

## TRIASSIC PLANTS FROM CRACOW.

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(With Plate I.)

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In 1934 the Chief Government Geologist forwarded to this department for determination a collection of plant fossils made by Mr. A. K. Denmead from cores of bores sunk at Walhalla, Cracow. Dr. F. W. Whitehouse submitted a preliminary report on the plants.

I have now, in the course of an effort to determine the age of the Cracow ore deposits, made a further examination, the results of which are the subject of this short paper.

The following is a revised list of determinations:—

“Star-Caps” or detached sporangiophores of an equisetalean plant.

? *Equisetites* sp.

*Dictyophyllum* ? *davidi*.

*Cladophlebis australis*.

*Cladophlebis* sp.

*Todites williamsoni*.

*Marattiopsis* sp.

*Thinnfeldia feistmanteli*.

*Thinnfeldia lancifolia*.

*Neuropteridium moombaense*.

*Sphenopteris superba*.

*Taeniopteris spatulata*.

*Taeniopteris* sp.

Petiole of *T. spatulata*.

Gymnosperm seeds.

Detached strobilus.

This assemblage constitutes a mixture of forms some of which are found in the Esk Series, others in the Ipswich Series, others again in the Walloon Series, and still others which are common to two or all three of these.



*Forms confined to the Esk Series:* The one species of *Dictyophyllum* is very poorly preserved but may be *D. davidi*, which is known only from the Esk Series. *Todites williamsoni* is also known only from the Esk Series, but the name represents a type of frond rather than a species. *Neuropteridium moombaense* is known with certainty only from the Esk Series, but Jones and de Jersey (1947) have doubtfully referred a form from the Ipswich Series to this species.

*Forms found in both Esk and Ipswich Series:* *Thinnfeldia lancifolia* and *Sphenopteris superba*. The former is much more common in the Ipswich than in the Esk Series.

*Forms confined to the Walloon Series:* *Taeniopteris spatulata* is common in and characteristic of this series. It has in the past been considered diagnostic of the Walloon Series.

*Forms common to all three Series:* *Cladophlebis australis* occurs abundantly in all three series, but is most common in the Walloon Series. *Thinnfeldia feistmanteli* is much more common in the Esk and Ipswich Series than in the Walloon.

*Genus not hitherto recorded from Australia:* *Marattiopsis* is known from both Triassic (especially Rhaetic) and Jurassic rocks, though more common in the Jurassic. In the absence of specific determination, the genus does not help greatly in the determination of the age.

Thus the flora in a number of species is strongest in Ipswich and Esk Series forms (Middle Triassic), but the Jurassic element is strengthened by the fact that *T. spatulata* is by far the commonest species in the collection. The admixture of forms suggests an horizon between that of the Ipswich and Walloon Series—the Bundamba Series (Upper Triassic). The flora of the Bundamba Series is little known except in the lowermost 300 feet in the type area, where it is essentially similar to that of the Ipswich Series. If the Cracow Strata are correctly regarded as Bundamba, it suggests that there was either lateral or vertical change in the flora, and in particular an earlier appearance of *Taeniopteris spatulata* than previously known.

The suggestion that these beds are the equivalents of part at least of the Bundamba Series agrees with Whitehouse's mapping (1945, fig. C, p. 27) of the main mass of sandstone a few miles to the west.

#### “STAR-CAPS” OR DETACHED SPORANGIOPHORES.

##### Plate I., fig. 1.

There are, in the collection, several curious structures which may be examples of those to which Harris referred as “Star-Caps” (1931, p. 11). They are circular and disc like, flat but slightly raised in the centre, with up to twenty-two radial ridges. Their diameter is 9 or 10 mm.



Harris (p. 12, pl. 11, fig. 4) showed that "Star-Caps" were attached terminally to a stem and suggested that they were modified leaf sheaths, the teeth of which were bent down over the stem apex. Harris' specimens were much smaller, 2.5 mm. diameter, than the Cracow examples and differed further in being slightly depressed in the centre instead of slightly raised, and with radial furrows instead of ridges. The Cracow specimens may be the under surface of large "Star-Caps," showing radial ridges instead of furrows and a raised instead of a depressed centre.

The other possibility is that the Cracow specimens represent impressions of the under sides of the heads of extremely large sporangiophores, but the latter exhibit ridges which are not strictly radial (see Harris 1931, pl. 11, fig. 12). Their interpretation as large "Star-Caps" seems more likely to be correct.

There is no evidence in the available material of an Equisetalean plant large enough to bear a cone of a size which would have such large sporangiophores, the only Equisetalean plant preserved being a very poor impression of *Equisetites?* which is only 7 mm. wide after compression. It is also unlikely that any of the described Ipswich or Esk Series forms would have borne such a large cone. There is, however, a very large undescribed Equisetalean form from the Ipswich Series in the Brisbane area, and a form such as that may well have had a cone of the size indicated.

