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NOTES ON *GLOSSOPTERIS ANGUSTIFOLIA* BRONGNIART

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ABSTRACT

The concept of the species *Glossopteris angustifolia* as defined by Brongniart is analysed for the identification of newly found leaves. The identification can now be based on Brongniart's diagnosis, figures and type-specimen. Some modificative views are also discussed which have led to errors in the usage of the specific name. It is concluded that the type-specimen and the author's diagnosis is adequate for the recognition of the species.

Key-words — *Glossopteris*, Cuticle, Modificative views.

सारांश

ग्लॉसॉप्टेरिस ऐंग्स्टिफ़ोलिया ब्रोंग्निआर्ट पर टिप्पणियाँ – इवा कोवाक्स ऐंन्द्रोदी

नवीन उपलब्ध पत्तियों के अभिनिधारण हेतु ब्रोंग्निआर्ट की ग्लॉसॉप्टेरिस ऐंग्स्टिफ़ोलिया जाति की संकल्पना विश्लेषित की गई है। अतः अब अभिनिर्धारण ब्रोंग्निआर्ट के निदान, चित्रों एवं प्रादर्श नमूने पर आधारित किया जा सकता है। जिन कारणों से जातीय नाम के प्रयोग में त्रुटियाँ हुई हैं ऐसे कुछ संशोधनशील विचार भी विवेचित किये गये हैं। यह निष्कर्षित किया गया है कि प्रादर्श-नमूना तथा लेखक का निदान जाति की पहचान के लिए पर्याप्त हैं।

"Among the many valuable contributions to palaeobotany made by the late Prof. Birbal Sahni, his description of the cuticles of *Glossopteris angustifolia* Borngn. will be always remembered".

Thomas, 1952

INTRODUCTION

Glossopteris angustifolia Brongniart is one of the first described species in the taxon *Glossopteris*, and as such knowledge of it is very important in the study of the glossopterids. The first species form the basis for comparison when other species are described. Any error or uncertainty in the definition of the first discovered species in a taxon can be misleading when newly found species are compared with the first ones. The errors then form a chain which can only be broken by clarifying the concept of the first described species. That is why exact knowledge of *Glossopteris browniana*, *G. indica* and *G. angustifolia* is of great importance in *Glossopteris* taxonomy.

The descriptions of species in a newly discovered taxon are usually short. The author, knowing a few species, was aware of only their most obvious distinguishing characters. In the case of the first *Glossopteris* species Brongniart also made some mistakes and they enhance the difficulties of the cognition of *Glossopteris browniana*, *G. indica* and *G. angustifolia*. He characterised the species *G. browniana* by nervulis basi obliquis reticulatis, but figured *G. browniana* var. *australasica* with anastomoses all over the lamina (1830, p. 223, pl. 62, fig. 1A). The type-specimen of *G. browniana* var. *indica* was glued together as one leaf, while in fact the two halves belonged to two different species. The figures of *G. angustifolia* are not quite correct in respect of the venation (pl. 63, figs 1, 1A).

Some palaeobotanists also found difficulty in the recognition of Brongniart's species in that the type-specimens were preserved without epiderms or reproductive organs. Such incompleteness even enhances the taxonomic value of preserved

characters on the type-specimens. The advice of M'Coy will never be outdated, who used herbaria "to work out.. points of structure in recent plants, neglected by botanists and omitted in their works, but which are of the highest importance in the investigation of fossil plants" (1847, p. 145). In the case where type-specimens are leaf-impressions, the species-concepts are based on them. Consequently the preserved specific characters of leaves are then highly significant. Once leaves with the same specific characters as those on the type-specimen are found with preserved epiderms or fructifications, knowledge of the species is increased. This idea of the usefulness of cuticular study was expressed by Prof. Sahni: "..a special advantage of such studies is that, once we have learnt to associate certain epidermal characters with certain species, it would thenceforth be easy to identify even small fragments ..". Sahni distinguished several species on well-preserved cuticles on fragments of leaves, but was of the opinion that "it would be scarcely worth while describing all these before they can be assigned to their respective species" (1923, p. 277).

