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Determinations for the Duration and Timing of the Deccan CFB

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We report $^{40}Ar/^{39}Ar$ ages for a suite of basalt lavas from the Deccan CFB. The current research programme has sought to generate high precision $^{40}Ar/^{39}Ar$ data within a well-defined and detailed stratigraphical context. Analyses were performed using the incremental laser heating technique on plagioclase separates. Data from the stratigraphically lowest (i.e. earliest), and highest (i.e. final) basalt lavas that comprise the Deccan are presented, thereby effectively bracketing the lava succession and providing an estimate of the timing and age duration of this important CFB. All ages are reported relative to the GA1550 biotite standard.

Previous dating studies of the Deccan have concentrated upon the 'classic' sections beautifully exposed along the Western Ghats escarpment of western peninsular India (Courtillot et al. 1986, Duncan & Pyle 1988). These provided crucial preliminary insight regarding the timing and duration of the CFB because they appeared to indicate a geologically rapid eruption near to the K-T boundary (65.0 ± 0.1 Ma). Moreover, these widely cited data have remained pivotal to many of the ensuing arguments citing CFB volcanism as either a primary or contributory cause of global floral and faunal extinction. Nevertheless, the relative roles of CFB events, their impact upon global climate and, in particular, the effect of the Deccan upon floral and faunal turnover at the K-T boundary have remained the source of much debate. However, whilst the link between the K/T boundary, the Deccan eruptions, and floral and faunal crisis seems compelling, the presence of deep weathering horizons, palynomorph-bearing palaeosols together with widespread fossiliferous palustrine and fluviatile beds (Prasad & Khajuria 1995) preserved within the volcanic pile, indicates that protracted hiatuses did occur during the volcanic episode. Such hiatuses clearly offered the opportunity for floral re-colonisation, and re-establishment of attendant faunas.

Whilst the 'classic' Western Ghats sections have provided excellent access to crucial parts of the Deccan lava succession, they by no means provide a complete chronological record of the eruptions. The general stratigraphical architecture of the Deccan CFB has been known for some time (e.g. Mitchell & Widdowson 1991) and offers an excellent framework for a comprehensive sampling programme. The earliest flows are widely thought to occur in the northwesternmost corner of the main Deccan outcrop. These consist of Mg- and K-enriched tholeiites typical of nascent, early stage, CFB eruptions. These are exposed in the lower reaches of the Narmada river valley where they were erupted directly upon to Late Cretaceous fluvio-marine Bagh beds and dinosaur-bearing caliches and palaeosols of the Lametas that comprise the pre-Deccan 'basement' of this region. Preliminary $^{40}Ar/^{39}Ar$ analyses of these basal lavas yield late Maastrictian ages (65.7 ± 0.6 Ma), indicating the onset of volcanism in this region some 0.1 - 1.3 Ma before the K/T boundary.

The final eruptions witnessed in the Deccan CFB are preserved only on the highest mesas in the Belgaum area which lies in the extreme SW Deccan (Widdowson & Cox 1996). The basalts here comprise the topmost succession of the volumetrically important Wai Subgroup which represents one of the major eruptive 'pulses' during the Deccan volcanic episode. Widdowson et al. (2000) indicate post K/T ages (62.8 ± 0.2 Ma) for this uppermost succession based on whole-rock step heating analyses of an associated feeder dyke system. This younger age is further confirmed by the current work which yields a weighted mean average of (63.7 ± 0.3 Ma) for a series of lavas from the upper Wai Subgroup.

Given these data, we suggest a duration of at least 2 Myr for the eruption of the main Deccan basalt lava succession. The onset of volcanism began in the north of the province during the latest Maastrictian, and continued across the K/T boundary into the Danian, with successively younger lavas building on the southern flank of the CFB edifice.

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