

# A MIOSPORE ASSEMBLAGE FROM THE LIASSIC COAL OF CRESTEN, AUSTRIA

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## ABSTRACT

A dispersed miospore assemblage comprising 10 miospore genera and 14 species, of which 4 species are new, has been described from the Liassic coal of Cresten, Austria. The mioflora is qualitatively impoverished and peculiar by lacking the non-striated saccate pollen grains which are so well associated with other miofloras of the comparable age. A brief comparison of this assemblage has been given with comparable miofloras. From this, it appears that the present assemblage may be an incomplete representation of the whole mioflora of its time.

## INTRODUCTION

THIS paper deals with a descriptive study of the miospores from the Liassic coal of Cresten, Austria. The dispersed spores represented in this coal have a poor variety and chiefly consist of trilete and monolete forms, the monosaccate and the disaccate pollen grains being only rarely represented. This assemblage has been referred to 10 miospore genera and 14 species, of which 4 species are new. They are, viz. *Dictyophyllidites enigmaticus* sp. nov., *D. austriensis* sp. nov., *Cingutriletes crassimarginatus* sp. nov., and *Polypodiidites minutus* sp. nov. Two genera, i.e. *Laricoidites* Pot., Thoms. & Thiery, and cf. *Simplicesporites* Lesch. are represented by one specimen each. Two badly preserved gymnospermic pollen grains are also described here. One spore assignable to *Lycopodiumsporites* sp., has also been encountered in this assemblage.

Thiergart (1949), Reissinger (1950) and Couper (1958) have contributed fairly well to our knowledge of Liassic miofloras from the European sediments. Rogalska (1954) has recovered a rich variety of spores and pollen grains referable to Mosses, Pteridophytes, Pteridosperms, Bennettitales, Cycadales, Ginkgoales, Coniferales and other gymnospermic groups from the Liassic coals of Poland. From Komlo, Gócazán (1956) has also dealt with the pollenanalytical studies on the Liassic coals, describing a rich mioflora consisting of trilete, monolete, saccate and non-saccate pollen grains.

## MATERIAL AND METHODS

The coal sample investigated was collected by Dr. D. C. Bharadwaj in October, 1954 from an out crop of Liassic coal seam near Cresten, Austria, and he very kindly passed it on to me for its miofloral study.

The miospores were extracted by macerating the coal sample with commercial nitric acid for 7 days at room temperature followed by a thorough washing with water to make it acid free. The macerate was further digested with warm 10 per cent KOH solution for 10 minutes. Then it was repeatedly washed with water and finally centrifuged. The sporiferous material was stored in glycerine. Slides were prepared in Canada balsam medium and are deposited in the Museum of the Birbal Sahni Institute of Palaeobotany, Lucknow.

## DESCRIPTION OF DISPERSED SPORES

- Anteturma* — *Sporites* H. Potonié, 1893  
*Suprasubturma* — *Acavatitriletes* Dettmann, 1963  
*Turma* — *Triletes* (R.) Potonié & Kremp, 1954  
*Subturma* — *Azonotriletes* Luber, 1935  
*Infraturma* — *Laevigati* (B. & K.) Potonié, 1956

*Genus* — *Dictyophyllidites* Couper emend. Dettmann, 1963

*Type Species* — *Dictyophyllidites harrisii* Couper, 1958

*Dictyophyllidites enigmaticus* sp. nov.  
Pl. 1, Figs. 1-5

*Holotype* — Pl. 1, Fig. 2; Slide No. 2633.

*Diagnosis* — Known size 40-54  $\mu$ , triangular to roundly triangular miospores, sides straight to convex, Y-rays more than  $\frac{3}{4}$  of the radius long, apex and ray-vertex raised, arcuate thickening along the Y-mark faint, exine 1-2  $\mu$  thick, laevigate.

*Description* — Holotype 42  $\mu$ , triangular to roundly triangular miospores in equatorial contour, dark brown in colour, sides straight to convex with broadly rounded

corners. Trilete mark prominent, Y-rays extending more than  $\frac{3}{4}$  of the radius, apex and ray-vertex raised, usually crumpled. Exine 1-2 $\mu$  thick, laevigate, imperceptibly arcuately thickened along the Y-mark.

