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PALYNOLOGY OF THE UPPER GONDWANA DEPOSITS OF RAMPUR AREA, PRANHITA GODAVARI BASIN, ANDHRA PRADESH, INDIA

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ABSTRACT

The paper records a fairly rich palynoassemblage from the Rampur area, Adilabad district, Andhra Pradesh. The palynoassemblage recorded constitute 32 genera and 45 species; of these one genus and 12 species are new to the basin viz., *Stereisporites antiquasporites, Impardecispora marylandensis, Lycopodiacidites irregularis, Lycopodiumsporites nodosus, L. trambauensis, Cicatricosisporites augustus, Ischyosporites punctatus, Ornamentifera baculata, Podosporites tripakshi, Cycadopites couperi, Monosulcites ellipticus* and *Classopollis pflugii*. The botanical affinities of the palynoflora have been assessed. The palynoassemblage of the Rampur area of the Pranhita Godavari basin is comparable to the Palynoflora of the Gangapur Formation, lower Creataceous flora of Godavari-Krishna basin of Andhra Pradesh; Cauvery and Palar basins of Tamil Nadu. The present study clearly indicates the absence of the Middle to Upper Jurassic strata in the Pranhita Godavari basin, as the Kota Formation is of Lower Jurassic (Liassic) age and the overlying Gangapur Formation is of Lower Cretaceous (Neocomian-Aptian) age. The palynoflora of the present investigation clearly suggest the Lower Cretaceous age to the Rampur upper Gondwana sediments.

On the whole, spore and pollen complex indicates a freshwater to brackish environment in the vicinity of the depositional basin, with a warm humid climate of subtropical nature with favourable good precipitation.

INTRODUCTION

The Upper Gondawana sequence of the Pranhita Godavari basin, South-Central India, comprises Maleri, Dharmaram, Kota and Gangapur (?. Chikiala) formations which is almost complete with a break in sedimentation on the top (Rudra, 1982). The Maleri Formation consists mainly of fossiliferous Upper Triassic red clays with intercalated calcareous sandstones and the Dharmaram Formation is represented by alternating fossiliferous red clays and sadstones units. The Kota Formation of early Jurassic age (Liassic) overlies the Dharmaram. It consists of sandstones, clays and a prominent zone of limestones. The Kota Formation conformably overlies the Dharmaram Formation with a marked sharp contact with an overall thickness of about 585 metres. The clays underlying the limestones have yielded typical dinosaurian and mammalian fossil remains (Jain, Kutty, Roy Chowdhury and Chatterji, 1975; Yadagiri and Prasad, 1977; Datta, Yadagiri and Jagannath Rao, 1978; Datta, 1981), whereas the limestones have yielded fossil remains of fish, crustacean shells (King, 1881; Jain, 1973, 1974; Tasch, *et al.*, 1973; Govindan, 1975; Yadagiri and Prasad, 1977); stromatolites (Gururaja and Yadagiri, 1981); and few trace fossils (Rudra, 1982). The fossils are localised in different places. The Chikiala Formation which overlies the Kota Formation consits of coarse to highly coarse-grained sandstones conglomerates of ferrugionous nature and a few lenses of clays. It is observed that the sequence from the base of the Upper Unit of the Kota Formation to the top of the Chikiala Formation is found to be coarsening upwards, which might have been formed under braided-cum-alluvial fan river deposits and the Kota limestones might have perhaps been deposited in a playa type lake or lacustrine (Rudra, 1982). Different views were expressed by various workers regarding the deposition of Kota sediments. Blanford (1978) described that the Upper Gondwana sediments were river and lake deposits and King (1881) stated that due to certain depositional chages in the draingage system might have led to the deposition of a "thick alternating series of a more arenacous and decidely calcareous rocks." Roy Chowdhury (1965) and Sengupta (1970) described that a system of river channels diverted along broad flood plains; the sandstones represent river channel deposits and the red clays flood plain deposits. Sengupta (1970), described that the upper Gondwana deposits might be the result of a clastic sedimentation of a horizontally diverting meandering river channel system which has extended from the lower Gondwana. Robinson (1970) stated that the Kota sediments consisted of sandstones (which are fluviatile) and the limestones and clays (lacustrine freshwater in origin). More recently, Satyanarayana and Sharma (1979) and Bhattacharya (1980) have stated a marine to mixed origin for the the Kota limestones. Prabhakar (1985) also stated on the basis of the Kota palynoassembleage that the Kota limestones might have been deposited under fresh water to brackish-shallow marine water conditions.

