THE AGE OF THE TIKI FORMATION: WITH REMARKS ON THE MIOFLORAL SUCCESSION IN THE TRIASSIC GONDWANAS OF INDIA

HARI K. MAHESHWARI, K. P. N. KUMARAN & M. N. BOSE
Birbal Sahni Institute of Palaeobotany, Lucknow-226007, India

ABSTRACT

The age of the Tiki Formation in the South Rewa Gondwana Basin has been discussed. Available data on the vertebrate fauna, megaflora and palynoflora of the Tiki Formation have been evaluated. It is concluded that the Tiki Formation *sensu lato* (i.e. including the Nidhpuri beds) ranges in age from Anisian through Norian and possibly extends into the Rhaetian.

On the basis of available palynological data an attempt has been made to establish the miofloral succession in the Triassic Gondwanas of India. Presently nine successive palynological zones have been recognized. However, possibility of existence of some more palynological zones is also not ruled out.

INTRODUCTION

THE Gondwana Sequence of rocks in India comprises fresh-water deposits ranging in age from Lower Permian to Lower Cretaceous (inclusive). The whole sequence is divided into two or three divisions on the basis of distribution of major fossil plants. The groups in tripartite division roughly correspond to the Permian, Triassic and Jurassic-Cretaceous systems of European geological time scale. The three groups, usually called as Lower, Middle and Upper Gondwanas, are characterized by the presence of the Glossopteris Flora, the Dicroidium Flora and the Ptilophyllum Flora respectively.

The Triassic Gondwanas, characterized by the so-called Dicroidium Flora, are fairly well-developed in the Satpura and South Rewa basins and the Damodar and Wardha-Godavari valleys. A generalized succession of rock formations in the Triassic System of peninsular India is tabulated below.

	Damodar Valley	South Rewa Basin	Satpura Basin	Wardha-Godavari Valley
Lower Jurassic				Kota Fm
Upper-Middle Triassic	Supra Panchets	Parsora Fm Tiki Fm Nidhpuri Beds	Denwa/Bagra Fm Pachmarhi Fm	Dharmaram Fm Maleri Fm Bhimaram Sst Yerrapalli Fm
Lower Triassic	Hirapur Fm Maitur Fm	Daigaon Beds		Mangali Beds
Upper Permian	Raniganj Fm	Raniganj Fm (Pali Beds)	Bijori Fm	Kamthi Fm

The Triassic System is best dated in the Wardha-Godavari Valley due to availability of characteristic vertebrate fossils. The Lower Triassic in the Damodar Valley is also well-established on the basis of reptilian fauna. The succession in the South Rewa Basin, though not satisfactorily dated so far, is the best known due to the occurrence of well-preserved plant fossils. Further the carbonaceous facies is known only in this region.

While the plant fossils of the Parsora Formation have been known for quite some time (see Bose, 1974, p. 287) it is only in recent years that a carbonized megaflora has been recognized and described from the Nidhpuri beds (see Bose, 1974, p. 287). The Tiki Formation has yielded only *Dicroidium hughesii* and a *Taeniopteris* (Rao in Krishnan, 1958).

The lithology of the Parsora Formation is not suitable for palynological studies. A mioflora has been described from the Nidhpuri beds by Bharadwaj and Srivastava (1969). The Tiki Formation has only very recently been studied palynologically. A rich and diversified assemblage of microspores, megaspores and pollen grains has been reported and described by Banerji, Kumaran and Maheshwari (1978), Kumaran and Maheshwari (in press) and Maheshwari and Kumaran (in press).

The fossil data available now provide enough clues to evaluate the age of the Tiki Formation and to work out a rough palynological succession in the Triassic Gondwanas of India. In the following pages these two studies are further elaborated.

THE TIKI FORMATION

Tiki (23°56′N. lat.: 81°22′E. long.) is a small village, about 12 kilometres south of Beohari, Shahdol District, Madhya Pradesh. T. W. H. Hughes, while surveying the South Rewa Gondwana Basin in 1879, noticed reptilian fossils near this village. Some more reptilian remains were collected from the area by G. de P. Cotter during his survey work in 1916. These reptile-containing beds were formally named as Tiki 'Stage' by Fox (1931, p. 230).

Aiyengar (1936, p. 405) found that the Tiki rocks could be divided into two lithological units. The lower unit is chiefly composed of red and green clays with subordinate sandstones. The sandstones at places contain clay balls. The unit contains reptilian fossils, fresh-water molluscs and fossil wood. The upper unit mostly comprises hard ferruginous sandstones and some shales.

MAP 1 — Showing the type areas of Tiki, Maleri and Bagra-Denwa formations.

The known distribution of the Tiki rocks is in the low lying vast tract between Tiki and Somarkoini (23°37'N. lat.: 81°10'E. long.). According to a recent view (Roy-Chowdhury *et al.*, 1975) the Nidhpuri beds are equivalent of the basal part of the Tiki Formation.