In this paper the identification of newly found leaves is based on the concept of *G. angustifolia* formed by Brongniart. Only those characters are considered which are mentioned in his diagnosis and description, figured by him and displayed on the type-specimen. For the terminology of venation see Kovács-Endrödy, 1979.

DISCUSSION ON BRONGNIART'S CONCEPTS OF *GLOSSOPTERIS BROWNIANA*, *G. INDICA* AND *G. ANGUSTIFOLIA*

Brongniart (1830) described the genus *Glossopteris* with four species. The removal of two of these species from *Glossopteris* does not affect the validity of the taxon. The remaining species, *G. browniana* with two varieties and *G. angustifolia*, characterised the taxon clearly, and subsequently more species have been recognised as belonging to *Glossopteris*. There are characters in the definitions, figures and the two type-specimens (the type of *G. browniana* var. *australasica* is lost) which are typical of each of the categories and consequently distinguish any one of them from the other two. The analysis is based solely on Brongniart's conception (1830).

Size —

G. browniana var. *australasica* — smaller
G. browniana var. *indica* — bigger
G. angustifolia — breadth 6-8 lines (12-16 mm); (if he used French lines; 13·8-18·4 mm)

Shape —

G. browniana var. *australasica* — subspathulatis obtusis
G. browniana var. *indica* — lanceolatis acutiusculis
G. angustifolia — angustis sublinearibus;

Venation —

G. browniana var. *australasica* and var. *indica* — Lateral venation starts at an acute angle and reaches the margin at almost a right angle;
G. angustifolia — Evenly curved lateral venation, steeper than in the previous two varieties;
G. browniana var. *indica* — First meshes shorter, broader, polygonal in contrast with the following ones which are longer, narrower and oblong with parallel sides;
G. browniana var. *australasica* and *G. angustifolia* — All the meshes are more or less simillar;
G. browniana var. *australasica* — Lateral venation forms a net of polygonal meshes;
G. angustifolia — Lateral venation is subparallel, bifurcating, occasionally anastomosing; the meshes are linear.

There are not many characters to evaluate, and that is why none of them can be ignored without the danger of misidentification. Certain characters in correlation are typical of any one of the three categories.

Schimper (1869) raised the two varieties to specific rank, because of their constant, well-marked distinguishing characters. In this paper *Glossopteris angustifolia* will be discussed, because of the existing confusion about the concept of the species.

DISCUSSION ON *GLOSSOPTERIS ANGUSTIFOLIA* BRONGNIART

Brongniart's Diagnosis — G. foliis angustis sublinearibus (sex-octo lineis latis); nervo medio valido plano; nervulis obliquis

pluriès dichotomis, basique rariùs anastomosantibus.

Brongniart's description of the species is as below:

" Le seul échantillon que je possède de cette plante ne renferme que des feuilles très-incomplètes, puisque les deux extrémités manquent dans toutes; cependant leur forme linéaire, étroite, allongée, leurs nervures plus obliques et à peine anastomosées à la base, les distinguent de toutes les empreintes si variées de taille et de forme de l'espèce précédente, et d'un autre côté leur forme générale, la largeur de leur nervure moyenne et la disposition des nervures secondaires les placent sans aucun doute dans ce genre". For the sake of clarity the whole description is repeated as under:

On plate 38, figs 10 and 10b (Schimper, 1869) are the copies of the original drawings of *G. angustifolia*. The comparison of the figures and the type-specimen leaves no doubt as to the identity. The venation is, however, not quite correctly drawn. The dividing fasciculi form more anastomoses than figured on drawing 1A of Brongniart (1830), though they anastomose rarely and irregularly. Actually drawing 1A is too stylised.

The fasciculi come nearer to each other to form anastomoses, then they divide, again. The spaces between the fasciculi are more or less the same near the fascis and margins. Thus the venation has a more parallel course than is figured (Text-fig. 1).

SOME MODIFICATIVE VIEWS ON THE CONCEPT OF *G. ANGUSTIFOLIA* BRONGNIART

Feistmantel (1876, pp. 374, 375) noticed that Brongniart made a mistake in not figuring the anastomoses near the margin. Otherwise he followed the pattern on Brongniart's drawing "secondary veins.. form tolerably large polygonal oblong areoles; but from here they are resolved suddenly into many branches, which form oblong and narrow areoles up to the margin".