The Gangapur Formation overlies unconformably the Kota Formation. Feistmantel (1879) and Rao and Shah (1959) have recorded earlier the following genera from the clays of the Kattarala (Kotharapally) viz., *Taeniopteris, Cladophlebis, Gleichenites, Otozamites, Ptilophyllum, Nilssonia, Elatocladus, Torreyites,*

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Pagiophyllum, Brachyphyllum and *Araucarites*. Recently Rajeshwar Rao *et al.*, (1983) recorded the following taxa from Ralapet, Kattarala and Anksapur: *Gleichenites, Cladophlebis, Equisetites, Taeniopteris, Ptilophyllum, Pagiophyllum, Brachyphyllum, Elatocladus* and *Araucarites*. In the field work of the present study, the author has collected the following plant fossils from the Kattarala (Kotharapally), Ralapet, Anksapur, Rampur and Wankulam localities, the plant mega fossils viz., *Cladophlebis indica, Gleichenites gleichenoides, Gleichenites* sp., *Cladophlebis indica, Equisetites* sp., *Otozamites* sp., *Ptilophyllum acutifolium, Pterophyllum* sp., *Nilssonia* sp., *Brachyphyllum* sp., *Pagiophyllum perigrinum, Elatocladus plana, E. conforta, E. jabalpurensis* and *Araucarites* sp., and the plant wood taxa, viz., *Bairoxylon, Platyspiroroxylon, Planoxylon, Mesembryoxylon, Araucarioxylon* and *Podocarpoxylon* etc. Of these, *Elatocladus* and *Araucarioxylon* are the most abundant members of the Gangapur Formation.

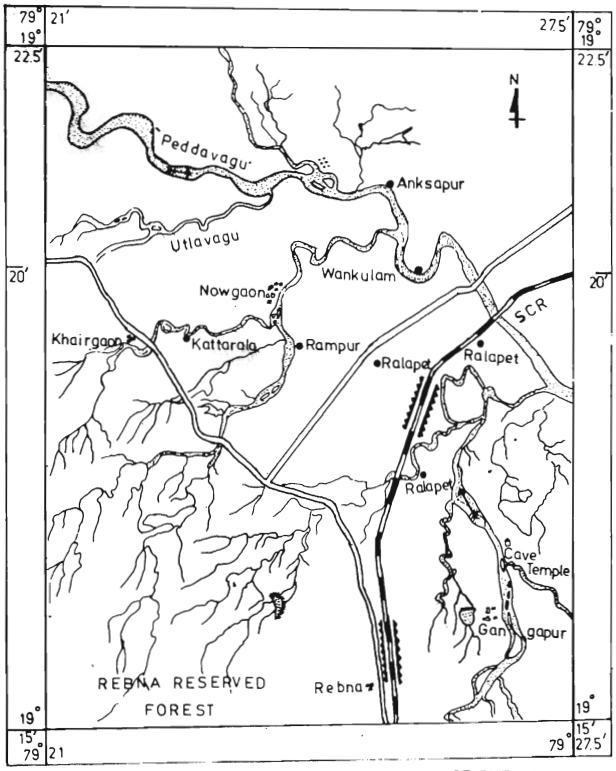

Fig 1. PRANHITA-GODAVARI BASIN SHOWING SOME OF THE UPPER GONDWANA LOCATION SITES A PART OF TOPOSHEET NO. 56 M/7 • LOCATION SITE

