Although, at present, the concept of a spectral seismogram is new and its potential yet to be utilized, it is likely to turn out as a powerful tool for routine analysis of seismograms in the near future, since it allows a detailed and quick analysis of the spectral character and time-varying behaviour of an earthquake. This tool can eventually be used to reconstruct the source time history. Also, it may find application in studies of surface wave dispersion, identification of relatively unknown phases and establishing similarities in the spectral character of earthquakes from a similar tectonic setup.

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An *Aquilapollenites*-associated palynoflora from Mohgaonkalan and its implication for age and stratigraphic correlation of Deccan Intertrappean beds

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Palynology of the intertrappeans of Mohgaonkalan of Chhindwara District, M.P. has been dealt for the first time. The palynoflorule recovered from the black shale is conspicuous due to the presence of *Aquilapollenites bengalensis*, *Azolla cretacea*, *Gabonisporis vigourouxii*, *Spinizonocolpites echinatus* and *Ariadnaesporites* sp. and is very much comparable with the palynoassemblages of Padwar–Ranipur intertrappean beds of Jabalpur. The palynological data are of significance as they now offer a fine resolution of age of Late Maastrichtian contrary to previous assignment of Early Tertiary on the basis of megafloristic evidences. Further, the association of *Aquilapollenites* palynoflora with the dinosaur remains at Mohgaonkalan has been found to be useful for correlation and tagging with the radiometric dates known from various localities of the Deccan basaltic province in Peninsular India. Considering the available palynological data and the dinosaur remains, the intertrappean beds at Mohgaonkalan are also very important for delineating Cretaceous–Tertiary Boundary (KTB) in Deccan Trap Volcanic Episode. In light of new palynological findings, a reappraisal of the Deccan Intertrappean flora and its biostratigraphic implication is needed to critically evaluate the influence of Deccan volcanic activity on the continental terminal Cretaceous biotas.

INTERTRAPPEAN palynofossils are very poorly documented as compared to plant mega fossils due to poor recovery and preservation of them in the trap-associated sediments. However, in recent years, discovery of more intertrappean horizons bearing carbonaceous facies has proved to be rewarding as the black shales in them are found to be rich in palynological contents[1,2]. While carrying out field work in and around Mohgaonkalan, we came across an unlined well that penetrated through a sequence of black shale-associated intertrappeans and this paper is based on the palynological contents yielded from it. In fact, palynoflora from this area have a significance for a fine resolution of age of the intertrappean beds of Mohgaonkalan in the Chhindwara District of Madhya Pradesh. Moreover, the new palynological data have been found to be useful for stratigraphic correlation of other palynological assemblages and the associated dinosaur-bearing intertrappean beds of the Deccan basalt province of India.

The Mohgaonkalan intertrappean sequence is exposed in an unlined water well situated about 0.5 km west of the village very close to the well-known fossil locality from where a large number of plant megafossils have been documented. The well can be easily located as local people fetch water from it for drinking and irrigation purposes. The intertrappean bed is less than 1 m thick and comprises black shale, greenish shale and light yellowish hard chert. The exact location and details of the intertrappean succession were dealt with recently where in the egg shells of dinosaurian affinities and other faunal elements have been described along with a mention of palynoassemblage[3]. The samples investigated for the present study were collected from material dug out of the water well and in fact, only the black shales have proved to be rich in palynological contents.

The palynological assemblage recovered from the black shales of Mohgaonkalan consists of *Azolla cretacea*, *Aquilapollenites bengalensis*, *Gabonisporis vigourouxii*, *Spinizonocolpites echinatus*, *Triporoletes reticulatus*, *Proxapertites operculatus*, *Tricoplites* sp., *Cyathidites minor*, *Todsporties* sp., *Ariadnaesporites* sp., *Ephedripites* sp., *Foveosporites* sp. and *Osmundacidites* sp., *Lycopodiumsporites* sp., *Alsophyllidites* sp. The palynofloral assemblage is dominated by *A. creatacea*, *G. vigourouxii* and other laevigate

