POLLEN AND SPORES FROM NEYVELI LIGNITE, SOUTH INDIA

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ABSTRACT

The paper describes some fossil pollen grains and spores from the Neyveli lignite. The fossil grains have been compared to their nearest modern equivalents. The families to which the fossil sporomorphs belong are Caprifoliaceae, Cruciferae, Gentianaceae, Labiatae, Meliaceae, Ranunculaceae, Santalaceae, Gramineae, Liliaceae and Polypodiaceae.

INTRODUCTION

THE Neyveli lignite field is considered as the single largest brown coal field in India, and lies in a NE-SW direction between parallels 79°24′ and 79°33′ N., and 11°24′ and 11°37′ E., in the South Arcot district, Madras State. The field is about 120 miles south-west of Madras and is approachable by road or rail from Madras either via Cuddalore on the main rail line or via Virddhachalam on the chord line to Trichinopoli.

The lignite bed is found associated with sandstones and clays and are of Tertiary (Miocene) Age. The sandstones are mostly arcosic, ferruginous in character, and are variegated. The clays are mostly rich in alumina, but in composition and colour it varies from white to variegated. The lignite bed is sandwiched between high pressure aquifers. The top of the lignite presents undulations and pot holes. The lignite deposit at the area from where the collection has been made is about 4 metres thick.

Jacob & Jacob (1950) and Rao (1955) have reported the occurrence of pollen and spores in the Neyveli lignite. In the present communication, a few more fossil pollen and spores, from the lignite, are described.

Pollen preparations have been made by the acetolysis method (ERDTMAN, 1943). The identification of the plants represented by the pollen and spores have been made to their nearest living equivalents. In describing the sporomorphs, the classification suggested by Erdtman (1947) has been followed. However, the sporomorphs are grouped under families of living plants to which the fossil grains have been equated. Terminology used in pollen description is after Erdtman (1952), except for those relating to apertures which is based on the suggestions made recently (Anonymous, 1958), while the term *Columella* is after Faegri & Iversen (1950).

FOSSIL POLLEN AND SPORES

DICOTYLEDONS

CAPRIFOLIACEAE

Tricolporites **(Erdtman 1947)**

Pl. 1, Fig. 1; Text-fig. 1

Three-zonicolporate, prolate spheroidal, 12 × 49 μ. Colpi narrow, 1 μ wide in the middle, ends pointed, tenuimarginate. Ora lalongate, 14 × 28 μ, lateral ends slightly rounded. Exine 1·4 μ thick. Sexine thicker than nexine, columella free, surface pilate.

The fossil pollen grain compares with the grains of *Viburnum*. The type is of rare occurrence in the lignite.

CRUCIFERAE

Tricolpites **(Erdtman 1947)**

Pl. 1, Fig. 2; Text-fig. 2

Three-zonicolpate, amb lobed, equatorial diameter 32 μ. Colpi not well defined, narrow, ends pointed. Apocolpium diameter 7 μ. Exine 2 μ thick. Sexine thicker than nexine, columella free, surface reticulate.

The above pollen grain compares with the pollen members of Cruciferae. The type occurs rarely in the lignite.