The present study was carried out in the Rampur (Fig.1) (19° 19' : 79° 23') which was mapped as Gangapur Formation of the Pranhita Godavari basin. The Lower Cretaceous beds are exposed here in the quarries; which extend upto a depth of 10-20 ft. A series of black and white clay bands appear in the quarry section (each band is about 1-2 ft. in thickness). A number of samples were collected from the black and white clays from different quarries. The clays have yielded a rich palynoassemblage, excluding angiosperm pollen. The Rampur area was not studied previosly, hence the present work is aimed at the detailed study of the spore and pollen contents of the area. It may connect the line of the outcrops which were exposed all along the pedda vagu river bed. This gives us a complete picture of palynoassemblage of the Gangapur Formation.

The general methods of maceration techniques were utilized for the recovery and concentration of the spore and pollen grains; pollen slides were made by using DPX mountant; unused samples and slides were kept in the Department of Botany, Post-graduate College of Science, Saifabad, Osmania University, Hyderabad.

PALYNOLOGICAL ASSEMBLAGE

The well preserved and rich palynological assemblage has been recovered from the Rampur Upper Gondwana deposits of the Pranhita Godavari basin. The following is the list of the palynofossils recorded in the present study. The most important taxa are illustrated in the plates 1 to 2. *Cyathidites australis*, Couper, 1953; *C. asper* (Bol) Dettmann, 1963; *Deltoidospora Juncta* (Kar and Murza) Singh, 1964; *Stereisporites antiquasporites* (Wilson and Webster) Dettmann, 1963; *Baculatisporites rotundus*, Kumar, 1973; *Neoraistrickia truncatus* (Cookson) Potnoie, 1956; *N. rallapetensis* Rajeshwar Rao, Ramanujam and Varma, 1983; *Concavissimi-sporites variverrucatus* (Couper) Singh, 1964; *Concavissimi-sporites* sp., *Impardecispora marylan-densis* (Brenner) Srivastava, 1975; *Lycopodiacidites irregularis* Pocock, 1970; *Lycopodiumsporites crassimacerious* Hedlund, 1966; *L. nodosus* Dettmann, 1963; *L. trambauensis* Singh, Srivastava and Roy, 1964; *Cicatricosisporites augustus* Singh 1971; *C. australiensis* (Cookson) Potonie 1956; *C. hallei* Delcourt and Sprumont, 1955; *C. hughesi* Dettmann, 1963; *Trilites tuberculiformis* Cookson, 1947; *Ischyosporites punctatus* Cookson and Dettmann, 1958; *Gleicheniidites senonicus* Ross, 1949; *Ornamentifera baculata* Singh 1971; *Contignisporites glebulentus* Dettmann, 1963; *C. cooksonii* (Balme) Dettmann, 1963; *C. crassicingulatus* Rajeshwar Rao, Ramanujam and Verma, 1983, *C. fornicatus* Dettmann, 1963; *C. multimuratus* Duttmann, 1963; *Crybelosporites* cf. *punctatus* Dettmann 1963, *Metamonoletes singhii* Rajeshwar Rao, Ramanujam and Verma, 1983, *Monolites indicus* Kumar, 1973, *Polypodiisporites multiverrucosus* Nagy 1963; *Callialasporites trilobatus* (Balme) Dev 1961; *C. discoidalis* (Doring) Bharadwaj and Kumar, 1972; *C. triletes* Singh, Srivastava and Roy, 1964; *Alisporites grandis* (Cookson) Dettmann, 1963; *Podocarpidites ellipticus* Cookson, 1947; *Platysaccus indicus* Sah and Jain 1965; *Microcachryidites antarcticus* Cookson, 1947; *Podosporites tripakshi* Rao, 1943; *Araucariacites australis* Cookson 1947;

Cycadopites couperi (Dev) Kumar, 1973; Monosulcites ellipticus (Dev) Kumar, 1973; *Classopollis classoides* (Pflug) Pocock and Jansonius, 1961; *Classoidites glandis* Ameroon, 1965; *Classopollis pflugii* Pocock and Jansonius 1961; *Schizosporis regulatus* Cookson and Dettmann 1959 and *Psilospora lata* (Venkatachala and Kar) emend Rajeshwar Rao, Ramanujam and Varma. 1983.