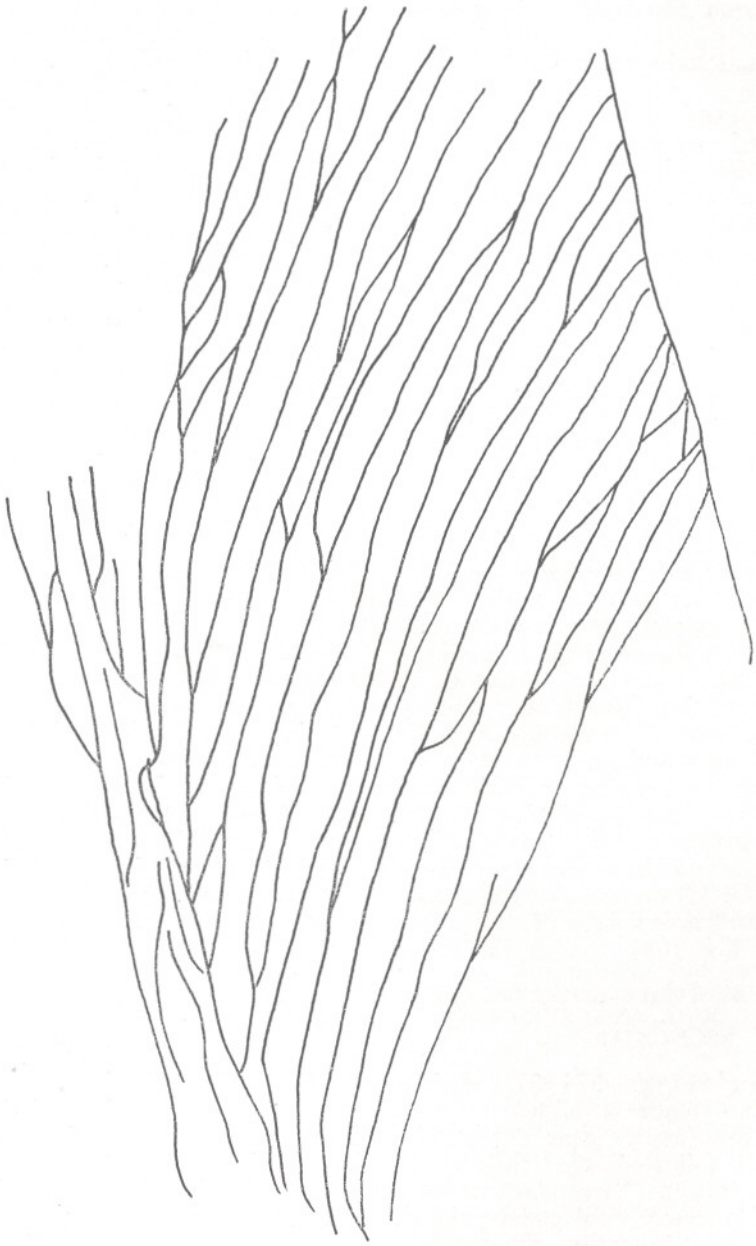
Arber (1905) and Seward (1910) reproduced, instead of Brongniart's drawing, the figure of Feistmantel (1876, fig. 2 on pl. 21) which is atypical, and seems to be the result of Feistmantel's misidentification. Moreover, they reconstructed it in such a way that the difference between the two kinds of meshes was more emphasized than in Feistmantel's figure. The two kinds of meshes, however, are not mentioned in their descriptions of the species. It is even more confusing that in Arber's Catalogue the venation is demonstrated by Zeiller's drawings of the type-specimen (fig. 19). The venation of the whole leaf after Feistmantel (fig. 18) and the enlarged drawing of the venation after Zeiller (fig. 19) are not similar.

Seward advised: " Zeiller has recently published accurate drawings of the venation in each of these types " (viz., *G. browniana*, *indica* and *G. angustifolia* " which would be consulted as more trustworthy than the less detailed figures given by Brongniart " (1897, p. 316). Zeiller's drawings are not more detailed than the original ones. Moreover, Zeiller blurred all the distinguishing characters of the venations of the three species (1896, pp. 363, 367, 370).