Dutta and Ghosh (1972, p. 232) do not recognize the Tiki Formation as a separate entity but would rather place it as the upper part of what they term as 'Pali Formation'. According to them the rocks around Tiki and Pali are lithologically very similar and based on their spatial relationship form a single lithostratigraphical unit. However, it would seem that these authors have not taken into account the occurrence of carbonaceous facies in the Tiki Formation, particularly in the Janar Stream and the Gopad River. The carbonaceous facies is very characteristic of the Tiki Formation and as far as we know it has not been reported in any other Triassic formation in India. On the basis of lithological data at hand we are rather inclined to treat Tiki Formation as separate from the Pali beds, the latter possibly being equivalent of the Raniganj Formation of the Damodar Valley.

While discussing the relationship of the Pali beds and the Tiki Formation one must also not loose sight of the striking differences in their megafloral contents. The floral assemblage from the Pali beds (Daigaon Stage of Lele, 1964) has a typical Upper Permian impress particularly at Karkati, Salaia and Daigaon. On the other hand the Tiki megaflora almost exclusively consists of *Dicroidium* with rare occurrence of *Pachypteris*-like forms. The vertebrate fauna of the Tiki Formation is also indicative of an Upper Triassic age (Chatterjee & Roy-Chowdhury, 1974, p.108). Thus there seems to be a time gap spanning a period from Scythian to Carnian between the Pali and the Tiki formations.

The rocks of the Tiki Formation have a typical Maleri aspect (Pascoe, 1959, p. 972). The rocks of the Maleri Formation occur about 575 km south of Tiki area. The Maleri Formation comprises broad spreads of red clays with white or pale grey sandstones and lenses of lime pellet rocks. A similar lithology also characterizes the Denwa Formation of Satpura Basin. The Denwa Formation has usually been taken to roughly correspond to the Maleri Formation of the Pranhita-Godavari Valley.

FAUNA OF TIKI FORMATION

The animal fossils in the Tiki Formation have been found only in the red clays occurring south of Tiki. The vertebrate fauna comprises a metoposaur (*Metoposaurus maleriensis*), a rhynchosaur (*Paradapedon huxleyi*) and a phytosaur (*Parasuchus* sp.). Scutes similar to *Typothorax* have also been found. Invertebrates are represented by *Unio* sp. This fauna is almost identical with that of the Maleri Formation *sensu stricto* (Chatterjee & Roy-Chowdhury, 1974, p. 105).

The Maleri 'Formation' *sensu lato* of King (1881) has yielded two successive zones of vertebrate fauna. The term Maleri Formation is now restricted to the upper part of the succession which has yielded a typical Maleri fauna. The lower part of the succession with a different fauna was named as the Yerrapalli Formation by Jain, Robinson and Roy-Chowdhury (1964). The two formations, Yerrapalli and Maleri, are separated by a sandstone called as Bhimaram Sandstone. According to Kutty (1969, p. 37), the age of the Yerrapalli Formation is late Lower or early Middle Triassic and that of the Maleri Formation is early Upper Triassic (Carnian through Norian).

Faunistically the Denwa Formation was earlier correlated with the Tiki and Maleri formations. However, this correlation may not be tenable now in view of new studies. Chatterjee and Roy-Chowdhury (1974, p. 105) are of the opinion that the Denwa beds may be older than the Tiki-Maleri beds and are probably equivalent of the Yerrapalli Formation.

Thus the available faunistic evidence seems to suggest that the age of the Tiki-Maleri fauna is Carnian through Middle Norian.

MEGAFLORA OF TIKI FORMATION

Fossil wood has been reported associated with the vertebrates in the Tiki Formation, south of Tiki. One such wood was named as *Mesembrioxylon malerianum* by B. Sahni (1931). There is no evidence that the wood is *in situ* in the Tiki Formation. According to M. R. Sahni and Rao (1956), the wood was probably derived from the younger beds.

In situ calcified and partly carbonized fossil wood is known to occur in the Tiki beds on the east bank of Son River near Ghiar (23°50′ N. lat.: 81°16′30″ E. long.). This wood is poorly preserved and does not show any identifiable features. However, Saksena (1962) reported a dicotyledonous wood, *Gondwanoxylon ghiarii* from the same locality. Evidently there seems to have been some mixup of material and Saksena's wood in all probabilities seems to have been derived from the overlying intertrappeans.