Of these 12 species are new records to the basin, they are viz., *Stereisporites antiquasporites, Impardecispora marylandensis, Lycopodiacidites irregularis, Lycopodiumsporites crassimaceriys, L. nodosus, L. trambauensis, Cicatricosisporites augustus, Ischyosporites puncatus, Ornamentifera baculata, Contignisporites cooksonii, Monosulcites ellipticus, Classopollis pflugii. Stereisporites antiquasporites* is new to the basin and also the auther is not aware of any earlier records of this taxon from the Upper Gondwana deposits (Neocomian-Aptian) of India. The following is the known or presumed botanical affinities of the following various genera recorded from Rampur area of the Pranhita Godavari basin:

ANALYSIS OF THE PALYNOASSEMBLAGE

The Rampur sediment of the Pranhita Godavari basin of Andhra Pradesh have yielded well preserved and rich palynological assemblage which include spores referable to bryophytes and pteridophytes and pollen referable to the cycadales and confiferales of the gymnosperms. The Rampur assemblage comprises 32 genera and 45 species of which one taxon and 12 species are new records to the basin. In the palynossemblage of the Rampur area, 18 genera constitute triletes of the bryophytes and pteridophytes and 6 genera reprsten the saccate pollen of coniferales, the rest include monolete, inaperturate Monosulcate, Monoporate and non-saccate grains.

The quantitative analysis of the 300 sporomorphs of the Rampur area have shown the following percentage of the various taxa:

Callialasporites	20%
Araucariacites	16%
Microcachryidites	15%
Classopollis	11%
Podocarpidites	9%
Contignisporites	7%
Cicatricosisporites	6%
Bisaccates other than the *Podocarpidites*	2%
Monoletes	1%
Cycadopites	1%
Other triletes	12%

The taxa represented by 20 per cent were treated as abundant member of the assemblage and those represented 9-16 per cent as common taxa; 2-7 per cent were considered to be fairly represented and those represented 1 per cent as of poor occurrence. On the whole, the triletes represented by 12 per cent were treated as better occurrence. The relative frequency of the various taxa explains that the gymnospermous pollen of non-saccates are the predominant members and the triletes on the whole occupied a reasonable position in the palynospectrum of the Rampur microflora. Within the gymnosperms *Callialasporites, Araucariacites, Microcachryidites, Classopollis* and *Podocarpidites* are the important taxa. The swamp plant Cheirolepidaceae represented by *Classopollis* pollen, occupied a suitable position and well represented. In the Palynospectrum *Monoletes* and *Cycadopites*, are poorly represented taxa. Among the triletes *Contignisporites* and *Cicatricosisporites* are fairly presented. *Monoletes* and *Cycadopites* are poorly represented taxa in the palynoassemblage of the Rampur area.

PALYNOLOGICAL COMPARISON WITH SOME OF THE UPPER GONDWANA DEPOSITS IN AND OUTSIDE INDIA

The microflora of the Rampur beds shows similarites with some of the Neocomian-Aptian palynoassemblages from India. These are known from Rajasthan (Jaisalmer), Kutch, Dharangadhra, Jabalpur, Rajmahal hills, South Rewa Gondwana basin of Madhya Pradesh, Mahanadibasin, Godavari-Krishna, Gangapur Formation of Andhra Pradesh, Cauvery and Palar basins of Tamil Nadu (Srivastava, 1966; Rao and Venkatachala, 1971; Singh, Srivastava and Roy, 1964; Venkatachala, 1966; 1969 a, b; Venkatachala, Kar and Raza, 1969; Venkatachala and Kar, 1970, 1972; Kar, 1972; Varma and Rawat 1964; Venkatachala and Rawat, 1970, Dev, 1961; Singh 1966; Bharadwaj, Kumar and Singh, 1972; Kumar, 1973; Vishumitre, 1954; Sah and Jain, 1965; Maheshwari, 1974, 1975; Sarma, Jain and Venkatachala, *1977;* Rajeshwar Rao, Ramanujam and Varma, 1983; Venkatachala, Sharma and Jain, 1972; Ramanujam and Srisailam, 1974; Varma and Ramanujam, 1984.

