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SEED-BEARING GLOSSOPTERIS LEAVES

by

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Seeds are commonly known elements of *Glossopteris* floras. The connection of these seeds to any definite elements in the floras and their systematic position with it has always been uncertain, and they are usually referred to as a group "incertae sedis". Several of these seeds have been described and placed in the genera *Cardiocarpus* Brongniart, *Cordiocarpus* Geinitz and *Samaropsis* Goeppert, specially erected for them. Arber (1905, p. 206) noticed the common occurrence of seeds with *Glossopteris* leaves, and refers to them without any further conclusion as "A few seeds . . . in association with fronds of *Glossopteris browniana*. The seeds are possibly referable to *Cardiocarpus*".

In 1973, two *Glossopteris* leaves were found at Hammanskraal, some 50 km north of Pretoria, at separate times, evidently in the same stratum where the seed hitherto classified as *Cardiocarpus* occurred. On each a seed was in organic connection with the midrib of the leaf. Both specimens here described belong to the same species, as can be ascertained from all morphologic characters of both the seeds and leaves. The generic characters of *Glossopteris,* as defined by Brongniart (1828, original description 1822) from the leaves, are clear: "Fronde simple entière, plus ou moins lancéolée, rétrécie insensiblement vers sa base; nervure moyenne large à sa base, s'évanouissant vers le sommet, et donnant naissance à des nervures secondaires, fines, arquèes. oblique, dichotomes, quelqefois anastomosées à leur base".

The plant fossils are found in an abandoned quarry in carbonaceous shales of the Middle Ecca Stage in the north-western corner of the farm Haakdoornfontein 119 JR, 7,25 km almost due south of Hammanskraal. The locality is situated at latitude 25° 28′ 15″ and longitude 28° 17′ 40″.

The quarry was worked for fire clay and is situated about 150 m east of the new highway between Pretoria and Warmbaths.

The seed-bearing *Glossopteris* leaves clarify the systematic position of the seed-genus *Cardiocarpus* Bgt. (1828) the latter being the seed of the earlier described *Glossopteris*. Thus *Cardiocarpus* has to be considered as a junior synonym of the genus *Glossopteris* Bgt.

On the second specimen, hereunder referred to as specimen "B" (catalogue No. H I 99), the seed sits on the midrib in a seminatural position, but is pressed flat on the surface of the leaf without any breakage or dislocation. On this specimen the external characters of a connected seed can be studied complete with the megasporophyll. On the first found specimen, "A" (catalogue No. H 1 74), the seed is partly broken off and a part of the megasporophyll is missing, exposing the connections between the inner tissues of the seed and those of the midrib. The comparative study of these two specimens provides clear evidence on the type of reproduction of *Glossopteridae* and refers the group to *Pteridospermophyta*.

The seed sits on the midrib without a stalk and is directly connected to it through the megasporophyll. The structure of both seeds is very similar. Specimen "A" (Figures 1—4) shows that sarcotesta is pointed oval (17 mm × 11,5 mm), with deep emargination at its apex. Its soft consistency is indicated by the transparent midrib at the apical part of the right margin (Figures 2 and 3). The sclerotesta is also pointed oval (11 mm x 6,5 mm) and was apparently much harder than the sarcotesta, possibly more or less stony, indicated by the interruption of the transparent midrib at its margin. A part of the megasporophyll is preserved at the right side of the base of the seed and its imprint is marked on the whole breadth of the base. The left half of the megasporophyll was removed during preparation, exposing a bundle of veins connecting the base of the sarcotesta with the inner tissues of the midrib of the leaf. The bundle of connecting tissue is about 1 mm below the surface of the midrib, possibly due to fossilisation pressure. It is in the shade of the cavity in figure 3, but is clearly visible in the more vertically illuminated figure 4. On the horizontally illuminated figure 3 the imprinted surface structure of the seed can be better examined. The present position of the seed is a result of the process of fossilisation. The sitting seed apparently broke off under pressure as it has no flexible stalk and remained connected to the midrib through the more elastic tissues of the soft sarcotesta.