*Comparison* — Miospores referable to *D. harrisii* Coup. and other species are different by having distinct and conspicuous arcuate interray thickening. *D. major* Bharad. & Singh closely resembles *D. enigmaticus* particularly in having similar nature of the interray thickening but differs from the latter in having appreciably thinner and lighter exine.

*Dictyophyllidites austriensis* sp. nov.

Pl. 1, Figs. 6-11

*Holotype* Pl. 1, Fig. 7; Slide No. 2642

*Diagnosis* — Known size 30-34 $\mu$ , triangular miospores, sides convex, corners rounded, Y-rays almost reaching the periphery, apex and ray-vertex raised, exine thin, laevigate with interray thickening along the Y-mark.

*Description* — Holotype 34  $\mu$ , miospores triangular in equatorial contour with convex sides and rounded corners. Trilete, Y-rays almost extending to the equator, apex and ray-vertex elevated. Exine laevigate, about 1  $\mu$  thick, arcuate thickening in interray area prominent.

*Comparison* — The exine and size range in the spores of *Dictyophyllidites harrisii* and *D. enigmaticus* is thicker and larger as compared to *D. austriensis*. *D. pectinataeformis* (Bolikhovitina) Dettmann differs from *D. austriensis* by having thicker exine and granulose exinal area bordering the laesurae. *D. crenatus* Dettmann has got sinuous Y-rays and thicker exine.

**Genus — *Stereisporites* Pflug, 1953**

*Type Species* — *Stereisporites stereoides* (Pot. & Ven.) Pflug, 1953

*Stereisporites antiquasporites* (Wil. & Web.) Dettmann, 1963

Pl. 1, Fig. 12

*Holotype* — Wilson & Webster, 1946, Pl. 1, Fig. 2.

*Description* — Miospore 22  $\mu$  in diameter, roundly triangular in equatorial view, sides convex, corners rounded. Trilete, Y-rays simple, 5-6  $\mu$  long, equal. Exine 1-1.5  $\mu$  thick, translucent, laevigate, distal polar thickening up to 8  $\mu$ .

*Remarks* — Morphographically as well as organizationally spores assigned to the genus *Stereisporites* compare well with the spores of the living genus *Sphagnum*. They have been reported from the Tertiary coals of Germany by Kirchheimer (1934), Rudolph (1935) and Thiergart (1937). Wilson and Webster (1946, p. 273) have mentioned that these spores are abundantly distributed in at least one Cretaceous coal of the rocky region. Radforth and Rouse (1957) have found them in the Upper Cretaceous coals of Western Canada. Couper (1958) has reported *Sphagnumsporites psilatus* Coup. from the British Mesozoic sediments. From the Liassic of Poland and Europe, spores comparable to *Stereisporites* are recorded by Reissinger (1950, Pl. 12, Fig. 13) and Rogalska (1954, Pl. 1, Fig. 2 & 5). In the microfossils recovered out of the Quaternary peat deposits, these spores are usually abundantly reported. Balme (1957) and Dettmann (1963) have reported the occurrence of *Stereisporites antiquasporites* from the Mesozoic strata of Western and S.E. Australia respectively.

**Infraturma — *Murornati* Potonié & Kremp, 1954**

**Genus — *Lycopodiumsporites* Thiergart  
Ex Delcourt & Sprumont, 1955**

*Lectogenotype* — *Lycopodiumsporites agathocus* (Pot.) Thiergart, 1938

*Lycopodiumsporites* sp.

Pl. 1, Fig. 13

*Description* — Roundly triangular miospores, about 40  $\mu$  in diameter, biconvex. Trilete, Y-rays faint, length  $\frac{2}{3}$  spore radius. Exine thin, reticulate on both the faces, meshes circular, 6-8  $\mu$  broad, muri 3-4  $\mu$  wide, straight edged.