The palynoflora of the Rampur beds is also comparable to a number of Neocomian-Aptian Palynoassemblages reported from Australia (Balme, 1957; Cookson and Dettmann, 1958; Dettmann, 1963; South Africa (Scott, 1976, Herngreen and Chlonova, 1981); Argentina (Archangelsky and Gamerro, 1965-1966 a,b,c).

It should be mentioned especially that the Rampur beds and other Indian microfloral assemblages of the Neocomian-Aptian age are characterized by the presence of diagnostic palynofossils viz., *Ornamentifera, Crybelosporites (C. punctatus), Contignisporites (C. glebulentus; C. multimurratus), Cicatricosiporites (C. australiensis, C. hallei, C. hughesi; C. augusuts), Impardecispora (I. marylandensis), Microcachryidites (M. antarcticus).* All these genera are marker elements of the Neocomian-Aptian sediments of the various segments of the Gondwanaland. In the present study

bryophytes, pteridophytes and gymnosperms spores and pollen grains were recovered in the large number of samples studied and it is concluded that the palynological evidence unequivocally points towards the Lower Cretaceous (Neocomian-Aptian) age for the Rampur beds of the Pranhita Godavari basin. The Rampur palynoflora is in conformjity with the Lower Cretaceous (Neocomian-Aptian) Palynoflora of the Gondwanaland as described by Herngreen and Chlonova (1981).

PALAEOECOLOGY AND DEPOSITIONAL ENVIRONMENT

The Rampur beds palynoassemblage shows conspicuous absence of dinoflagellate member or any of the marine phytoplanktonic elements. Thus the palynoflora indicates a fresh water environment in the depositional site. The gymnosperms represent fewer taxa than the pteridophytes but quatitatively dominate the palynospectrum. In the saccate pollen were derived from the flora growing around the depositional basin and it clearly shows that there was only short transportation. The trilete spores of the bryophytes and pteridophytes altogether constitute local lowland vegetation and the vegetation indigenous to the depostitional basin; the winged conifer pollen grains of the gymnosperms were probably flown into the basin from a nearby upland vegetation. The enormous production of gymnospermous pollen is a natural phenomena to survive and propagate their genera, in which the wing development is to facilitate the most powerful air transportation to at least a short distance from their growing site; that the gymnosperms might be generally shrubs and long trees to suit this type of anaemophilous pollen mechanism and also helped them to overcome the pteridophyte population quantitatively, they gradually adapted to the environmental conditions and thus this character appears to be one of the factors to occupy the pro-angiosperm position in the evolution of the seed plants; thus we can say that the gymnosperms are more evolved and active plants than the pteridophytes in this particular aspect.

The better representation of the *Classopollis* pollen of the cheirolepidaceae plant, which grows in the coastal region and brackish marine sediments of the entire Mesozoic period (see, Venkatachala, 1966), indicate a fresh to brackish water, swampy environment, close to the depositional site. Many of the earlier authors expressed their opinion that the Cheirolepidaceae plants generally grow on the slopes and lowlands near to the coastal region or growing in well drained soils and in the warm climate. (see Srivastava, 1976).

The palynoassemblage on the whole indicates a warm humid climate of subtropical nature with reasonably good precipitation in the immediate environs of the depositional basin.