#### DICTYOPHYLLUM ?DAVIDI Walkom.

Plate I., fig. 2.

1917 *Dictyophyllum davidi* Walkom, p. 10, pl. 3, fig. 2.

*Remarks:* A form which is very probably a species of *Dictyophyllum* is represented by two impressions, one of each surface of the one pinna. The pinna was more than 4.5 cm. long and, including the lobes, about 2.5 cm. wide. The acutely directed but bluntly rounded lobes reach only about one-quarter of the distance to the midrib of the pinna. The venation is indistinct, but each lobe has a midrib which gives off veins at an acute angle. The anastomosing veins cannot be seen. In size and form this agrees fairly well with *D. davidi*, but with such poor preservation it is not possible to be sure of its identity with that species.

#### TODITES WILLIAMSONI (Brongniart) Seward.

Plate I., figs. 3 and 4.

1928 *Todites williamsoni* (Brongniart) Walkom, p. 459, pl. xxvi, figs. 1, 2.

There are several detached pinnae which agree well with Walkom's description and figures. The longest is over 7 cm. and is limited only by the diameter of the bore core. The rachis is stout, about 1.5 mm.



in diameter with a median ridge. The pinnules are small, crowded, and almost semi-circular in shape, 3 to 4 mm. long. The venation is neuropterid, the midvein arising at or just below the centre of the base of the pinnule and running almost at right angles to the base. It loses its identity about two-thirds of the way to the apex. From either side of the midvein there arise four secondary veins, each of which, except the first, branching once. In a few pinnules (towards the end of the pinnae?) the midvein arises near the lower margin of the pinnule diverging only gradually from the rachis, the venation then approaching that of *Thinnfeldia odontopteroides* (Pl. I, fig. 4). No sporangia have been observed. Harris (1931, p. 35) has pointed out that two species had been included under *T. williamsoni*; the present form appears to agree with the first type, the type with smaller pinnules and with entire margins.

*Cladophlebis australis* (Morris) Seward.

For synonymy and figures see Walkom (1917, p. 3, pl. 5, figs. 1, 2a; pl. 7, fig. 1; pl. 8, fig. 1; text fig. 1).

*Remarks:* Several portions of well preserved, quite normal fronds of this species occur in the collection. The secondary veins divide once, close to the midrib.

CLADOPHLEBIS sp.

Plate II, fig. 5.

*Remarks:* One poorly preserved bipinnate frond differs from *C. australis*. It is less robust, the pinnules are more crowded, rather narrower, 2 mm. wide and 5 mm. long, and markedly falcate. The venation is indistinct, but it appears not to differ from that of *C. australis*.

MARATTIOPSIS sp.

Plate I, fig. 6.

*Description:* Two specimens only, both fertile, can be referred with certainty to this genus. The larger and better preserved fragment (Pl. I, fig. 6) is 22 mm. long and 8 mm. wide tapering gently upwards. Neither the base nor the apex of the pinna is preserved. The midrib is about 1 mm. wide, the secondary veins are almost at right angles to the midrib, about 8 to 10 in 5 mm. The impressions of the synangia, situated on the outer ends of the secondary veins, are 1.5 to 2 mm. long and about 0.5 mm. wide. No details of structure can be seen.

*Remarks:* Harris (1931, pp. 64-67) has summarised the available information on species of *Marattiopsis* and has pointed out that only five are well known. All of these are much wider and have much larger synangia than the Cracow specimens. Du Toit (1927, pp. 322-3, pl. xviii, figs. 1 and 2) placed specimens more comparable in size in *M. münsteri*, but his form has a marginal vein and was referred to



*Yabeiella? dutoiti* sp. nov. by Oishi (1931, p. 264). Close comparison with other species is impossible owing to the fragmentary nature of the Cracow material.

Many of the sterile specimens in the Cracow material have a very strong midrib which is markedly asymmetrical in position. These are all thought to be *Taeniopteris spatulata*, as several show the pinna tapering to a long petiole and as the fertile fragments which are undoubtedly *Marattiopsis* have a much narrower midrib.

THINNFELDIA LANCIFOLIA (Morris) Gothan.

For synonymy and figures see Walkom (1917, p. 21, pl. 3, fig. 3; pl. 4, fig. 1; pl. 7, fig. 2; text fig. 6).

*Remarks:* Three pinnules, detached, but lying parallel and clearly not much separated from the rachis, can be referred to this species. The pinnules are 20 mm. long and 9 mm. wide, rather longer than is normal in this species and approaching the size of *T. eskensis*; but specimens of *T. lancifolia* of this size are known. The angle between the secondary veins and the midrib,  $20^\circ$ , also approaches that in *T. eskensis*.

