; Venkatesan *et al* 1993; Venkatesan and Pande 1996; Hofmann *et al* 2000)

but inferences about age and duration of Deccan Traps are based on plausibility arguments, the persuasiveness of which often depends more on the eloquence of their advocates than on the weight of the relevant data.

The Deccan Trap overlies and are often inter-layered with sediments of Maastrichtian to late Maastrichtian age. The overlying sediments contain microfauna of P2 zone of the Paleocene (60–65 Ma). The biostratigraphy therefore limits the age of the Deccan to 73–60 Ma (Jaeger *et al* 1989). The magnetostratigraphy (figure 1) typically consists of a poorly exposed lower normal polarity zone, overlain by a middle reversed polarity zone that is capped by the upper normal polarity zone. If the magnetostratigraphy of the traps has continuously recorded the geomagnetic field, the eruption would have lasted for 3–4 m.y., the duration of the longest reversed polarity chron between 73 and 60 Ma (Courtillet *et al* 1986, 1987; Wensink 1987; Acton and Gordon 1989; Vandamme *et al* 1991). The radiometric ages have been obtained using K-Ar and Ar-Ar technique (Kaneoka 1980; Baksi 1987, 1994; Courtillet *et al* 1988; Duncan and Pyle 1988; Pande *et al* 1988; Vandamme *et al* 1991; Venkatesan *et al* 1993, 1996; Hoffman *et al*

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