DECCAN VOLCANISM AT THE CRETACEOUS-TERTIARY BOUNDARY

V. Courtillot, D. Vandamme, J. Besse (Institut de Physique du Globe de Paris, Laboratoire de Paléomagnétisme et Géodynamique, Place Jussieu, 75005 Paris, France), and J.J. Jaeger (Laboratoire de Paléontologie, Université Paris 6, Place Jussieu, 75005 Paris, France)

The accuracy with which one can claim that Deccan trap volcanism occurred at the Cretaceous-Tertiary boundary over a very short time interval is of key importance in deciding whether a volcanic origin of the KTB events should be taken seriously. In the two years since we published paleomagnetic, paleontological and geodynamic evidence that such was indeed the case (1), further data have become available and the case now appears to be well constrained. $^{40}Ar/^{39}Ar$ results from six labs (2) have yielded some 24 reliable plateau ages that narrow the age range to 65-69 Ma. Moreover, it appears that a significant part of this range results from inter-lab spread and possible minor alteration. Paleontology demonstrates that volcanism started in the Maestrichtian, more precisely in the *A. mayaroensis* zone (3). Paleomagnetism shows that volcanism spanned only 3 chrons (1,4) and only one correlation remains possible, that of the main central reversed chron with 29R. Therefore, whereas $^{40}Ar/^{39}Ar$ is able only to restrict the duration of volcanism to some 4 Ma, paleomagnetism restricts it to 0.5 Ma. It is difficult to expect better resolution. Using some geochemical indicators such as ^{13}C as proxy, we suggest that volcanism actually consisted of a few (possibly 4) shorter events of unequal magnitude (Figure 1). The first may have lasted some $<10^5$ yr at the end of chron 30N and may have coincided with a ^{13}C anomaly (5) and the disappearence of Inoceramids. The second pulse, only shortly before the KTB, was already in 29R, and may be related to the disappearence of Ammonites. The main pulse at the KTB may have lasted 10^4-10^5 yr (?) and its fine structure may be related to fine structure in the extinction record. We propose that a final pulse occurred in 29N, in the Danian, although this is yet to be correlated with other anomalies. The ^{13}C record (5) would therefore be a reflexion of the intensity of Deccan volcanism, in agreement with the observed NRN magnetostratigraphy of the lava pile (1).

Extrusion rates may have been as high as 10^2 km^3/yr and fissure lengths as long as several 10^2 km. Such a scenario appears to be at least as successful as others in accounting for most anomalies observed at the KTB. Particularly important are Iridium and other platinum group elements (PGE) profiles, $^{87}Sr/^{86}Sr$, ^{13}C, ^{18}O, other exotic geochemical signatures (such as As, Sb, ...), spherules, soot, shocked minerals, selective and stepwise extinctions. These will doubtless be discussed by others at the meeting. The environmental impact of CO_2 possibly released during explosive phases of volcanism, and SO_2 released during effusive phases, and the ability of volcanism to ensure worldwide distribution of KTB products have now all been adressed (6). Particularly important when discussing an internal cause for KTB events are long term anomalies (volcanism, seafloor spreading and continental breakup, major regression, oceanic isotopic composition, polar wander, frequency of geomagnetic reversals) on which the short term KTB anomalies are superimposed, which indicate that increased mantle activity started well in advance of the KTB climax.

In conclusion, the case for a causal link betwwen internal hotspot activity, birth of the Réunion hotspot itself as the Deccan and KTB events appears to rest on an increasingly stronger basis (7).

References

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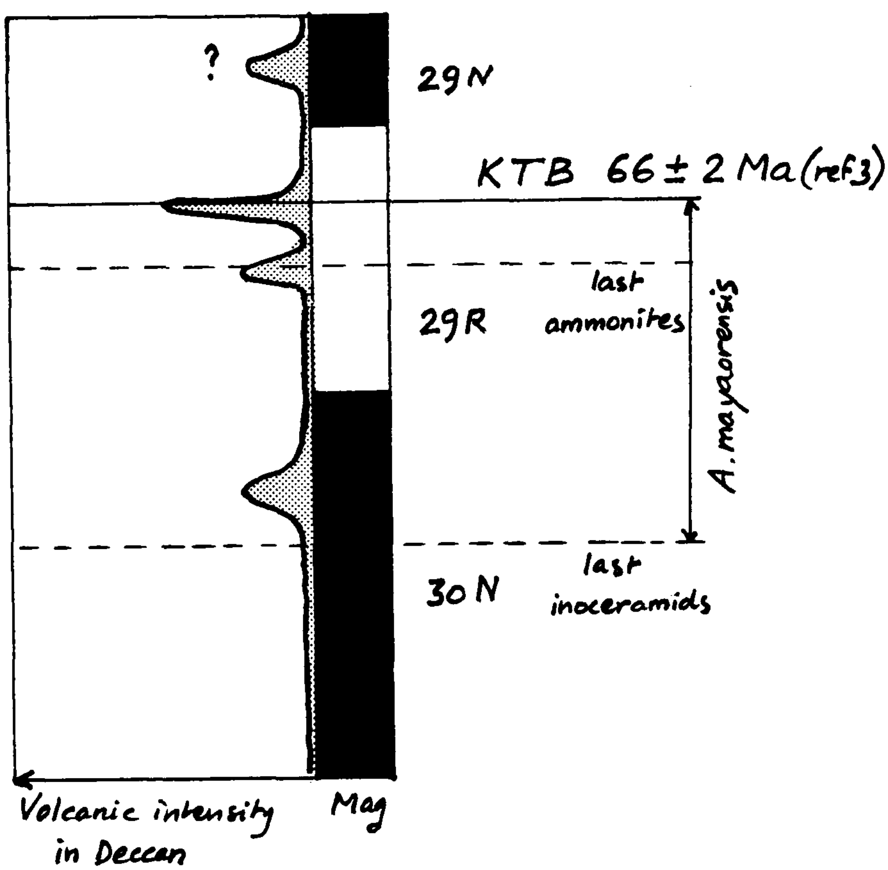

Figure 1

A scenario of volcanic intensity in the Deccan (using ^{13}C from reference 5 as proxy) and the geomagnetic reversal time scale.