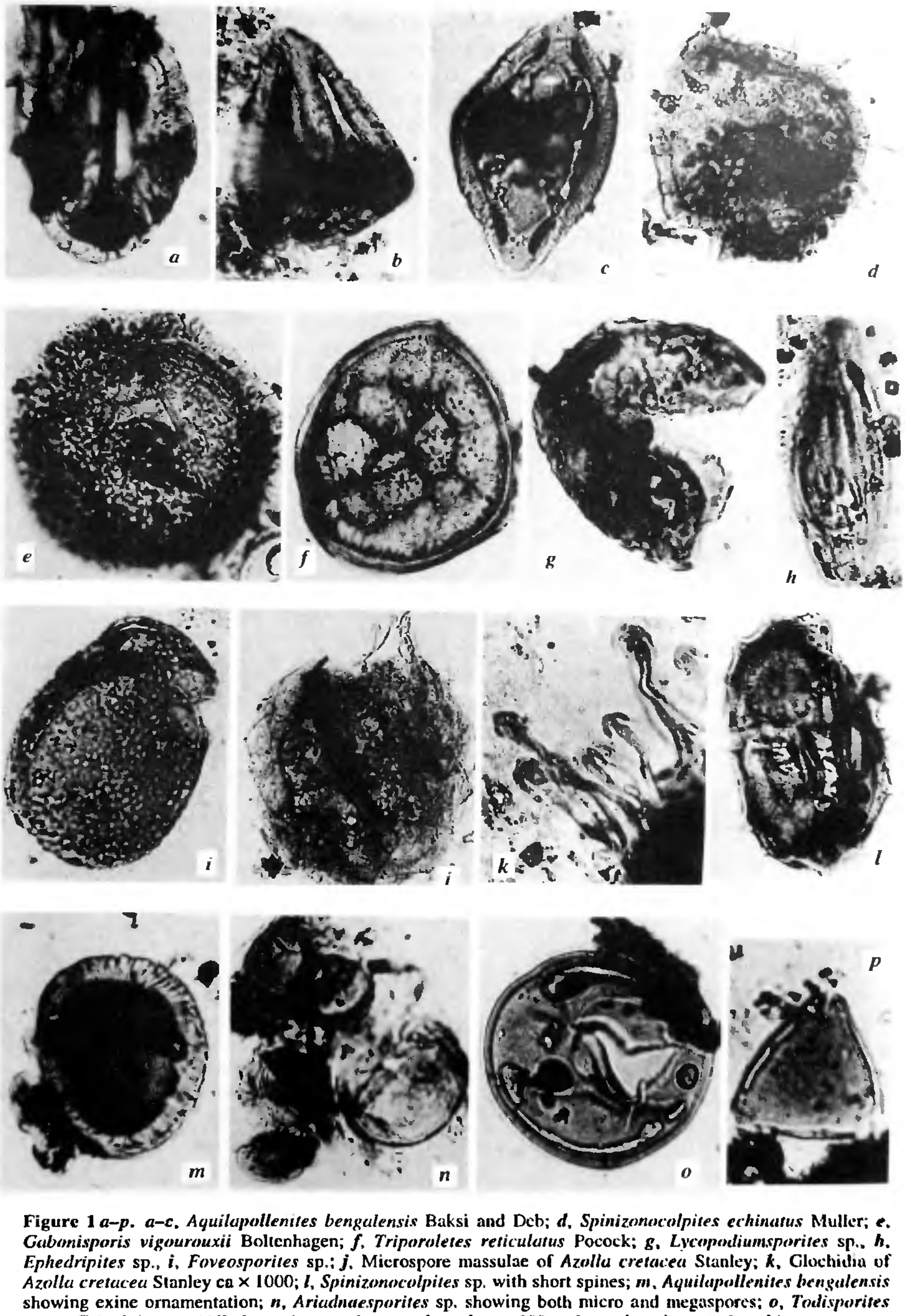

Figure 1 *a–p*. *a–c*, *Aquilapollenites bengalensis* Baksi and Deb; *d*, *Spinizonocolpites echinatus* Muller; *e*, *Gabonisporis vigourouxii* Boltenhagen; *f*, *Triporoletes reticulatus* Pocock; *g*, *Lycopodiumsporites* sp., *h*, *Ephedripites* sp., *i*, *Foveosporites* sp.; *j*, Microspore massulae of *Azolla cretacea* Stanley; *k*, Glochidia of *Azolla cretacea* Stanley ca × 1000; *l*, *Spinizonocolpites* sp. with short spines; *m*, *Aquilapollenites bengalensis* showing exine ornamentation; *n*, *Ariadnaesporites* sp. showing both micro and megaspores; *o*, *Todisporites* sp.; *p*, *Tricolpites* sp. (All photomicrographs are enlarged ca × 600, unless otherwise mentioned.)

pteridophytic spores (Figure 1 *a–p*). The detailed qualitative and quantitative aspects of the palynofloral assemblage will be dealt with separately elsewhere.

The Mohgaonkalan palynoflora is very much comparable with that of Bengal Basin, Cauvery Basin, Narasapur – well no. 1, Padwar–Ranipur and Naskal Section B assemblages[4–9] as they have common palynotaxa, viz., *A. bengalensis*, *T. reticulatus*, *Tricolpites* sp., *Ephedripites* sp., *S. echinatus*, *G. vigourouxii*, *Ariadnaesporites* sp. and *A. cretacea*. The palynological data

confirm a Late Maastrichtian age for the Mohgaonkalan intertrappeans, since most of these forms are documented from well-dated strata having good palaeontological, stratigraphical and geophysical controls[8–13]. Thus, the new data have been found to be useful to resolve the discrepancy in the ages of the intertrappean beds of Mohgaonkalan. In view of the above, a reappraisal of plant megafossil records is needed to ascertain the biostratigraphic and palaeobiogeographic implications of the Nagpur–Chhindwara and Mandla assemblages[14] and other contemporanaeous biotas associated with Deccan volcanic sedimentary sequences in Peninsular India. Further, the *Aquilapollenites*-associated palynoflora of Mohgaonkalan has an important bearing on the palaeoposition of India as it has Laurasian affinities while enjoying an extensive distribution in central