Nageswara Rao (in Krishnan, 1958, p. 12) recorded the presence of *Thinnfeldia* sp. (= *Dicroidium* sp.) and *Taeniopteris* sp. from the green shale bands of Tiki Formation exposed near Ghiar. Singh (in Sastry *et al.*, 1977, p. 73) has now reported the occurrence of *Dicroidium, Pachypteris, Noeggerathiopsis* and *Taeniopteris* from the same locality. Our collection from the Ghiar locality, too, includes a fragmentary *Noeggerathiopsis*-like leaf in a clay ball. However, unlike to Permian *Noeggerathiopsis* leaves, the Ghiar leaf has a very fragile cuticle.

Thinnfeldia (= *Dicroidium*) *hughesii* fronds were also reported from the Tiki Formation exposed in the Janar Stream between Bijouri and Harai by Nageswara Rao (*ibid*). In our collection there are carbonized leaves of *Dicroidium*/*Lepidopteris* which possibly belong to more than two species.

The occurrence of the genus *Dicroidium* in the Tiki Formation is a pointer of Triassic age. The genus *Pachypteris* is known in India so far only from the Jurassic sedimentary rocks. The genus *Dicroidium* is also abundant only in the Nidhpuri beds and the Parsora Formation of Middle Triassic and Rhaetic age respectively. As the genus *Dicroidium* is not known to persist above the Parsora Formation (except probably in Jurassic of Vemavaram, Jain, 1968, p. 153) its association with the genus *Pachypteris* may be regarded as an indicator of an Upper Triassic age.

PALYNOFLORA OF TIKI FORMATION

The first ever record of the palynoflora from the Tiki Formation is from the Nidhpuri beds by Bharadwaj and Srivastava (1969). The exposure from which this palynoflora has been recorded shows striking lithological resemblance to the Raniganj Formation in having thin carbonaceous shale bands. Satsangi (1964), who first discovered plant fossils in these beds dated these as Triassic. Bharadwaj and Srivastava (1969, p. 146) surmised that the Nidhpuri beds were the upper part of the Panchet 'Stage' ('Daigaon Stage') which is faunistically dated as Scythian. Bharadwaj (1969, p. 89) assumed that the palynoflora of the Parsora 'Stage' too would not have been much different from that of the Nidhpuri beds.

However, none of the above two views were accepted by Maheshwari (1975, p. 241). The Panchet beds are much older than the Nidhpuri beds as unlike the latter they have an almost Upper Permian megaflora which lacks the genus *Dicroidium*. Further the Panchet palynoflora, particularly of the upper part, is characterized by the abundance of pteridophytic spores, both mega- and micro-, whereas the Nidhpuri palynoflora is mostly composed of saccate pollen. The Parsora Formation is megafloristically younger than the Nidhpuri beds as it almost lacks the genus *Glossopteris* which is a characteristic Permian holdover in the Nidhpuri beds. Bharadwaj and Tiwari (1977, p. 45) now agree that the Nidhpuri mioflora is younger as compared to the Panchet mioflora.

The presence of thin carbonaceous shale bands with *Dicroidium* in the Nidhpuri exposure reminds one of similar carbonaceous shale bands with *Dicroidium* in the Tiki Formation exposed in the Janar Stream. Therefore, Roy-Chowdhury *et al.* (1975) seem to have been correct in placing the Nidhpuri beds as equivalent to the base of the Tiki Formation. In that light the age of the Nidhpuri beds would be near about Lower Anisian.

The Tiki Formation in the type area has only very recently been studied palynologically from three localities, viz., Tharipathar, Ghiar and Bijouri-Harai (Sundaram *et al.*, 1977; Banerji, Kumaran & Maheshwari, 1978; Kumaran & Maheshwari, in press; Maheshwari & Kumaran, in press).

The miofloras from Tharipathar and Ghiar exposures have following stratigraphically important species: *Aulisporites astigmosus* (Leschik) Klaus 1960, *Enzonalasporites densus* (Leschik) Dolby 1976, *E. ignacii* (Leschik) Maheshwari & Kumaran 1978, *E. vigens* Leschik 1955, *Rimaesporites potoniaei* Leschik 1955, *Samaropollenites speciosus* Goubin 1965, *Camerosporites secatus* Leschik 1955 and *Duplicisporites granulatus* Leschik 1955 along with pollen of the genus *Staurosaccites* Dolby 1976. Maheshwari and Kumaran (in press) compare these miofloras with the *Samaropollenites speciosus* zone of the Onslow Microflora. The *S. speciosus* zone is of probable Carnian age (Dolby & Balme, 1976).

