PALYNOLOGY OF THE MATANOMADH FORMATION IN TYPE AREA, NORTH WESTERN KUTCH, INDIA (PART 1).  
SYSTEMATIC DESCRIPTION OF PTERIDOPHYTIC SPORES

R. K. SAXENA  
Birbal Sahni Institute of Palaeobotany, Lucknow-226007, India

ABSTRACT

The present paper deals with the systematic description of the pteridophytic spores recovered from the Matanomadh Formation in its type area, north-western Kutch, India. The palynological assemblage described in this paper is represented by 27 species of pteridophytic spores assigned to 14 dispersed genera. Of these, 4 species are new.

INTRODUCTION

THE Matanomadh Formation constitutes the basal lithostratigraphic unit of the Tertiary sequence in Kutch. Wynne (1872), for the first time, recognized this succession as a separate stratigraphic unit. He named it Subnummulitic Group and assigned a Lower Eocene age. The Lower Eocene dating for this formation was subsequently supported by Oldham (1893), Tewari (1952, 1957), Nagappa (1959) and Poddar (1959, 1963). Pascoe (1964) on the other hand, opined that the Subnummulitic Group (= Matanomadh Formation) may be of Palaeocene age. Biswas (1965), who named this unit as Madh Series, also supported the Palaeocene age for this formation. He correlated the Madh Series with the Ranikot Series (Palaeocene) of Sind-Baluchistan. Biswas and Raju (1971, 1973) introduced the term Matanomadh Formation for the basal lithostratigraphic unit of the Tertiary sequence of Kutch, based on its certain lithological peculiarities and mappability.

Lately, Saxena (1977a) published an account of lithostratigraphy of this formation. He, on the basis of lithological distinctiveness, divided this formation into two members, viz., Laterite Member and Clastic Member. The litho-, bio- and chronostratigraphic status of the Matanomadh Formation has been discussed by Saxena (1977b).

The palynological studies on this formation were initiated by Mathur (1966). He, on the basis of the palynoflora, assigned a Palaeocene age. Algal and fungal microfossils from this formation have, for the first time, been described by Kar and Saxena (1976).

The palynological work on the overlying Naredi Formation (Lower Eocene) has been carried out by Mathur (1963), Venkatachala and Kar (1968, 1969a, 1969b) and Sah and Kar (1969, 1970).

MATERIAL AND METHOD

The samples for the present palynological work were collected from four measured sections around Matanomadh — the type area for the Matanomadh Formation. The sampling was done in such a way that top and bottom of each lithofacies were represented. The samples were collected at a stratigraphic interval of 0.3 m. The samples included almost all the rock types met within the Matanomadh Formation. The various lithic types, thus collected, were carbonaceous shale, tuff, tuffaceous shale, clay, sandstone, etc.

During collection of samples, special attention was paid to avoid surface contamination or mixing. Depth of weathering was considered important and all efforts were made to collect samples from fresh surfaces. In some cases where the rocks were much weathered, as in case of carbonaceous shales, exposures had to be removed up to more than 0.5 m to obtain a fresh face. Particular attention was paid to the collection of samples from thin tuffaceous or carbonaceous shale bands within sandstone or mottled clay beds. The larger pieces of hard rock samples, during collec-
tion, were reduced to approximately 100 gm. In case of soft and fragile material only bigger chips were collected while powdery material was completely rejected. The samples were simultaneously sealed after proper labelling and packing in polythene bags bearing the field number. The maceration was done by using hydrofluoric acid in case of sandy shale, clay and tuffaceous shale and nitric acid in case of carbonaceous or lignitic shales. The digestion period of the samples varied from 2 to 3 days. The samples were then washed with water and treated with 3% KOH for about 5-10 minutes. The material was finally washed through 400 mesh sieve. A number of test samples showed better results when the macerated residue was acetolysed. For acetolysis, Erdtman's (1952) method was followed. The slides were prepared in polyvinyl alcohol and mounted in canada balsam. All the slides have been preserved in the repository of the Birbal Sahni Institute of Palaeobotany, Lucknow.