THINNFELDIA FEISTMANTELI Johnston.

For synonymy and figures see Walkom (1917, p. 17, pl. 1, fig. 3; pl. 2, figs. 1, 2; text fig. 5).

*Remarks:* A portion of one frond shows the typical bipinnate division and traces of the odontopteroid venation of this species. It is the medium-sized type with pinnules about 5 mm. long.

SPHENOPTERIS SUPERBA Shirley.

Plate I, fig. 7.

*Remarks:* Two fragments possibly belong to this species but are too poorly preserved to be identified with certainty, but that illustrated can be referred with confidence to this species.

NEUROPTERIDIUM MOOMBRAENSE Walkom.

Plate I, figs. 8 and 9.

1928 *Neuropteridium moombraense* Walkom, p. 463, pl. 27, fig. 4.

*Description:* The material consists of four pinnules, two attached to a rachis and two unattached. The longest is 25 mm. long and 12 mm. wide; the broadest is 14 mm. wide and 22 mm. long. One is only 8 mm. wide. The margins, particularly the lower margin, are lobed. The venation is neuropterid, the rather weak mid-vein running about two-thirds the length of the pinnules. The secondary veins divide dichotomously close to the midrib and usually each branch



divides dichotomously again. The secondary veins make an angle of about  $75^\circ$  with the rachis. The rachis is stout, 3 mm. wide and striated longitudinally.

*Remarks:* These pinnules agree very closely with Walkom's description and figure of the upper pinnules of *N. moombaense*. The lower pinnules differ, being much shorter and rhomboid in outline; none of the lower pinnules is preserved in the Cracow material.

#### TAENIOPTERIS SPATULATA McClelland.

Plate I, figs. 10-14.

For synonymy see Walkom 1917, p. 30.

*Remarks:* Specimens of this genus are difficult to distinguish from the species of *Marrattiopsis* described above unless the lower portion of the frond is preserved. In *T. spatulata* the lamina of the pinna becomes gradually narrower and finally the pinna tapers into a long petiole. On the other hand, in *Marattiopsis* the pinnule is not petiolate and the base of the lamina is rounded or abruptly contracted (see Harris 1931, p. 65).

In the Cracow collection, there are fertile pinnules which must be referred to *Marattiopsis*, and also sterile pinnae which taper to a long petiole (Pl. I, figs. 13, 14) which are referred to *T. spatulata*.

The midrib of the Cracow specimens is strong—2 mm. wide—as is usual in this species, and in nearly all specimens it is asymmetrically placed, but to a greatly varying degree. This asymmetry appears (the evidence is not conclusive) to increase towards the petiole, the lamina on one side decreasing more rapidly than on the other; some specimens show lamina on one side only near the base. Further up the pinna the midrib is symmetrically placed. Frequently the lamina is bent back along its junction with the midrib and in some cases it is broken off, usually on one side only.

In the strong asymmetrical midrib and the gradual tapering to a petiole it is like *T. elongata* from the Maryborough Series (Walkom, 1918, p. 6, pl. 1, figs. 1-3), but is narrower and has more closely set secondary veins (15 or 16 in 5 mm.). While the specimens of *T. spatulata* figured by Walkom are symmetrical about the midrib, he included in the synonymy those forms figured by Feistmantel (1890) as *T. daintreei*, two of which, both small pinnae (pl. 27, fig. 4, 4a and pl. 28, fig. 6, 6a), show an asymmetrical midrib.

#### TAENIOPTERIS sp.

*Remarks:* A fragment of a wider pinna—13 mm.—is probably only a wider than usual specimen of *T. spatulata*, but may represent a distinct species. Walkom (1917, p. 30) included forms as large as this in *T. spatulata*, but in the Cracow material there is no gradation between the forms of the two sizes.



*Gymnosperm Seeds.*

*Remarks:* There is a number of detached seeds which do not appear to differ from the type common in the Ipswich Series. There is also one form which may be a scale of a conifer cone.

*Detached Strobili.*

Plate I, fig. 15.

*Remarks:* In the collection are two detached strobili which are poorly preserved but have a general resemblance to Equisetalean strobili such as *Calamostachys*. They may equally, however, be related to *Pteruchus*. The axis is 9 mm. long and about 0.5 mm. wide. From the axis are given off synangia, about 1.25 mm. long, which may have had a spiral arrangement but are now quite flattened.

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## EXPLANATION OF PLATE I.

FIG. 1.—“Star-Cap” of an equisetalean plant. x 2.

FIG. 2.—*Dictyophyllum ? davidi*. Nat. size.

FIGS. 3 and 4.—*Todites williamsoni*. Fig. 3, Nat. size. Fig. 4, apical end of pinna x 2.