The stratigraphically important species in the Janar Stream (Bijouri-Harai) mioflora are: *Aulisporites astigmosus, Apiculatisporis globosus* (Leschik) Playford & Dettmann 1965, *Convolutispora microrugulata* Schulz 1967, *Camarozonosporites rudis* Klaus 1960, *Leschikisporis aduncus* (Potonié) Bharadwaj & Singh 1964, *Carnisporites mesozoicus* (Klaus) Mädler 1964, *Dictyophyllidites mortonii* (de Jersey) Playford & Dettmann 1965, *Clavatisporites hammenii* (Herbst) de Jersey 1971, *Lycopodiacidites kuepperi* Klaus 1960, *Conbaculatisporites mesozoicus* Klaus 1960, *Neoraistrickia taylorii* Playford & Dettmann 1965, *Uvaesporites verrucosus* (de Jersey) Helby in de Jersey 1971, *Discisporites psilatus* de Jersey 1964, *Rimaesporites potoniaei, Samaropollenites speciosus, Lunatisporites rhaeticus* (Schulz) Kumaran & Maheshwari 1979 and *Pseudoenzonalasporites summus* Scheuring 1970. The mioflora also contains specimens referable to the genera *Conipollenites* Cameron 1974, *Infernopollenites* Scheuring 1970 and *Equisetosporites* Daugherty 1941 along with the characteristic genus *Staurosaccites.*

None of the above taxa occur below the Late Triassic. On the other hand, some of the above species, viz., *Apiculatisporis globosus, Camarozonosporites rudis, Clavatisporites hammenii, Convolutispora microrugulata, Lunatisporites rhaeticus* and *Lycopodiacidites kuepperi* range even in the Liassic. The mioflora has a clear affinity with the Onslow Microflora of Carnarvon Basin, Australia (Dolby & Balme, 1976) in the characteristic occurrence of the genus *Staurosaccites* which is not known from anywhere else. The age of the Onslow Microflora is from Carnian to Norian.

The Janar Stream microflora also contains a diversified assemblage of megaspores (Banerji, Kumaran & Maheshwari, 1978). In this assemblage megaspores referable to the genus *Banksisporites* Dettmann 1961 dominate both in number of species and specimen counts. Other important megaspore genera are *Horstisporites* Potonié 1956, *tNahorstisporites* Jung 1958 and *Verrutriletes* Hammen ex Potonié 1956. The megaspore assemblage as such is more akin to the Rhaetic-Liassic assemblages from Gondwanaland rather than to the Permian-Lower Triassic or the Jurassic-Cretaceous assemblages. The Janar Stream megaspore assemblage also shows a close similarity with the Keuper megaspores from Germany and the Rhaetic megaspores from Poland.

Marcinkiewicz (1971), while summarizing the distribution pattern of megaspore species in Europe, observed that (i) *Banksisporites pinguis* (Harris) Dettmann may be regarded as the index species for the Rhaetic, (ii) *Horstisporites areolatus* (Harris) Potonié and *Nathorstisporites hopliticus* Jung are characteristic of Liassic sediments. As all the three species are present in the Janar Stream assemblage, it would be natural to presume that its age is somewhere at the Rhaetic-Liassic boundary. A comparative distribution of some of the important megaspore species in different countries (Chart 1) also seems to confirm this view.

Thus while the mioflora of the Janar Stream exposure has Carnian-Norian affinities, the megaspores have a clear Rhaetian aspect. In the absence of characteristic Rhaetian miospores, viz., *Rhaetipollis, Riccisporites, Gliscopollis, Staplinisporites, Triancoraesporites, Zebrasporites, Limbosporites* etc., we are more inclined to accept a Norian age for these beds.

THE AGE OF THE TIKI FORMATION

In the preceding pages we have evaluated three different palaeontological parameters, viz., vertebrate fauna, megaflora and palynoflora for deciding the age of the Tiki Formation *sensu lato.*

The faunistic evidence is available only for the lower part of Tiki Formation *sensu stricto* (i.e. excluding the Nidhpuri beds). It gives an age from Carnian through Middle Norian.

The megafloral evidence is not very instructive. The Nidhpuri beds seem to be younger than the Scythian Panchet Group of Damodar Valley but definitely older than the Tiki Formation proper, the latter having indications of an Upper Triassic flora in the dominance of *Dicroidium,* and the presence of *Pachypteris.*

The palynoflora is more indicative of a definite age to the Tiki Formation *sensu*