SYSTEMATIC PALYNOLOGY

Anteturma — Proximegerminantes Potonie, 1970
Turma — Triletes (Reinsch) Dettmann, 1963
Suprasubturma — Acavatitriletes Dettmann, 1963
Subturma — Azonotriletes (Luber) Dettmann, 1963
Infaturma — Laevigati (Bennie & Kistton) Potonie, 1956

Genus — Lygodiumsporites (Potonie, Thomson & Thiergart) Potonie, 1956

Type Species — Lygodiumsporites adriennis Potonie, Thomson & Thiergart, 1950.
Lygodiumsporites lakiensis Sah & Kar, 1969
Pl. 1, fig. 3
Lygodiumsporites eocenicus Dutta & Sah, 1970
Pl. 1, fig. 4
Lygodiumsporites pachyexinus sp. nov.
Pl. 1, figs. 5, 6

Holotype — Pl. 1, fig. 5, size 52 μ. Slide no. 4766/12.
Type Horizon — Matanomadh Formation (Clastic Member).
Type Locality — Matanomadh, Kutch, India.
Diagnosis — Spores triangular-subtriangular in polar view, 40-65 μ. Trilete, rays extending up to 2/3 radius, commissure distinct. Exine up to 6 μ thick, laevigate.
Comparison — The present species approximates L. lakiensis Sah & Kar (1969) in shape and size but the former has a comparatively very thick exine. L. eocenicus Dutta and Sah (1970) has bigger size range and comparatively thinner exine.

Genus — Todisporites Couper, 1958

Type Species — Todisporites major Couper, 1958.
Todisporites major Couper, 1958
Pl. 1, fig. 7
Todisporites minor Couper, 1958
Pl. 1, fig. 8
Remarks — Most of the specimens referred to this species are degraded. The degradation is pronounced along the inter-radial region producing pseudopunctate pattern. The degradation might have been caused either by biological agencies or chemical action.

Genus — Cyathidites Couper, 1953

Type Species — Cyathidites australis Couper, 1953.
Cyathidites australis Couper, 1953
Pl. 1, fig. 1
Cyathidites minor Couper, 1953
Pl. 1, fig. 2
Remarks — Spores of this species recovered from Matanomadh Formation are slightly bigger (upto 50 μ) than the spores (31-45 μ) described by Couper (1953) from New Zealand.
Genus — *Dandotiaspora* Sah, Kar & Singh, 1971

*Type Species* — *Dandotiaspora dilata* (Mathur) Sah, Kar & Singh, 1971.

*Dandotiaspora dilata* (Mathur) Sah, Kar & Singh, 1971

Pl. 1, figs. 10, 11

**Remarks** — Some of the specimens referred to this species are as small as 46 μ. Most of the specimens are infected by fungi, especially in the contact area, exhibiting a pseudopunctate pattern. One of the specimens (Pl. 1, fig. 11) has a verrucose ornamentation but other characters are similar to *D. dilata*.

*Dandotiaspora plicata* (Sah & Kar) Sah, Kar & Singh, 1971

Pl. 1, fig. 12

*Dandotiaspora telonata* Sah, Kar & Singh, 1971

Pl. 1, fig. 13

*Dandotiaspora pseudoauriculata* Sah, Kar & Singh, 1971

Pl. 1, fig. 14

Genus — *Intrapunctisporis* Krutzsch, 1959

*Type Species* — *Intrapunctisporis intrapunctis* Krutzsch, 1959.

*Intrapunctisporis intrapunctis* Krutzsch, 1959

Pl. 1, fig. 18

*Intrapunctisporis apunctis* Krutzsch, 1959

Pl. 1, fig. 19

**Remarks** — The specimens of *Intrapunctisporis apunctis* Krutzsch (1959) in the present preparation are smaller in size (44-55 μ) than the holotype (60 μ).

Infraturma — *Apiculati* (Bennie & Kids ton) Potonie, 1956

Subinfraturma — *Granulati* Dybova & Jachowitz, 1957

Genus — *Osmundacidites* Couper, 1953

*Type Species* — *Osmundacidites wellmannii* Couper, 1953.

*Osmundacidites minutus* Sah & Jain, 1965

*Osmundacidites cephalus* sp. nov.

Pl. 2, figs. 20, 21

**Holotype** — Pl. 2, fig. 20, size 68 μ. Slide no. 4945/8.

**Type Horizon** — Matanomadh Formation (Clastic Member).

**Type Locality** — Matanomadh, Kutch, India.

**Diagnosis** — Spores subcircular-circular, 49-72 μ. Trilete, rays distinct, extending up to 3/4 radius, with raised commissure. Exine 2.5-4 μ thick, grana closely spaced, 1.5-3 μ in size, sometimes imparting a verrucose appearance.