FIG. 5.—*Cladophlebis* sp. Nat. size.

FIG. 6.—*Marattiopsis* sp. x 2.

FIG. 7.—*Sphenopteris superba*. Nat. size.

FIGS. 8 and 9.—*Neuropteridium moombraense*. Fig. 8, x 2. Fig. 9, Nat. size.

FIGS. 10-14.—*Taeniopteris spatulata*.

Fig. 10. Lower portion of pinna, showing asymmetrical midrib. x 2.

Fig. 11. Middle portion of pinna. x 2.

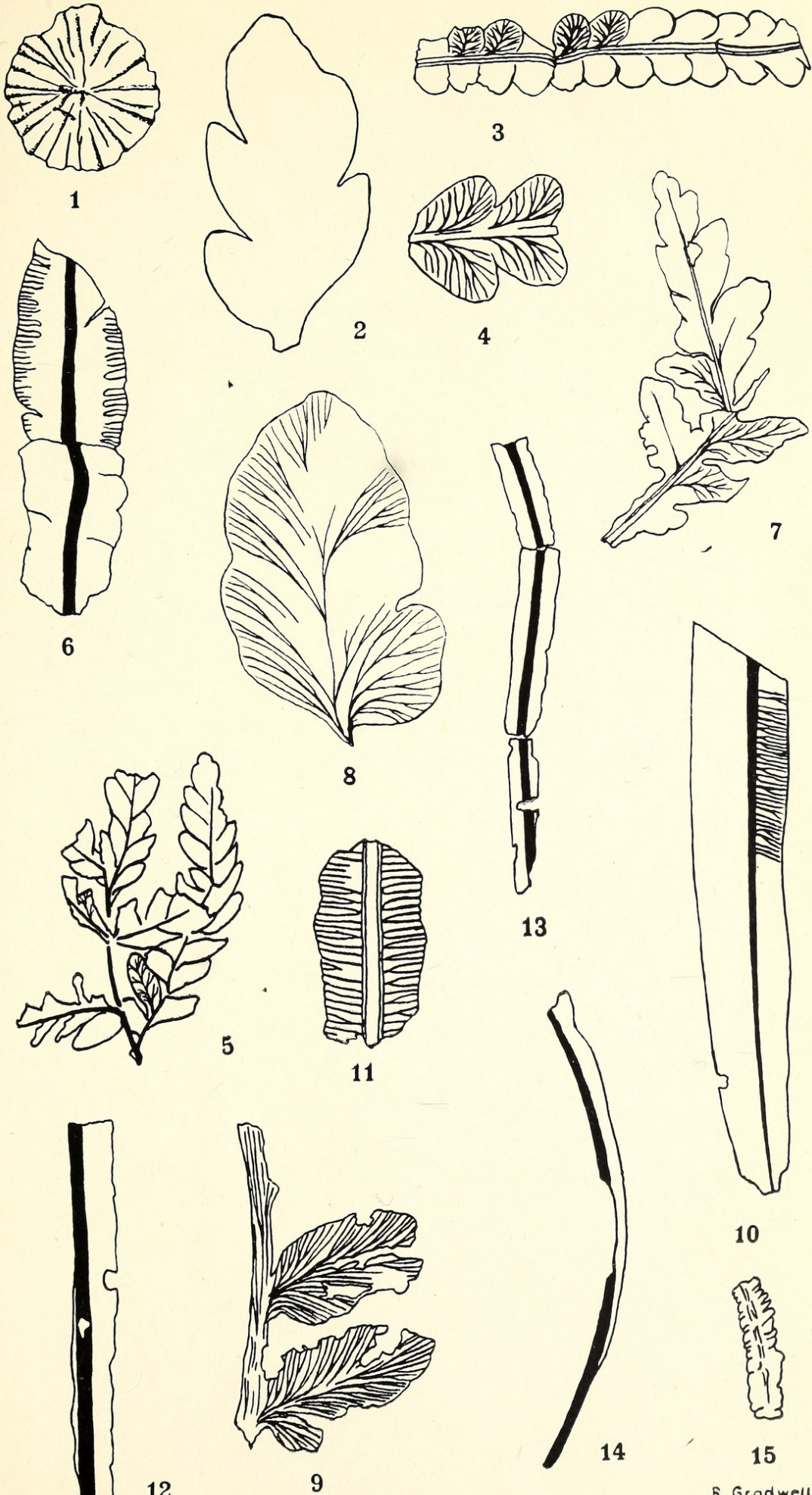
Fig. 12. Lower portion of pinna, with lamina on one side only. Nat. size.

Figs. 13 and 14. The pinna grading into the petiole. Nat. size.

FIG. 15.—Detached strobilus. x 2.

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