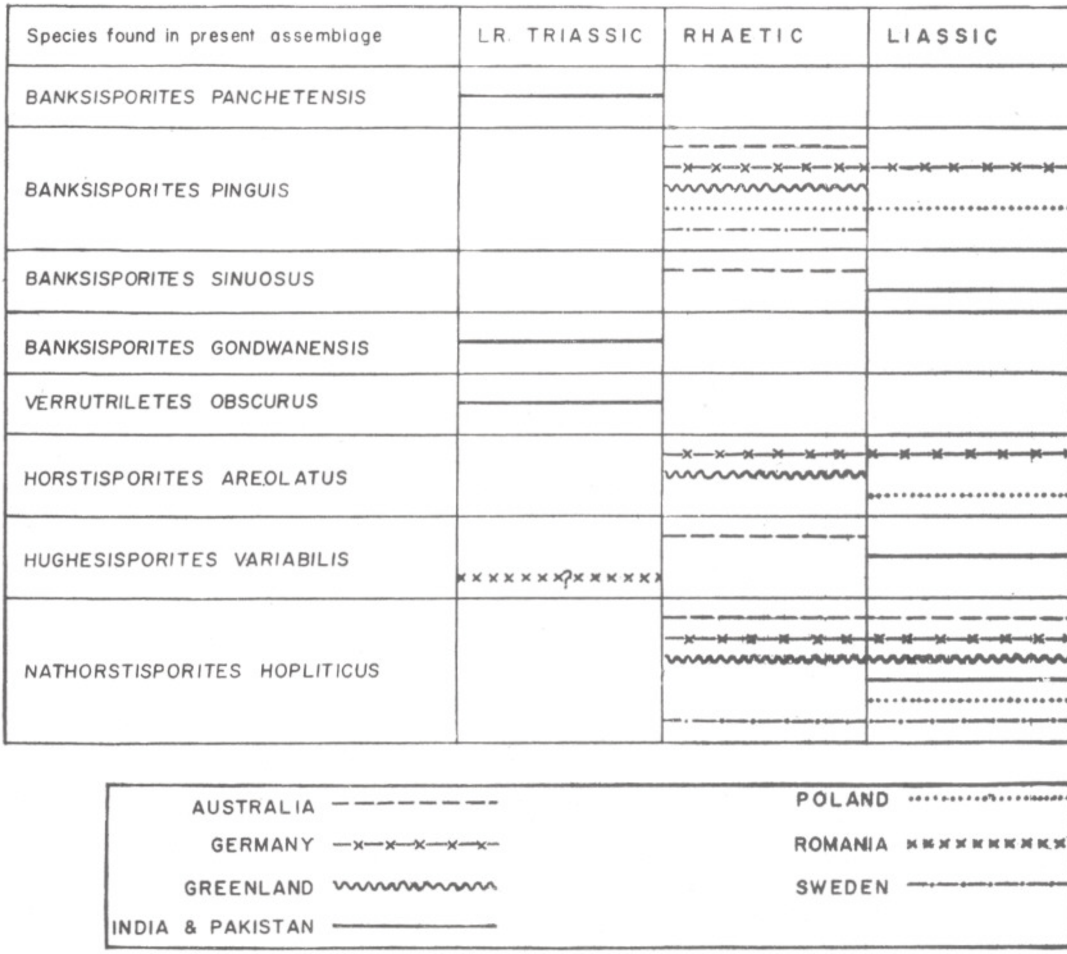

CHART 1 — Showing distribution of some important megaspore species recovered from the Jnar Nala samples in the Triassic-Liassic strata.

stricto, though it has little to contribute to the age of the Nidhpuri beds. In the Tiki Formation proper, the Tharipathar-Ghiar section is possibly of Carnian age whereas the Janar Stream section is possibly of Norian age, probably extending into the Rhaetian.

Thus the Tiki Formation (including the Nidhpuri beds) seems to have ranged from Anisian through Norian as also suggested by Roy-Chowdhury *et al.* (1975). It possibly extended into the Rhaetian too.

MIOFLORAL SUCCESSION IN TRIASSIC OF PENINSULAR INDIA

We now have a lot more information about the palynology of the Triassic sediments of Peninsular India than ever before. On the basis of available palynological data we may now attempt to establish the miofloral succession in the Triassic of Peninsular India. Maheshwari (1975) discerned five palynological zones in the Indian Triassic. Recently acquired data show that the number of palynological assemblages is at least nine, may be more as part of the Indian Triassic sediments has yet to be palynologically examined. The presumed stratigraphic position of seven of these assemblages are shown in Chart 2.