Seward and Walton (1923, p. 322) thought to find a " complete transition between spatulate and more linear examples . . . . in none of the narrow leaves that we have examined are there any distinctive venation characters other than such as one would expect in a restricted lamina ". It can be understood that they abolished the species, though they did not state it firmly. Nevertheless the name is mentioned till today, though the concept of the species is not clear.

It can be concluded that the species *G. angustifolia* was not correctly recognized by Feistmantel (1876, 1881), Arber (1905) and Seward (1910), and consequently by all those who read their definitions of the species for identifications.

One more perception of the species *G. angustifolia* Brongniart is mentioned here, because it touches the concept of species on a basic theoretical level, i.e. Pant and Gupta (1968): " The narrow lamina (up to about 4-5 cm wide) of all the presently, described new species is similar to that of *G. angustifolia* Brongniart, but their cuticular structure is distinctive and they are therefore assigned to different species. Moreover, the type specimen of *G. angustifolia* (No. 509), kept in the Paris Museum, is a mere impression without any carbon and therefore that name too cannot be used (it should henceforth be restricted



TEXT-FIG. 1 — The enlarged line drawing of the venation of the first leaf from the right on the type-specimen (No. 509) of *G. angustifolia*. ca × 12.

for ill-preserved narrow leaves which may belong to more than one species) for any of our leaves which are based on structural details" (p. 46) "....the name *G. angustifolia* Brong. can be used only for ill-preserved specimens whose structural details are unknown" (p. 53). Such application of cuticular analysis is in disagreement

with Prof. Sahni's proposition (1923). It is also against the principles and rules of botanical nomenclature (ICBN).

Leaves with a width of 4·5 cm are by no means narrow in the taxon *Glossopteris*, but are in the middle of the size range. Brongniart restricted the name *G. angustifolia* for sublinear leaves up to 16 mm in width. Evaluating the external characters in such a broad sense results in more species being lumped together under one specific name. Consequently the leaves identified in such a flexible manner display specifically distinct cuticular structures. The broad-sense perception of the species by later authors, however, does not affect the validity of the species *G. angustifolia* Brongniart and its type-specimen.

COMPARISON

M'Coy distinguished *Glossopteris linearis* (1847) and Bunbury *G. leptoneura* (1861) from *G. angustifolia* by fine, close and repeatedly anastomosing venation, while the venation of *G. angustifolia* is coarse, distant and sparingly anastomosing. Bunbury separated *G. leptoneura* from *G. linearis* by the much more oblique lateral venation, while the lateral venation of *G. linearis* is " not more oblique than that of the *G. Browniana* " (M'Coy, 1847, p. 151).

Some of the specimens found by Bunbury were six inches long, while *G. angustifolia* and *G. linearis* seem to be shorter. It is interesting to note the rather accurate drawing of the fascis on pl. 9, fig. 4 of *G. leptoneura* (1861). For more comparison see Banerjee and Ghosh, 1970, p. 562.

SOUTH AFRICAN SPECIMENS IDENTIFIED WITH BRONGNIART'S DIAGNOSIS AND THE PHOTOGRAPH OF THE TYPE-SPECIMEN (NO. 509) OF *GLOSSOPTERIS ANGUSTIFOLIA*

The species seems to be a rare one in the Transvaal-Vryheid Formation (Middle Ecca beds). The specimens identified as *G. angustifolia*: V. I. 17, T-V 267, T-V 359 from Vereeniging, layer P3/F3; H. I. 165a from Hammanskraal.

V. I. 17 (Pl. 1, fig. 1). A whole leaf. The venation is preserved by hematite.

Size — 1·2×9·4 cm.