**Comparison** — *O. microgranifer* Sah & Jain (1965) described from Rajmahal Hills resembles in size range but can be distinguished by its small sculptural elements.
O. minutus also described by Sah and Jain (1965) is much smaller in size (19-27 μ). In O. kutchensis Sah & Kar (1969), grana are sparsely placed.

Remarks — In a few specimens, the grana appear to be less in number on the proximal surface and somewhat distantly placed.

Subinfraturma — Verrucati Dybova & Jachowitz, 1957

Genus — *Leptolepidites* Couper, 1953

*Type Species — Leptolepidites verrucatus* Couper, 1953.

*Leptolepidites major* Couper, 1958

Pl. 2, fig. 22

Infraturma — *Murornati* Potonie & Kremp, 1954

Genus — *Foveosporites* Balme, 1957

*Type Species — Foveosporites canalis* Balme, 1957.

*Foveosporites* sp.

Pl. 2, fig. 23

Description — Spores subcircular, 60-77 μ. Trilete, rays straight, extending upto 3/4 radius. Exine upto 1·5 μ thick, foveolate, foveolae closely placed and uniformly distributed all over the exine.

Remarks — The Matanomadh specimens differ from *F. canalis* Balme (1957) in not having elongated foveolae.

Genus — *Lycopodiumsporites* Thiergart, 1938

*Type Species — Lycopodiumsporites agathoeus* (Potonie) Thiergart, 1938.

*Lycopodiumsporites bellus* Sah & Kar, 1969

Pl. 2, fig. 24

*Lycopodiumsporites umstewensis* Dutta & Sah, 1970

Pl. 2, fig. 25

Remarks — The specimens of *Lycopodiumsporites umstewensis* Dutta & Sah (1970) observed here, are slightly smaller in size (26-36 μ) than those described by Dutta and Sah (1970) from South Shillong Plateau, Meghalaya.

Genus — *Cicatricosisporites* Potonie & Gelletich, 1933

*Type Species — Cicatricosisporites dorognensis* Potonie & Gelletich, 1933.

*Cicatricosisporites australiensis* (Cookson) Potonie, 1956

Pl. 2, fig. 26

*Cicatricosisporites pseudotripartitus* (Bolkhovitina) Dettmann, 1963

Pl. 2, fig. 27

*Cicatricosisporites* sp.

Pl. 2, fig. 28

Description — Spores triangular, 60-68 μ. Trilete, rays straight, extending upto 3/4 radius. Exine 2·5-4 μ thick, ornamented by low, flat topped costae (ca. 1-2 μ high), wider (2-4 μ) than lumina (0·5 μ) and running parallel to each other, costae 5-8 in each contact area.

Comparison — The present grains differ from *C. australiensis* (Cookson) Potonie (1956) in having flat flappy costae. *C. pseudotripartitus* (Bolkhovitina) Dettmann (1963) has thinner exine.

Subturma — *Zonotriletes* Waltz, 1935

Infraturma — *Tricrassati* Dettmann, 1963

Genus — *Gleicheniidiites* (Ross) Dettmann, 1963

*Type Species — Gleicheniidiites senonicus* Ross, 1949.

*Gleicheniidiites senonicus* Ross, 1949

Pl. 2, fig. 29

Turma — *Monoletes* Ibrahim, 1933

Suprasubturma — *Acavatomonoletes* Dettmann, 1963

Subturma — *Azonomonoletes* Luber, 1935

Infraturma — *Laevigatmonoletes* Dybova & Jachowitz, 1957
Genus — *Polypodiaceaesporites* Thiergart, 1938

*Type Species* — *Polypodiaceaesporites haardti* (Potonié & Venitz) Thiergart, 1938.

*Polypodiaceaesporites levis* Sah, 1967
Pl. 2, fig. 30

*Polypodiaceaesporites major* sp. nov.
Pl. 2, figs. 31-33

*Holotype* — Pl. 2, fig. 31, size 77×54 μ. Slide no. 4771/15.

*Type Horizon* — Matanomadh Formation (Clastic Member).