I. *Klausipollenites schaubergeri* Assemblage

This assemblage is known only in the subsurface of the Damodar Valley (*Purnea*

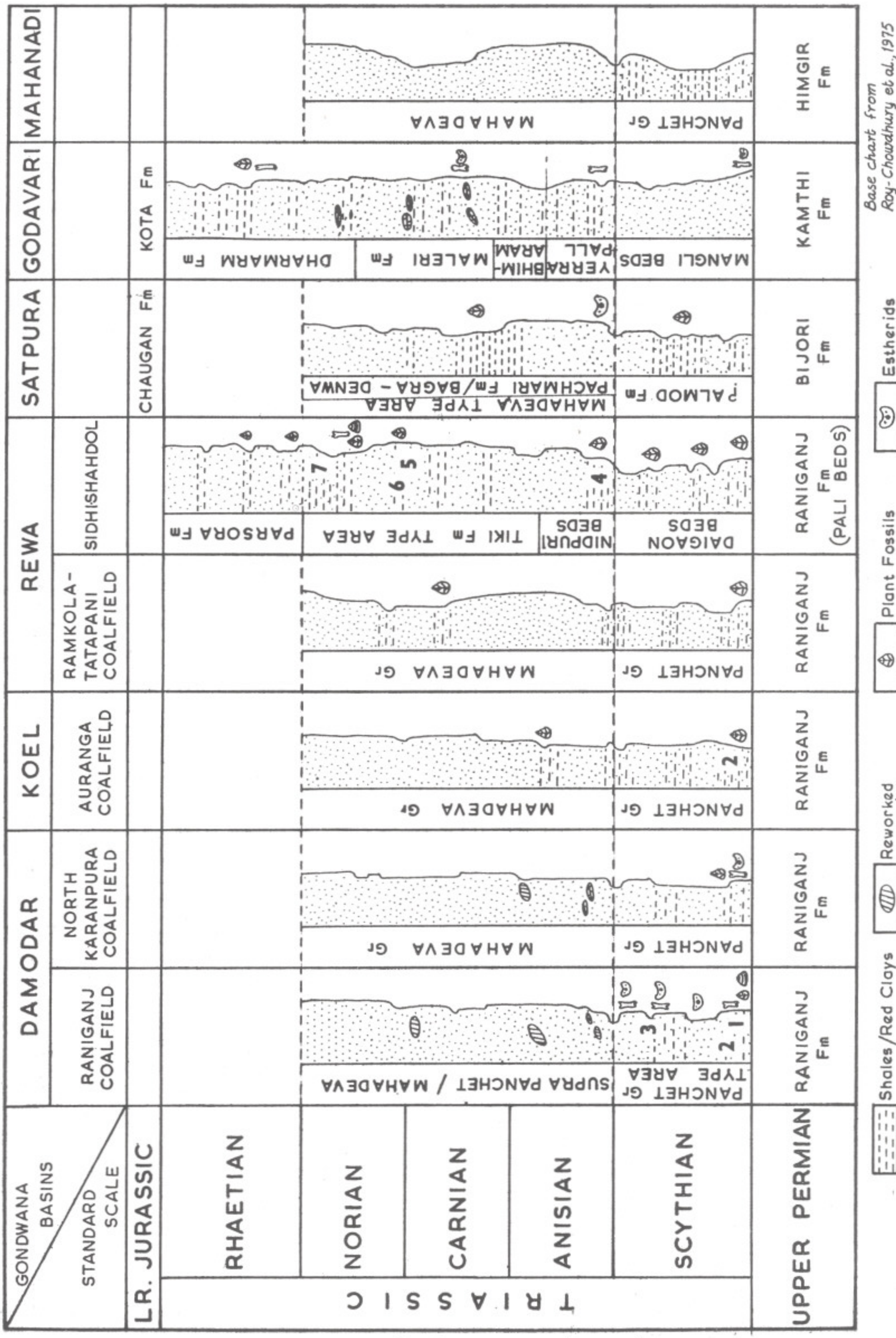

CHART 2 — Showing the probable locations of 7 of the known 9 Triassic palynological assemblages in peninsular India.

CHART 3 — Showing occurrence of palynotaxa in different palynological assemblages of Triassic age in peninsular India.

1. *Kraeuselisporites rallus*, *K. cuspidus*
2. *Lunatisporites noviaulensis*, *L. obex*
3. *Verrucosisporites narmianus*, *V. triassicus*
4. *Densipollenites densus*, *D. indicus*, *D. invisus*
5. *Lunatisporites ovatus*, *L. gopadensis*
   Gondwanipollenites brevis, *G. decorus*, *G. labrus*, *G. magnificus*, *G. varus*, *G. venustus*, *G. diffusus*, *G. bengalensis*, *G. multistriatus*
   Lahirites incertus, *L. raniganjensis*, *L. rarus*, *L. triassicus*
   Crescentipollenites fuscus
   Protohaploxypinus varius, *P. parvus*, *P. bharadwajii*, *P. microcorpus*, *P. gopadensis*
   Striatites levistriatus, *S. communis*, *S. sidhiensis*, *S. solitus*, *S. cancellatus*
   Lahirites navicula, *L. singularis*
   Hindipollenites indicus,
   Verticipollenites gibbosus, *V. crassus*,
   Chordasporites raniganjensis, *C. australiensis*, *C. magnus*, *C. klausii*
   Stroterspories raniganjensis, *S. sidpurensis*,
   Distriatites insculptus
   Striatoabieites aytugii
6. *Cyathidites australis*, *C. concavus*
7. *Verrucosisporites bosei*, *V. contactus*, *V. densus*, *V. surangei*
8. *Convertubisporites contactus*, *C. densus*
9. *Lundbladispora baculata*, *L. densispinosa*, *L. microconata*
10. *Rhizomaspora biharia*, *R. decarcata*
11. *Alisporites cacalicorpus*, *A. minutisaccus*, *A. grobus*
12. *Klausipollenites decipiens*, *K. sulcatus*
13. *Cyclogranisporites chatoneri*, *C. tritetes*
14. *Granuloperculatispollis distinctus*, *G. flavatus*, *G. problematicus*
15. *Weylandites bilateralis*, *W. circularis*, *W. indicus*, *W. irregularis*
16. *Minutosaccus crenulatus*, *M. potoniaei*
17. *Enzonalasporites ignacii*, *E. vigens*
18. *Callumispora magna*, *C. tenuis*
19. *Dictyophyllidites cymbatus*, *D. surangei*
20. *Guttatisporites guttatus*, *G. visscheri*
21. *Lappesisporites armatus*, *L. lappasus*, *L. villosus*
22. *Foveosporites mimosae*, *F. triassicus*
23. *Carnisporites hercynicus*, *C. mesozoicus*
24. *Cingulizonates indicus*, *C. verrucosus*
25. *Tikisporites balmei*, *T. complicatus*
26. *Brachysaccus ovalis*, *B. indicus*
27. *Triadispora plicata*, *T. ellis*
28. *Infernopollenites jangrensis*, *I. parvus*, *I. pseudoclaustratus*, *I. simplex*
29. *Staurosaccites densus*, *S. marginalis*, *S. minutus*, *S. ovalis*
30. *Lunatisporites acutus*, *L. rhacticus*