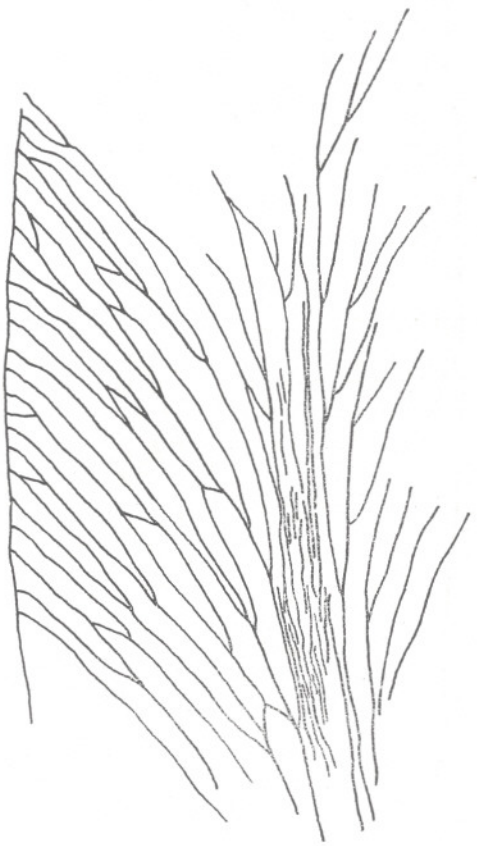
Shape — Linear, attenuates very gradually towards apex and base.

Apex — Obtuse. Two apical parts of leaves though not quite complete are preserved on the slab (No. 509) of the type-specimen. It had to escape Brongniart's attention (les deux extrémités manquent) ". One of them is figured (fig. 1) which is also an obtuse apex.

Base — The leaf folded at the base, it seems to be acute normal.

Fascis — The fascis is remarkably well-illustrated on Brongniart's pl. 63, fig. 1A (1830). On the photograph of the type-specimen the longitudinal fasciculi are also seen. They are not stronger or broader than the lateral fasicculi. The fascis is flat. All these features are also seen on the South African specimen.

Lateral Fasciculi — Arch evenly in a steep and slight curve from the fascis to the margins. They run almost parallel, divide



TEXT-FIG. 2 — *G. angustifolia*, enlarged line drawing of the venation of the specimen V.I. 17×6.

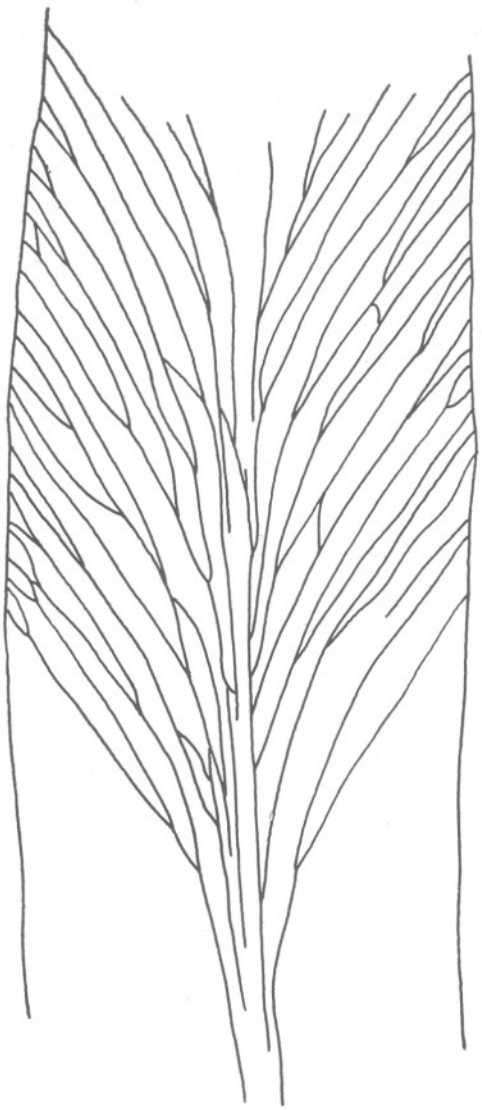
twice or thrice. The branches of bifurcating fasciculi getting near to each other may form anastomoses, but on the same leaf neighbouring fasciculi only fork without anastomosing forming a similar pattern as on fig. 1A of Brongniart (1830). The difference between the density of the venation in the middle and near the margin is not εs prominent as is figured by Brongniart. The distance between two fasciculi is 0·3-0·5 mm. Fasciculi become thinner towards the margins due to bifurcations and finer venation between the fasciculi. The latter is not clearly preserved, but in some places fine, perpendicular strands connect the fasciculi (Pl. 2, fig. 2; Text-fig. 2).