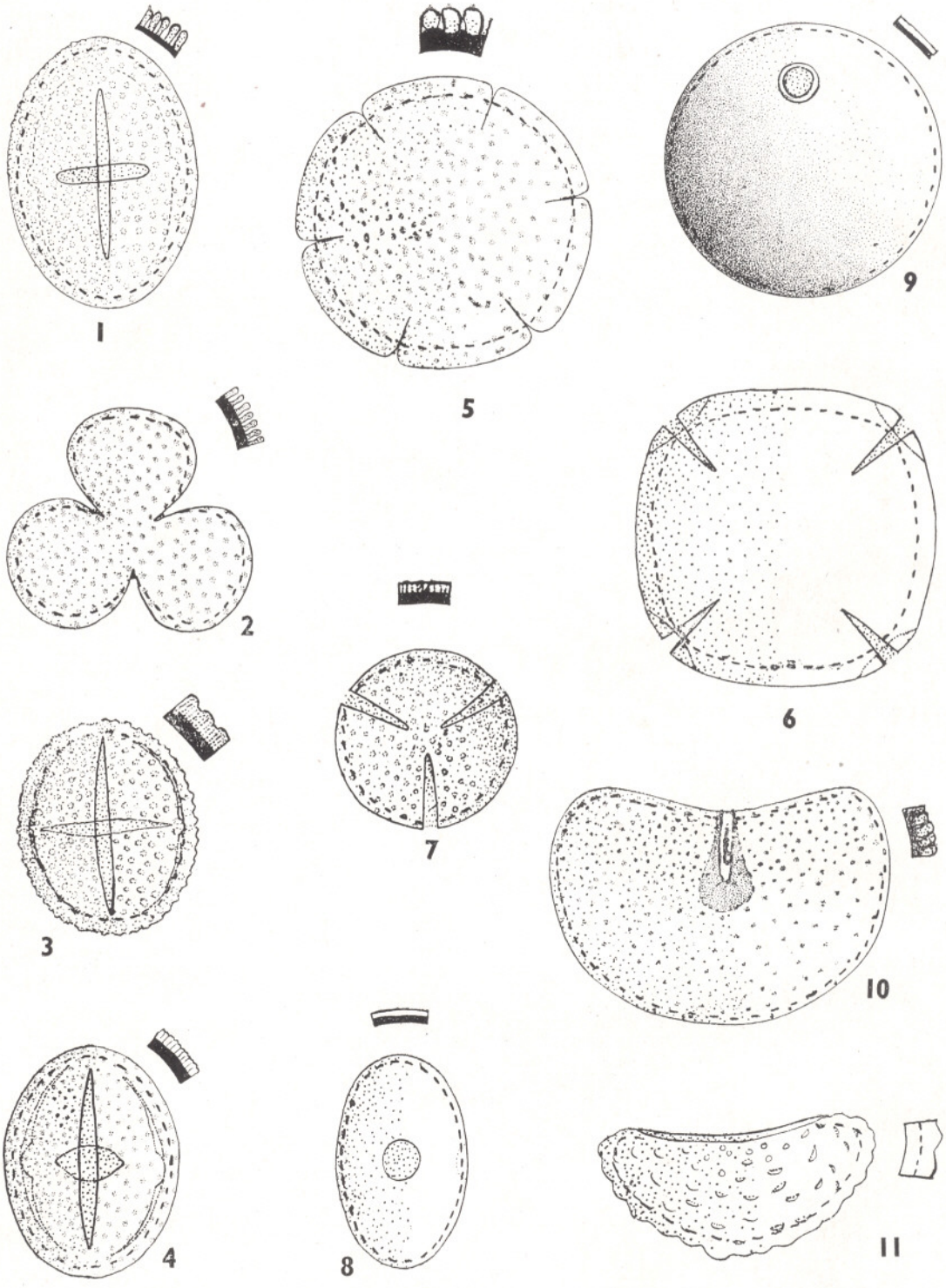
EUPHORBIACEAE

Tricolporites **(Erdtman 1947)**

Pl. 1, Fig. 3; Text-fig. 3

Three-zonicolporate, subprolate, 32 × 24·5 μ. Colpi narrow, 25 × 3·5 μ, tenuimarginate, ends pointed. Ora lalongate, 2 × 21 μ. Exine 3·5 μ thick. Sexine slightly thicker than nexine, columella not clear, surface provided with thick granules (verrucate).

The grain shows resemblances to pollen grains of Euphorbiaceae. The type is of abundant occurrence in the lignite.



TEXT-FIGS. 1-11 — Diagrammatic representation of fossil pollen grains from Neyveli lignite. 1, *Tricolporites* (Caprifoliaceae). 2, *Tricolpites* (Crucifereae). 3, *Tricolporites* (Euphorbiaceae). 4, *Tricolporites* (Gentianaceae). 5, *Hexacolpites* (Labiatae). 6, *Tetracolporites* (Meliaceae). 7, *Tricolpites* (Ranunculaceae). 8, *Triorites* (Santalaceae). 9, *Monoporites* (Gramineae). 10, *Monocolpites* (Liliaceae). 11, *Monolites* (Polypodiaceae).

Note — (i) Inner limit of exine is shown by hatched lines
(ii) Magnification: main figure, × 1000; strata, × 2000.

GENTIANACEAE

***Tricolporites* (Erdtman 1947)**

Pl. 1, Fig. 4; Text-fig. 4

Three-zonicolporate, prolate, 35 × 28 μ. Colpi narrow, 25 × 2 μ, tenuimarginate, ends pointed. Ora lalongate, 7 × 10·5 μ, lateral ends acute. Exine 2 μ thick. Sexine almost as thick as nexine, columella clear, surface faintly reticulate, lumina small.

The fossil pollen grain compares with the grains of *Swertia* of Gentianaceae. The type is more common in the upper layers of the 4 metre thick deposit.

LABIATAE

***Hexacolpites* (Erdtman 1947)**

Pl. 1, Fig. 5; Text-fig. 5

Six-zonicolpate, amb circular, equatorial diameter 46 μ. Colpi narrow, 1 μ wide in the middle, tenuimarginate, ends pointed. Apocolpium diameter 30 μ. Exine 3·5 μ thick. Sexine slightly thicker than nexine, columella clear, surface reticulate, lumina small. Nexine shows an irregular outline on its outer limit.