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EXPLANATION OF PLATE

PLATE I

(All Photomicrographs magnified X 500 unless otherwise stated)

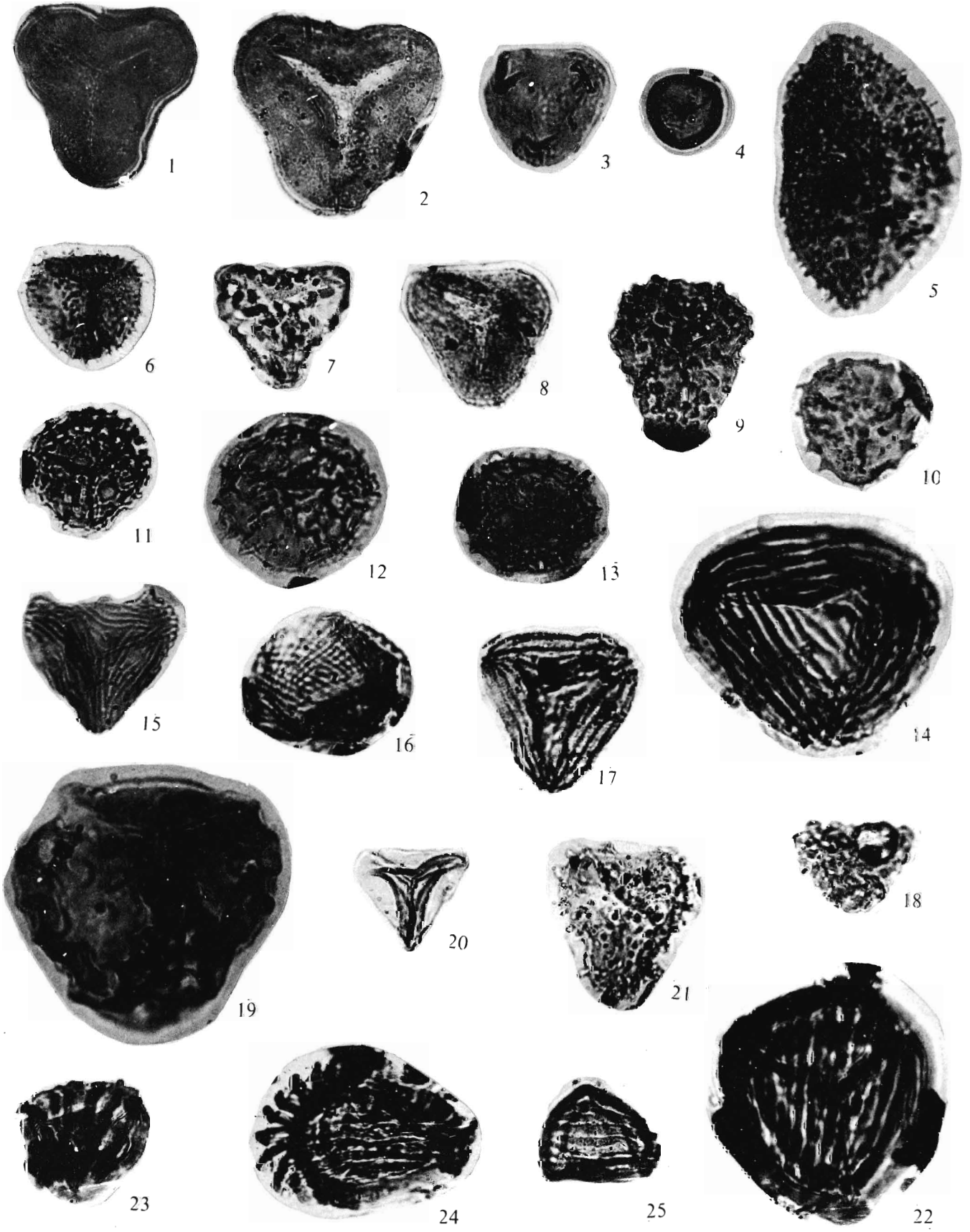
1. *Cyathidites australis*
2. *Cyathidites asper* X 750
3. *Deltoidospora juncta* x 1000
4. *Stereisporites antiquasporites*
5. *Baculatisporites rotundus* x 1000
6. *Neoraistrickia truncatus* x 1000
7. *Neoraistrickia rallapetensis*
8. *Concavissimisporites variverrucatus*
9. *Impardecispora marylandensis*
10. *Lycopodiacidites irregularis*
11. *Lycopodiumsporites crassimacerius* x 750
12. Lycopodiumsporites nodosus
13. *Lycopodiumsporites trambauensis*
14. *Cicatricosisporites augustus* x 1000
15. Cicaticosisporites australiensis
16. *Cicatricosisporites hallei*
17. *Cicatricosisporites hughesi*
18. *Trilites tuberculiformis*
19. *Ischyosporites punctatus* x 1000
20. *Gleicheniidites senonicus* x 1000
21. *Ornamentifera baculata*
22. *Contignisporites glebulentus* x 1000
23. *Contignisporites cooksonii*
24. Contignisporites crassicingulatus x 750
25. *Contignisporites fornicatus*