*Comparison* — *Lycopodites* sp. Gócažán (1956, Pl. 1, Fig. 1) is closely comparable with *Lycopodiumsporites* sp. figured here.

**Turma — *Zonales* (B. & K.) Potonié, 1956  
Infraturma — *Cingulati* Potonié & Kläus, 1954**

**Genus — *Cingutritetes* Pierce emend.  
Dettmann, 1963**

*Type Species* — *Cingutritetes congruens* Pierce, 1961

*Cingutritetes crassimarginatus* sp. nov.

Pl. 1, Figs. 14-17

*Holotype* — Pl. 1, Fig. 14; Slide No. 2645.*Diagnosis* — Known size 21-25  $\mu$ , roundly triangular miospores, Y-rays about 4 $\mu$  long, simple, cingulum thick, 3-4  $\mu$  broad, exine translucent, laevigate.*Description* — *Holotype* 23 $\mu$ , roundly triangular miospores in equatorial view. Trilete, Y-rays faint, simple. Cingulum crassitudinous, 3-4 $\mu$  broad along the equator. Exine thin at the central region of the spore, translucent, laevigate.*Comparison* — *Cingulatisporites complexus* Coup., *C. dubius* Coup., *C. foveolatus* Coup., *C. problematicus* Coup., *C. scabratus* Coup., *C. pseudoalveolatus* Coup., are different by not having crassitudinous cingulum. *C. rigidus* Coup., is bigger in size having a broader cingulum and hence is not comparable. *Cingutritetes clavus* (BALME) Dettmann is bigger in size and has a thicker circular area of the exine about the distal pole of the spore.**Turma** — *Monoletes Ibrahim*, 1933**Subturma** — *Azonomonoletes Lubert*, 1935**Infraturma** — *Sculptatomonoleti Dybova- & Jachowicz*, 1957**Genus** — *Leschikisporis Potonié emend. Bharad. & Singh*, 1964*Type Species* — *Leschikisporis aduncus* (Lesch.) Potonié, 1958  
*Leschikisporis aduncus* (Lesch.) Potonié, 1958

Pl. 1, Figs. 18-19

*Holotype* — Leschik, 1955, Pl. 3, Fig. 17.*Diagnosis and Description* — See Bharadwaj and Singh, 1964, p. 36.*Remarks* — The miospores figured here and assigned to *L. aduncus* faithfully answer to the diagnosis and description of the same species given by Bharadwaj and Singh (1964). Formerly these authors (1956) described *in situ* spores of *Asterotheca meriani*, (Brongn.) Stur which in morphographic details agree much with the dispersed spores of *L. aduncus*.**Genus** — *Polypodiidites Ross*, 1949*Type Species* — *Polypodiidites senonicus* Ross, 1949*Polypodiidites minutus* sp. nov.

Pl. 1, Figs. 20-22

*Holotype* — Pl. 1, Fig. 20; Slide No. 2642.*Diagnosis* — Known size 24-28  $\mu$ , circular to oval miospores, monolete, exine thin, finely microverrucose, verrucae low, closely spaced, proximal face in lateral view slightly convex, distal surface deeply convex.*Description* — *Holotype* 21  $\mu$ , circular miospores in polar view, appearing oval in lateral view. Monolete mark faintly perceptible, about 14  $\mu$ , long simple. Exine thin, verrucose, verrucae unequal, usually closely spaced, simulating negative reticulum in top focus, in lateral view proximal face slightly convex, distal face deeply arched. *Extrema lineamenta* appearing beaded due to the presence of small verrucae.*Comparison* — The spores referable to *Polypodiidites minutus* are distinguishable from *P. senonicus* by the presence of thinner exine, finer and more closely spaced verrucae.*Remarks* — *P. minutus* is closely comparable to the Palaeozoic spore genus *Thymospora* Wilson & Venkatachala.**Anteturma** — *Pollenites R. Potonié*, 1931**Turma** — *Saccites Erdtman*, 1947**Subturma** — *Monosaccites (Chitaley) Potonié & Kremp*, 1954**Infraturma** — *Aletesacciti Leschik*, 1956**Genus** — *Simplicesporites Leschik*, 1955*Type Species* — *Simplicesporites virgatus* Leschik, 1955cf. *Simplicesporites* sp.