and the eastern marginal basins of Bengal, Godavari and Cauvery in India. This paleoposition may have also allowed a free dispersal and migration of taxa between India and Eurasia through dispersal routes and terrestrial connection during the Late Cretaceous as rich assemblages of *Aquilapollenites* are distributed in northeastern China[15]. Perhaps palaeobiogeographically, India might have served as a meeting ground for both the southern and northern floral and faunal migrants during the Latest Cretaceous prior to initiation of volcanic activity.

Presence of *Aquilapollenites* in the intertrappeans has also stratigraphic implications as it is not recorded so far either in the pre-Maastrichtian sediments or in the Tertiary palynoflora of India. The global records indicate that the *Aquilapollenites* group arose in the latest Turonian and reached the peak of its abundance in the Late Maastrichtian, followed by a drastic decline to extinction in the Early Eocene[16]. Therefore, its restricted distribution during the Late Maastrichtian along with the dinosaur remains is to be considered a strong point for correlation of widely-separated intertrappean beds of Peninsular India. As there is no evidence of *Aquilapollenites* pollen that persisted across the K–T boundary in India, we have to critically assess the degree of impact of volcanic activity on the contemporaneous biota. In fact, *Aquilapollenites* being a Northern Hemisphere (circum-Pacific) form enjoying cooler climate, may have been subjected to environmental stress as a result of increase in temperature and the accompanying shift in the climate as compared to the pteridophytic spore forms that persisted for very long times. It is also likely that the Peninsular India could have been the southern boundary of *Aquilapollenites* during the Late Maastrichtian. Thus, it would be worthwhile to investigate palynoflora of more intertrappean beds in order to evaluate the disappearance of such elements with reference to Deccan Volcanic Episode that initiated just before the end of Cretaceous.

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