T-V 267 — An almost whole leaf. Venation preserved as impression.

Size — 1·1×9·5 cm without the base (Pl. 3, fig. 3).

T-V 359 — An apex, the fragment is 3 cm long, 1·3 mm broad at the base of the fragment.

H.I. 165a — A 4·5 cm long fragment, already tapering towards base, 1·1 cm broad (Pl. 3, fig. 4; Text-fig. 3).



TEXT-FIG. 3 — *G. angustifolia*, enlarged line drawing of the specimen H.I. 165a×6.

CONCLUSION

The number of correlative, common characters in the leaves on the type-specimen of *Glossopteris angustifolia* Brongniart is sufficient for specific determination. Consequently these characters distinguish *G. angustifolia* from all the other glossoptrid species. The broad-sense perception of the species led to the conclusion that externally similar leaves to that of *G. angustifolia* could have specifically distinctive cuticular structures, though obviously more species than one were lumped together under one name.

The specific name *Glossopteris angustifolia* Brongniart is restricted to leaves which are: linear with an obtuse apex up to 20 mm in width; lateral venation is arched evenly in a steep and slight curve towards the margins; fasciculi run almost parallel bifurcating twice or thrice occasionally anastomosing; the formed meshes are linear and more or less the same all over the lamina.

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Explanation of catalogue numbers — V.I. and H.I. = Collections of the Geological Survey in Pretoria. T-V = Collection of the Bernard Price Institute, Univ. Witwatersrand.

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EXPLANATION OF PLATES

PLATE 1

1. Leaf of *Glossopteris angustifolia* Brongniart from Vereeniging; Cat. no. V.I. — 17.

PLATE 2

2. Enlarged photograph of *Glossopteris angustifolia* Brongniart. Note (↓) fine perpendicular strands in mesh; Cat. no. V.I. — 17.

PLATE 3

3. Leaf of *Glossopteris angustifolia* Brongniart from Vereeniging; Cat. no. T.V. — 267.
4. Fragment of leaf *Glossopteris angustifolia* Brongniart from Hammanskraal; Cat. no. H.I. — 165a.