The fossil grain compares with pollen grains of the members of Labiatae. The type is not common in the lignite.

MELIACEAE

***Tetracolporites* (Erdtman 1947)**

Pl. 1, Fig. 6; Text-fig. 6

Four-zonicolporate, amb square-shaped, equatorial diameter 53 μ. Colpi narrow, about 2 μ wide in the middle, tenuimarginate, ends pointed. Ora lalongate, 14 μ along its length. Exine about 3·5 μ thick. Sexine and nexine not clearly delimited, sexine being very thick. Sexine surface apparently smooth.

The fossil grain has resemblance to the pollen of *Melia*. The type is very rare in the lignite.

RANUNCULACEAE

***Tricolpites* (Erdtman 1947)**

Text-fig. 7

Three-zonicolpate, amb spheroidal, equatorial diameter 21 μ. Colpi 2·5 μ wide in the middle, tenuimarginate, ends pointed. Apocolpium diameter 2·8 μ. Exine 2 μ thick. Sexine almost as thick as nexine, columella faint, surface granulate, granules thick, about 1 μ apart.

Preservation of the fossil grain is not very good (microphotograph not attached). The fossil grain compares with the pollen of *Ranunculus* or to species of *Anemone*. The type is rare in the lignite.

SANTALACEAE

***Triorites* (Erdtman 1947)**

Pl. 1, Fig. 7; Text-fig. 8

Three-zonipororate, prolate, 34 × 20 μ. Pores slightly elliptical, 7 × 5·6 μ, tenuimarginate. Exine 2 μ thick. Sexine almost as thick as nexine, columella obscure, surface psilate.

The fossil grain compares with the pollen of *Santalum*. The type is rare in the lignite.

MONOCOTYLEDONS
GRAMINEAE

***Monoporites* (Erdtman 1947)**

Pl. 1, Fig. 8; Text-fig. 9

One-porate, spheroidal, 42 μ. Pore circular, diameter 3 μ, margin slightly thickened. Exine about 0·5 μ thick. Sexine and nexine not well differentiated, surface granulate.

The fossil pollen belongs to Gramineae.

LILIACEAE

***Monocolpites* (Erdtman 1947)**

Pl. 1, Fig. 9; Text-fig. 10

One-colpate, kidney-shaped in lateral view, 53 × 39 μ (P × E). Colpi narrow, 1 μ wide in the middle (one end bulged possibly by breakage during the process of acetolysis). Exine 3·5 μ thick. Sexine thicker than nexine, columella clear, slightly united laterally, surface reticulate, lumina small.

The fossil grain shows similarities to grains of members of Liliaceae.

FILICINEAE
POLYPODIACEAE

***Monoletes* (Erdtman 1947)**

Pl. 1, Fig. 10; Text-fig. 11

Monolete, kidney-shaped in lateral view, measures 39 μ along the longer axis and 21 μ along the shorter axis. Aperture elongate, about 17·5 μ long. Exine 3 μ thick. Sexine and nexine not well differentiated, surface undulate (verrucate).

The fossil spore shows affinities to some members of Polypodiaceae.

OBSERVATIONS

In its general surface characteristics, the Neyveli lignite shows similarity to lignites from Germany, Australia, and other countries, the lignite being peaty, with woody and coaly bands, of high moisture content (45-50 per cent), and of low ash content (about 3 per cent). However, the pollen content in Neyveli lignite is comparatively poor.

The sporomorphs that were recovered in the present preliminary investigation belong to dicotyledons, monocotyledons and pteridophytes, apart from which have been observed fungal spores of *Helminthosporium* and *Alternaria* and also broken fungal sporangia. Pollen types belonging to dicots represent Cparifoliaceae (? *Viburnum*), Cruciferae, Euphorbiaceae, Gentianaceae (? *Swertia*), Labiatae, Meliaceae (? *Melia*), Ranunculaceae (? *Ranunculus* or *Anemone*) and Santalaceae (*Santalum*), and those of monocots belong to Liliaceae and Gramineae, while the spores of pteridophytes belong to Polypodiaceae.

Pollen grains of the type related to Caprifoliaceae, Labiatae, and Ranunculaceae are evidenced in the illustrations of Tertiary pollen and spores from other localities in India and Pakistan, namely Palana (Rao & Vimal, 1950 and 1952a), Warkallai (Rao & Vimal, 1952b; Vimal, 1953), Dandot (Vimal, 1952) and also from South Arcot (Rao, 1955). Pollen grains of Santalaceae (*Santalum*) are known from the Cainozoic deposits in Australia (Cookson & Pike, 1954).