Morphology of the seed Specimen "B" (Figures 5 and 6) is similar. Sarcotesta 15 mm long and 11 mm broad, sclerotesta 10 mm long and 7,5 mm broad. The megasporophyll is complete on this specimen exposing its near-lateral side joining the midrib of the leaf within the margin of the latter. Its apical portion supports the sclerotesta. The sarcotesta joins the megasporophyll at its sides and most likely embraced it when alive.

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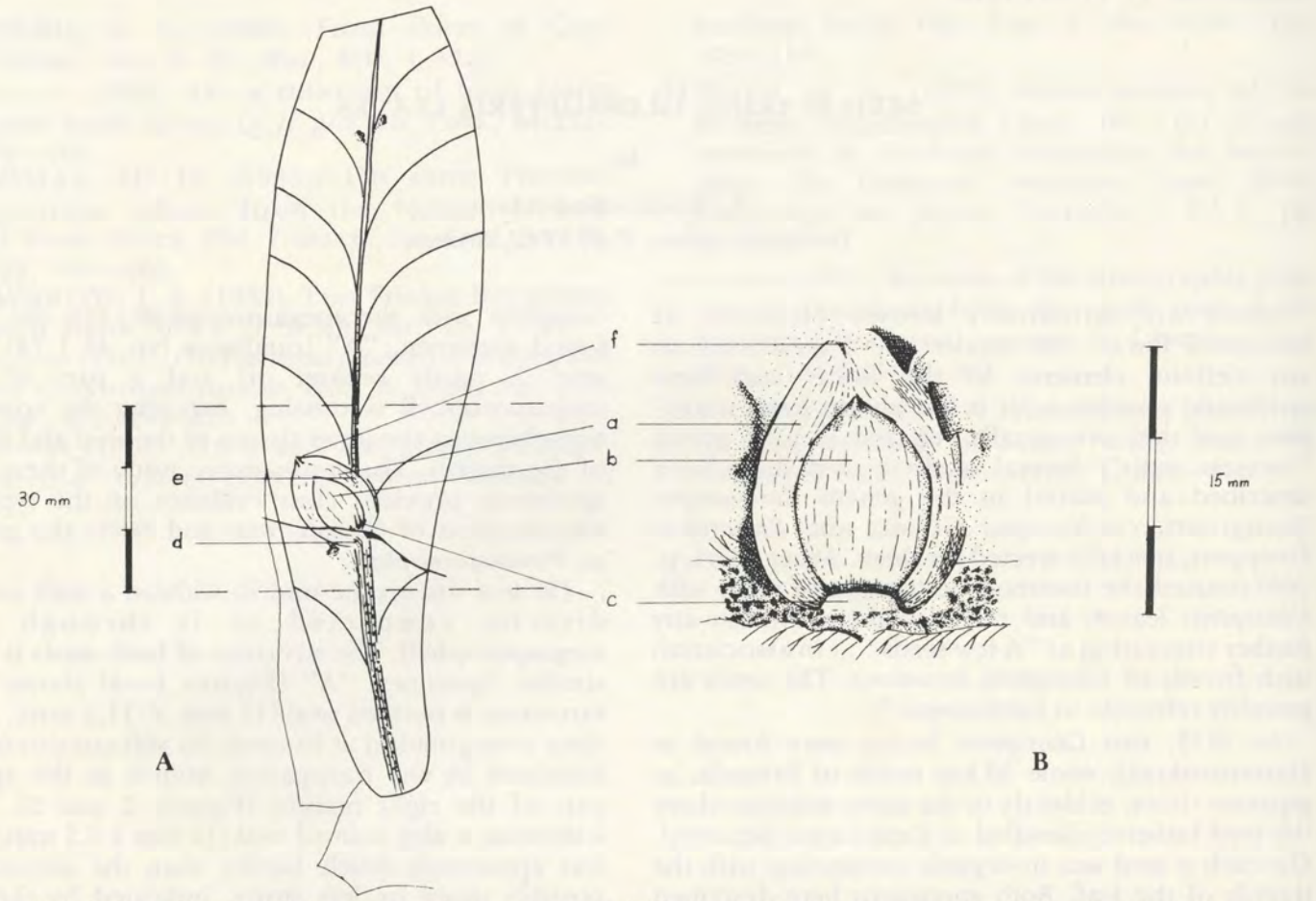

Fig. 1 Morphological terms of *Glossopteris* seeds. A= specimen "A", cat.no. H I 74; B = specimen "B", cat.no. H I 99. a = sarcotesta; b = sclerotesta; c = megasporophyll; d = connecting tissues of sarcotesta of specimen A; e = midrib of leaf transparent through the sarcotesta on specimen A; f = micropyle. The curved lines on the surface of leaf (A) indicate the trend of dense secondary venation. The broken horizontal lines on (A) demarcate the section shown on figures 2 and 3.