PLATE II

26. *Crybelosporites* cf *punctatus* x 750
27. *Metamonoletes singhii*
28. *Monoletes indicus*
29. *Callialasporites trilobatus* x 750
30. *Callialasporites* sp.
32. *Alisporites grandis*

33. *Podocarpidites ellipticus* x 1000
34. *Platysaccus indicus* x 1000
35-36. *Microcachryidites antarcticus* x 1000
37. *Podosporites tripakshi* x 1000
38. *Araucariacites australis*
39. *Cycadopites couperi*
40. *Monosulcites ellipticus* x 750
41. *Classopollis classiodes*
42-44. *Classoidites glandis* x 750
45-46. *Classopollis pflugii* x 750
47. *Psilospora lata.*

Plate I



PRABHAKAR.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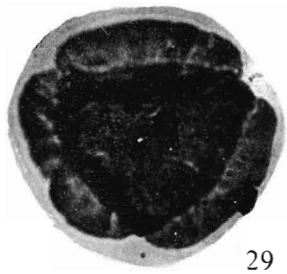
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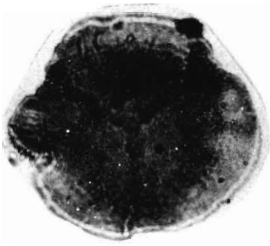
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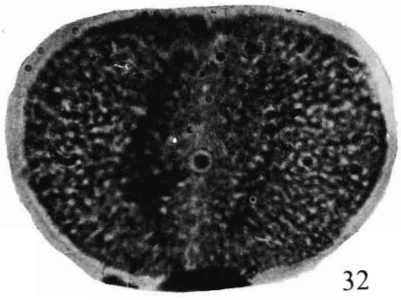
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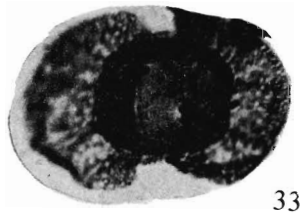
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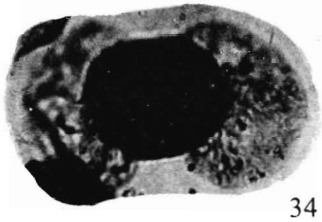
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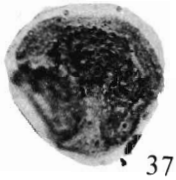
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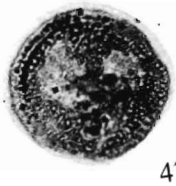
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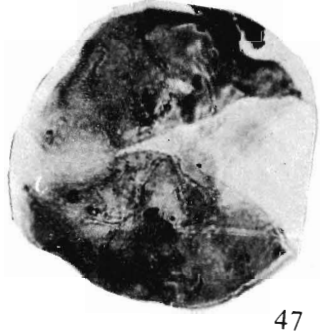
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