Pl. 1, Fig. 23

*Description* — Size 36 $\mu$ , pollen grains? monosaccate, central body  $\pm$  circular, 28  $\mu$  in diameter, body exine thicker at the equator and thinner at the central portion bladder thin, intrareticulate.*Remarks* — It is hardly possible to discuss this specimen in detail as this is the only record of its type and that too in a bad stage of preservation.**Subturma** — *Disaccites Cookson*, 1947**Infraturma** — *Disaccitrileti (Lesch.) Potonié* 1958.**Genus** — *Vitreisporites Leschik*, 1955*Type Species* — *Vitreisporites signatus* Leschik, 1955

*Vitreisporites* sp.

Pl. 1, Fig. 24

*Description* — Bisaccate pollen grains,  $34 \times 26 \mu$  in size, more or less haploxyloid with a dark brown, circular central body measuring  $24 \mu$  in diameter. Exine of the central body indeterminably sculptured. Bladders more than hemispherical, coming fairly close to each other laterally, intrareticulate.

*Comparison* — Gócazán (1956, PL. 9, FIG. 27) has figured *Pityopollenites pallidus* Reissinger which is almost similar to *Vitreisporites* sp. but differs from it in having a vertically oval central body.

*Remarks* — The specimen figured here as *Vitreisporites* sp. is the only record of the disaccate pollen grains represented in this mioflora.

Turma — *Aletes* Ibrahim, 1933Subturma — *Azonoletes* (Luber) Potonié & Kremp, 1954Infraturma — *Psilonapiti* Erdtman, 1947Genus — *Laricoidites* Potonié, Thomson & Thiergart, 1950

*Type Species* — *Laricoidites magnus* (Pot.) Potonié, Thomson & Thiergart, 1950

*Laricoidites* sp.

Pl. 1, Fig. 25

*Description* — Pollen grains circular in equatorial contour,  $60 \mu$  in diameter. Alete. Exine thick, brownish in colour, intrapunctate. *Extrema lineamenta* smooth.

*Remarks* — Rogalska (1954, PL. 12, FIGS. 2-7) has illustrated pollen grains under cf. *Sporopollenites magnus* R. Pot. f. *dubius* Thierg., from the Liassic of Poland which compare well with the specimen described here.

? *Laricoidites* sp.

Pl. 1, Fig. 26

*Description* — Pollen grains circular in equatorial contour,  $60 \mu$  in diameter. Alete. Exine punctate. *Extrema lineamenta* smooth.

*Remarks* — The specimen figured here though differs from *Laricoidites*, in having distinctly punctate exine, is included in it tentatively.

Turma — *Monocolpates* Iversen & Troels-Smith, 1950Subturma — *Intortes* (Naum.) Potonié, 1958Genus — *Ginkgocycadophytus* Samoilo-witz, 1953

*Type Species* — *Ginkgocycadophytus carperatus* (Luber) Samoilo-witz, 1963

*Ginkgocycadophytus* sp.

Pl. 1, Fig. 27

*Description* —  $38 \times 24 \mu$ , pollen grains bilateral, monosulcate, sulcus pole to pole. Exine finely verrucose, verrucae low, sparsely spaced, folds present on either side of the sulcus. *Extrema lineamenta* rough.

*Comparison* — *Ginkgocycadophytus* sp. differs from the rest by virtue of its verrucose exine.

Subturma — *Retectines* (Malawkina) Potonié, 1958Genus — *Ginkgoretectina* Malawkina, 1953

*Type Species* — *Ginkgoretectina punctata* Malawkina, 1953

*Ginkgoretectina* sp.