— Venkatachala & Rawat, 1974; *Borehole NCRD 6*: Assemblage 2 — Bharadwaj & Tiwari, 1977). Like the underlying Upper Permian Raniganj Formation, this assemblage, too, has a predominance of striate-bisaccate pollen. But, at the same time the pteridophytic spores are rather much more diverse. Besides *Klausipollenites schaubergeri* (Potonié & Klaus) Jansonius, other important species are *Lunatisporites ovatus* Goubin (= *L. rhombicus* Bharadwaj & Tiwari), *L. pellucidus* (Goubin) Maheshwari & Banerji (= *L. diffusus* Bharadwaj & Tiwari), *Alisporites landianus* Balme (= *A. grobus* Bharadwaj & Tiwari), *Tigrisporites playfordii* de Jersey & Hamilton and *Playfordiaspora cancellosa* (Playford & Dettmann) Maheshwari & Banerji. This assemblage is within the Scythian Stage of European standard scale.

II. *Playfordiaspora cancellosa* Assemblage

This assemblage is represented in the Maitur Formation (basal Panchet Group) of the Damodar Valley (*Raniganj Coalfield* — Maheshwari & Banerji, 1975; Banerji & Maheshwari, 1977; *Borehole NCRD 6*: Assemblage 3 — Bharadwaj & Tiwari, 1977; *Auranga Coalfield* — Banerji & Maheshwari, 1975). Here too, the bisaccate-striate pollen continue to be important but are associated with a quantitatively significant and well diversified pteridophytic spore flora.

Besides the characteristic presence of *Playfordiaspora cancellosa*, other significant species are *Punctatisporites maiturensis* Maheshwari & Banerji, *Verrucosisporites morulae* Klaus, *Kraeuselisporites wargalensis* Balme, *Lundbladispora* sp., *Densoisporites complicatus* Balme, *Falcisporites stabilis* Balme, *Platysaccus queenslandi* de Jersey and *Lunatisporites pellucidus*.

III. *Decisporis variabilis* Assemblage

This assemblage comes from the Hirapur Formation (upper Panchet Group) and is represented in the subsurface only of the Damodar Valley (*Borehole RO 1(B)* — Shrivastava & Pawde, 1962; *Borehole RE 9* — Kar, 1970; *Borehole RE 1* — Sarbadhikari, 1972). The assemblage is dominated by pteridophytic spores (71-80 per cent). Besides *Decisporis variabilis* Kar (incl. *D. panchetensis* Kar and *D. rudis* Kar), the other important species are *Divaripunctites globosus* Kar (incl. *D. plicatus* Kar), *Rimaspora plicata* Kar and *Protohaploxypinus varius* (Bharadwaj) Balme (= *Striatopiceites clarus* Kar). Assemblages II and III are also of Scythian age as dated by vertebrate fossils.

IV. *Weylandites indicus* Assemblage

The stratigraphical position of the beds which have yielded this assemblage is controversial. These beds, exposed in the Gopad River near Nidhpuri, Madhya Pradesh unconformably overlie the Raniganj Formation and are overlain by alluvium. Two miofloral assemblages have been described from this area and both have been assigned a Triassic age. However, the assemblage reported by Trivedi and Misra (1969) has all the characteristic features of the Raniganj mioflora and definitely is of Upper Permian age. The other assemblage, described by Bharadwaj and Srivastava (1969), has also been a subject of controversy. Balme (1970) and Venkatachala (1976) are of the opinion that this assemblage too has Permian affinities. However, it is quite unlikely as the palyniferous horizon contains the characteristic Triassic genera *Dicroidium* and *Pteruchus*. These two genera are not known from the Scythian or older beds of India. Therefore, the Nidhpuri beds presumably are Anisian or younger in age.