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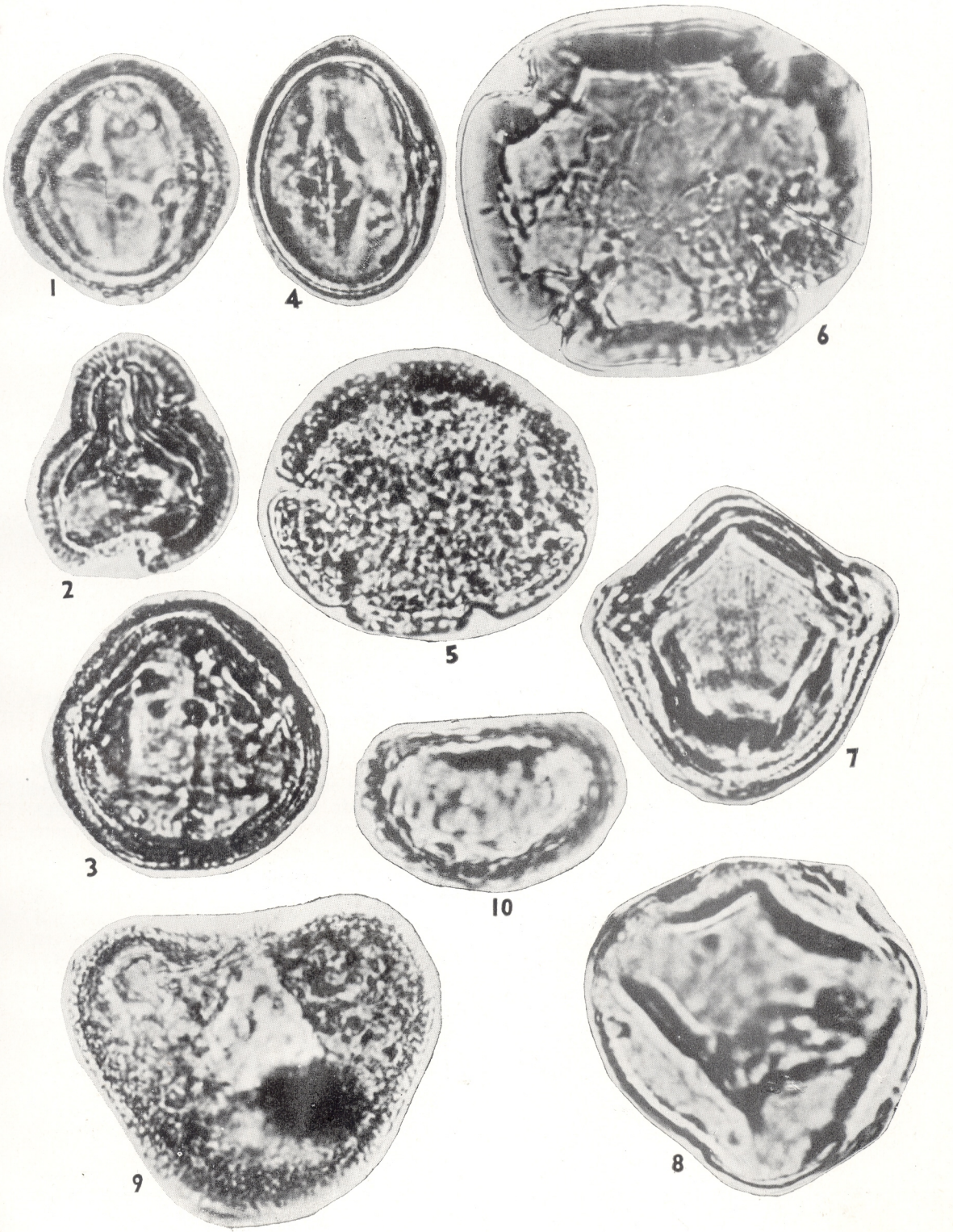
EXPLANATION OF PLATE 1

(Pl. 1, Figs. 1-10)

1. *Tricolporites* (Caprifoliaceae; equatorial view).
2. *Tricolpites* (Cruciferae; polar view).
3. *Tricolporites* (Euphorbiaceae; equatorial view).
4. *Tricolporites* (Gentianaceae; equatorial view).
5. *Hexacolpites* (Labiatae; polar view).
6. *Tetracolpites* (Meliaceae; polar view).
7. *Triorites* (Santalaceae; obliquely equatorial view).
8. *Monoporites* (Gramineae; lateral view).
9. *Monocolpites* (Liliaceae; lateral view).
10. *Monoletes* (Polypodiaceae; lateral view).

Magnifications × 1000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