*Type Locality* — Matanomadh, Kutch, India.

*Diagnosis* — Spores bean-shaped, 58-86 X 38-56 μ. Monolette, laesura not well discernible, extending upto 3/4 of the longer axis. Exine 1.5-2.5 μ thick, laevigate, proximal exine thinner than distal.

*Comparison* — The present species resembles *P. tertiarius* Dutta & Sah (1970) in shape and size range but differs in having a thinner proximal surface and laevigate exine. *P. levis* Sah (1967) is much smaller in size.

*Polypodiaceaesporites sp.*
Pl. 2, fig. 34

*Description* — Spore bean-shaped, 72×43 μ. Monolette, ray not well discernible. Exine ± 1 μ thick, exoexine very thin and ornamented with very minute granules.

*Comparison* — The present specimen closely resembles *Polypodiaceaesporites major* in size range and shape but differs in having granulose ornamentation.

Infraturma — *Scuplpatomonoleti* Dybova & Jachowitz, 1957

Genus — *Polypodiisporites* Potonié, 1934

*Type Species* — *Polypodiisporites favus* Potonié, 1934.

*Polypodiisporites repandus* Takahashi, 1964
Pl. 2, fig. 35

*Polypodiisporites mawkmaensis* Dutta & Sah, 1970
Pl. 2, fig. 36

*Polypodiisporites sp.*
Pl. 2, figs. 37, 38

*Description* — Spores oval, 68-92 X 58-68 μ. Monolette, laesura extending upto 2/3 of the longer axis. Exine upto 2 μ thick, verrucose, verrucae very closely placed.

*Comparison* — The species described here can be differentiated from *Polypodiisporites repandus* Takahashi (1964) and *P. mawkmaensis* Dutta & Sah (1970) by its low set verrucae. Other known species of *Polypodiisporites* differ in having bigger sculptural elements.

**References**


EXPLANATION OF PLATES

(All photomicrographs are enlarged ca. × 500)

PLATE 1

1. Cyathidites australis Couper; Slide no. 4936/14.
2. Cyathidites minor Couper; Slide no. 4937/14.
3. Lygodiumsporites lakiensis Sah & Kar; Slide no. 4938/8.
4. Lygodiumsporites eocenicus Dutta & Sah; Slide no. 4781/16.
5. Lygodiumsporites pachyexinus sp. nov.; Slide nos. 4766/12 (Holotype), 4766/11.
6. Todisporites major Couper; Slide no. 4939/20.
7. Todisporites minor Couper; Slide no. 4773/1.
8. Todisporites kutchensis Sah & Kar; Slide no. 4777/2.
10. Dandotiaspora plicata (Sah & Kar) Sah, Kar & Singh; Slide no. 4941/14.
11. Dandotiaspora telonata Sah, Kar & Singh; Slide no. 4942/1.
13. Dictyophyllidites granulatus sp. nov.; Slide nos. 4777/10 (Holotype), 4798/6, 4943/30.
14. Intrapunctisporis intrapunctis Krutzsch; Slide no. 4944/2.
15. Intrapunctisporis apuncits Krutzsch; Slide no. 4791/7.

PLATE 2

20. 21. Osmundacidites cephalus sp. nov.; Slide nos. 4945/8 (Holotype), 4940/7.
22. Leptolepidites major Couper; Slide no. 4767/3.
24. Lycopodiumsporites bellus Sah & Kar; Slide no. 4766/2.
25. Lycopodiumsporites umstewensis Dutta & Sah; Slide no. 4948/1.
26. Cicatricosisporites australiensis (Cookson) Potonié; Slide no. 4771/19.
27. Cicatricosisporites pseudotripartitus (Bolkhovitina) Dettmann; Slide no. 4951/20.
29. Gleicheniidites senonius Ross; Slide no. 4938/30.
30. Polypodiaceaesporites levis Sah; Slide no. 4780/4.
31-33. Polypodiaceaesporites major sp. nov.; Slide nos. 4771/15 (Holotype), 4781/5, 4953/39.
34. Polypodiaceaesporites sp.; Slide no. 4943/21.
35. Polypodiisporites repandus Takahashi; Slide no. 4773/2.
36. Polypodiisporites mawkmaensis Dutta & Sah; Slide no. 4944/9.