The most characteristic elements of Assemblage-IV of course is the genus *Weylandites* with 5 species. Other important taxa are: *Nidipollenites monoletus* Bharadwaj & Srivastava, *Falcisporites nidpurensis* (Bharadwaj & Srivastava), *F. triassicus* (Bharadwaj & Srivastava) and *Praecolpatites nidpurensis* Bharadwaj & Srivastava.

V. *Staurosaccites tharipatharensis* Assemblage

This assemblage is known from the Tharipathar exposure (Maheshwari & Kumaran, in press). Characteristic elements of this assemblage are *Staurosaccites tharipatharensis*, *Samaropollenites speciosus* Goubin, *Falcisporites stabilis* Balme, *Rimaesporites potoniaei* Leschik, *Aulisporites astigmosus* (Leschik) Klaus, *Camerosporites secatus* Leschik, *Duplicisporites granulatus* Leschik and *Enzonalasporites densus* (Leschik) Dolby. This assemblage is indicative of Upper Carnian age.

VI. *Rimaesporites potoniaei* Assemblage

This assemblage is known from the Ghiar exposure (Maheshwari & Kumaran, in press). It is rather poor in pteridophytic spores. Important elements are *Rimaesporites potoniaei*, *Falcisporites stabilis*, *Lycopodiumsporites* sp., *Densoisporites* sp. and *Enzonalasporites* spp. This assemblage seems to be slightly younger than the previous assemblage, but may not be younger than Upper Carnian.

VII. *Tikisporites balmei* Assemblage

This is one of the best known Triassic assemblages from India. It has a highly diversified pteridophytic microflora comprising both micro- and megaspores (Banerji, Kumaran & Maheshwari, 1978; Kumaran & Maheshwari, in press). The age of the assemblage is more likely to be Norian, may be even younger.

The most important element of the assemblage is the genus *Infernopollenites*. Other characteristic taxa are *Convolutispora microrugulata* Schulz, *Camarozonosporites rudis* Klaus, *Clavatisporites hammenii* (Herbst) de Jersey, *Dictyophyllidites mortonii* (de Jersey) Playford & Dettmann, *Lycopodiacidites kuepperi* Klaus, *Playfordiaspora cancellosa* (reappearance of the taxon), *Neoraistrickia taylorii* Playford and Dettmann, *Carnisporites mesozoicus* (Klaus) Mädler, *Uvaesporites verrucosus* (de Jersey) Helby, *Chordasporites australiensis* de Jersey, *Rimaesporites potoniaei*, *Samaropollenites speciosus*, *Staurosaccites* spp., *Lunatisporites acutus* (Leschik) Scheuring, *L. rhaeticus* (Schulz), *Tikisporites balmei* and *T. complicatus*.

VIII. Shumarwali Miospore Assemblage

This assemblage is imperfectly known from the subsurface in an exploratory well near Shumarwali area, Rajasthan (Tikku, Lukose, Singh, Misra, Gupta & Abbasi, 1976). The reported forms include *Gliscopollis*, *Staplinisporites*, *Tigrisporites*, *Rugulatisporites*, *Guttatisporites*, *Lundbladispora*, *Ovalipollis*, *Lunatisporites* and *Samaropollenites*. The age of the assemblage is supposed to be Late Triassic-Rhaetian.

IX. *Rhaetipollis germanicus* Assemblage

This assemblage, too, is imperfectly known in subsurface from the Banni well-2 of Kutch (Koshal, 1975). Besides *Rhaetipollis germanicus*, the assemblage contains *Dictyophyllidites*, *Klausipollenites*, *Lunatisporites rhaeticus*, *Falcisporites*-complex, *Lundbladispora* sp., *Aequitriradites minor* Mädler, *Concavisporites* sp., *Gliscopollis-Classopollis* complex, *Convolutispora microrugulata* Schulz and *Porcellispora* (= *Naiadita*). This assemblage has been dated as of Rhaetic-Liassic age on the basis of palynomorphs.

The above miofloral assemblages cover almost whole of the Triassic succession of peninsular India. However, even now a big palynological gap exists between Late Anisian and Late Carnian. Also in other stages there may be present many more assemblages. The dating of some of the assemblages, e.g. I, IV, VIII and IX is only provisional as no independent palaeontological control is available.

The miofloral succession in the Triassic of Peninsular India is depicted in Chart 3.

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