Pl. 1, Fig. 28

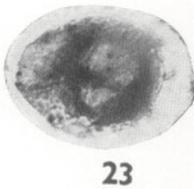
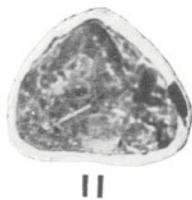
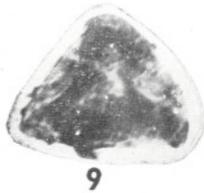
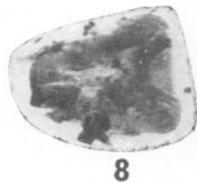
*Description* — Known size  $30 \mu$ , pollen grains spindle-shaped to boat-shaped in polar view. Monosulcate, sulcus with thickened edges running from one end to the other, broader in the middle and acute at the ends. Exine  $\pm 1.5 \mu$  thick, laevigate. *Extrema lineamenta* smooth.

*Comparison* — Pollen grains of *Ginkgoretectina punctata* and *G.* (al. *Ginkgo*) *tripartita* Bolchov., differ from *G.* sp. by being larger in size. Gócazán (1956, PL. 8, FIG. 17) has illustrated *Ginkgo* sp. (Type 12) which is very similar to *G.* sp. but differs from it in having more attenuated apices.

## DISCUSSION

The mioflora recovered out of Cresten coal, Austria is qualitatively poor. It is represented by the genera listed below:

*Dictyophyllidites**Stereisporites**Lycopodiumsporites**Leschikisporis**Polypodidites**Cingutriteles*cf. *Simplicesporites**Vitreisporites*



*Laricoidites*  
*Ginkgocycadophytus*  
*Ginkgoretectina*

Excepting *Dictyophyllidites*, the spores referable to each one of the genera mentioned above, are represented by one or only few specimens. In view of this, it appears that this assemblage may be an incomplete representation of the whole mioflora of its time. Thus its detailed comparison with other miofloras is not possible. However, a brief comparison of the Cresten coal assemblage with other miofloras of Liassic, viz. described by Thiergart (1949), Reissinger (1950), Rogalska (1954), Gócazán (1956) and Couper (1958) reveals that miospores referable to the genera viz. *Dictyophyllidites*, *Stereisporites*, *Lycopodiumsporites*, *Leschikisporis*, *Cingutriteles* cf. *Simplicesporites*,

*Vitreisporites*, *Laricoidites* and *Ginkgocycadophytus* are reported also from most of the other Liassic miofloras. However, the assemblage from Cresten coals is peculiar from all the above mentioned miofloras by conspicuously lacking non-striated disaccate pollen grains along with a number of other miospore genera which usually form a characteristic spectrum among the latter. The geological age of Cresten coal from Austria is believed to be Liassic.

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\*Literature not consulted in original.

## EXPLANATION OF PLATE 1

All figures are from unretouched negatives and unless otherwise stated are  $\times 500$ .

- 1-5. *Dictyophyllidites enigmaticus* sp. nov. Photo Nos. 32/8, 32/9, 32/15, 32/10, 33/18.
- 6-11. *D. austriensis* sp. nov. Photo nos. 32/17, 33/6, 33/18, 33/14, 15, 33/12.
12. *Stereisporites antiquasporites* (Wilson & Webster) Dettmann. Photo No. 33/3.
13. *Lycopodiumsporites* sp. Photo No. 32/14.
- 14-17. *Cingutriteles crassimarginatus* sp. nov. Photo Nos. 33/11, 33/7, 33/16, 33/4.
- 18-19. *Leschikisporis aduncus* (Lesch.) Potonié. Photo No. 33/2, 32/12.
- 20-22. *Polyodiidites minutus* sp. nov. Photo Nos. 33/5, 32/13, 33/1.
23. cf. *Simplicesporites* sp. Photo No. 33/13.
24. *Vitreisporites* sp. Photo No. 33/17.
25. *Laricoidites* sp. Photo No. 32/16.
26. cf. *Laricoidites* sp. Photo No. 33/4.
27. *Ginkgocycadophytus* sp. Photo No. 33/10.
28. *Ginkgoretectina* sp. Photo No. 33/9.