PLATE 1

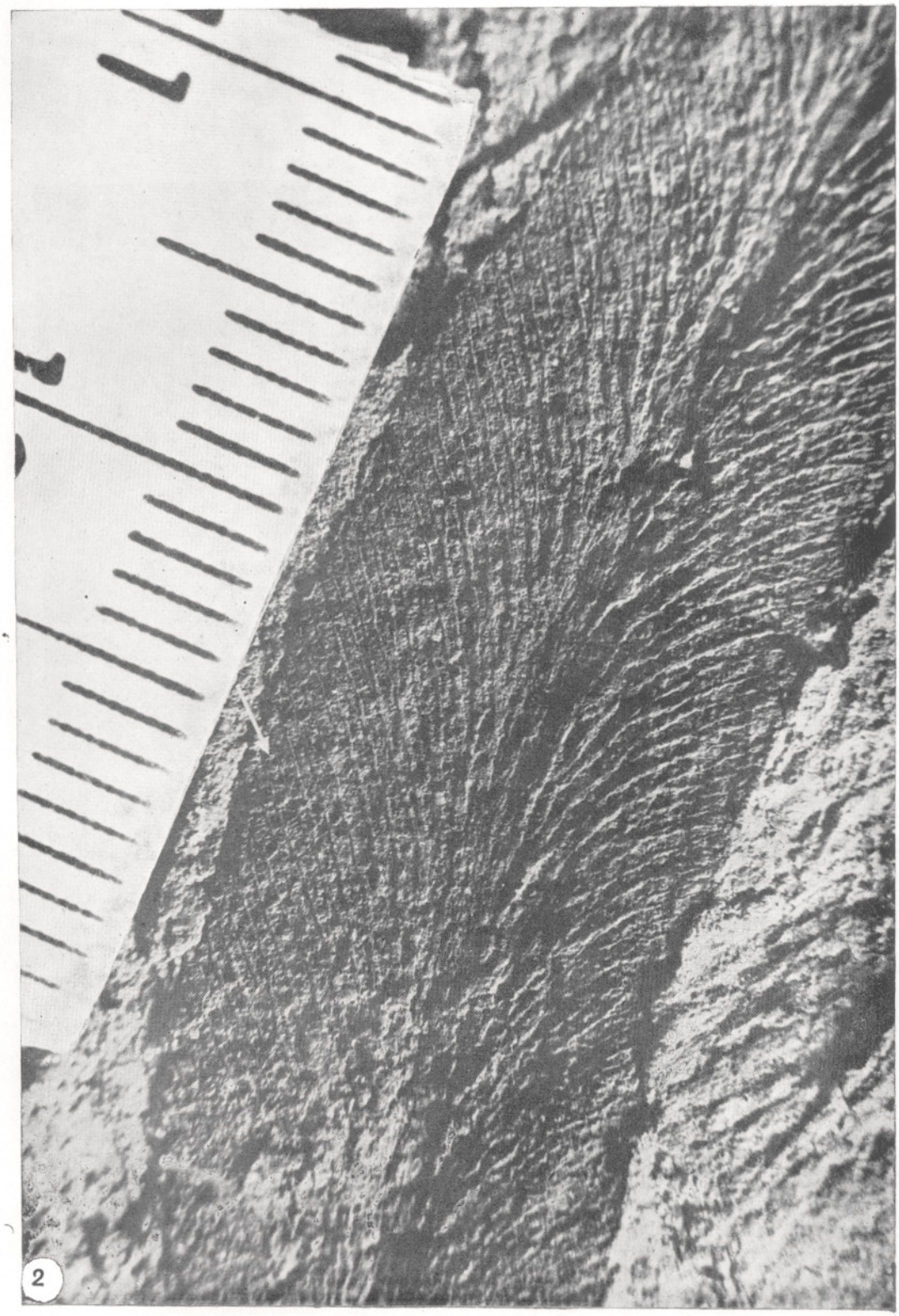

PLATE 2

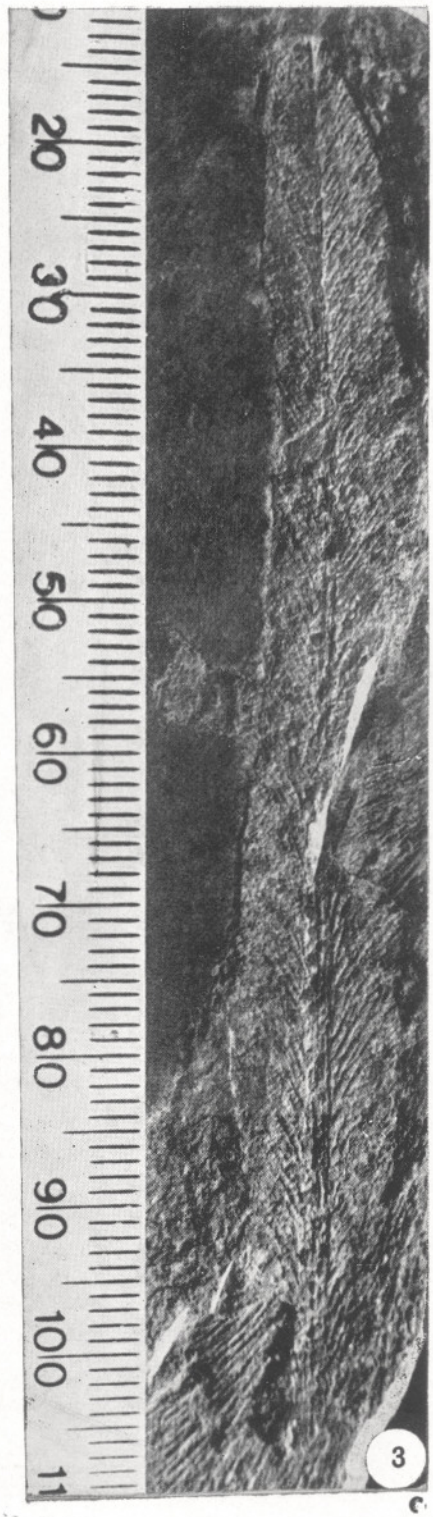

PLATE 3