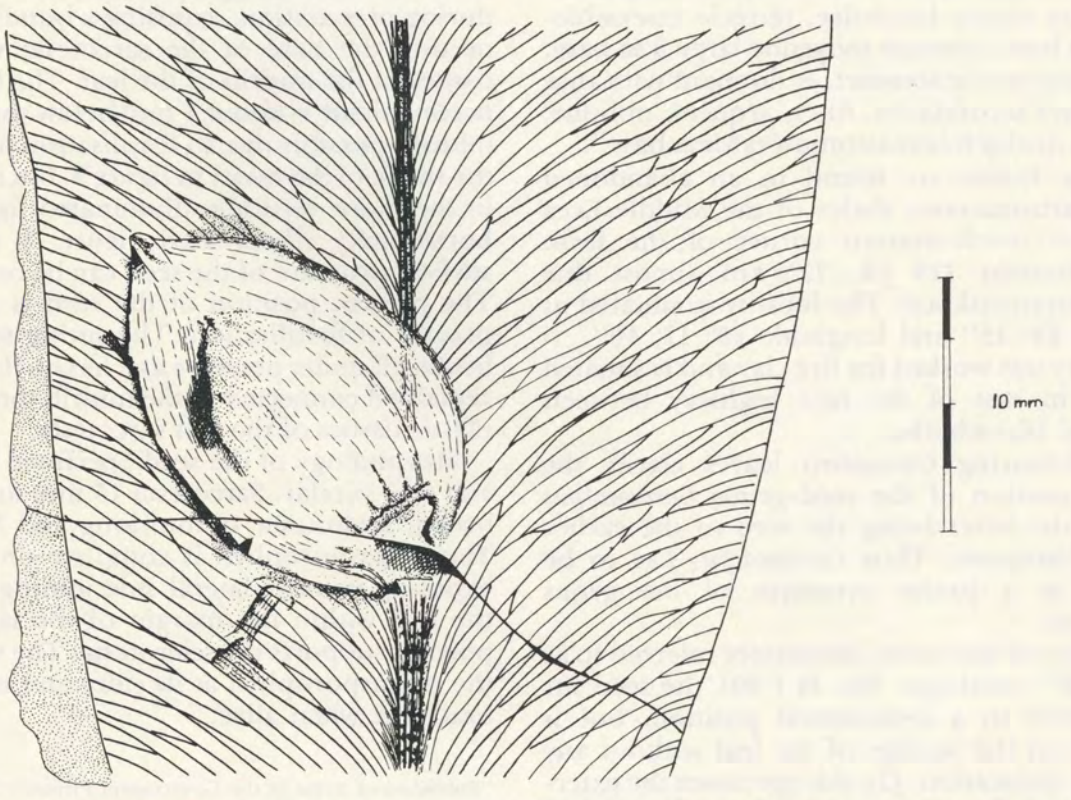

Fig. 2 *Glossopteris* seed (sepcimen "A", cat.no. H I 74). Enlarged part of leaf as marked on figure 1.

The leaf. The leaves of the *Glossopteridae* are not completely analogous with the leaves of *Gymnospermae* and *Angiospermae*. By definition a leaf of these groups is vegetative, and never bears reproductive organs. What we call a "leaf" in *Glossopteridae* has the combined function of assimilating and bearing reproductive organs.

The apices of the leaves are missing on both specimens, a greater part being preserved on specimen "A", but more of the base is visible on specimen "B". On specimen "A" the margins of the preserved portion of the leaf are already curved towards the apex and contracted towards the base, consequently it can be assumed that the complete leaf could not have been much longer. The preserved portion is 130 mm long, with a maximum width of 33 mm. The shape is oblanceolate, broadest above the middle, tapering towards the base and more rapidly towards the apex.

On specimen "B" the midrib is fairly broad, 4 mm under the seed, 3 mm above it. The petiole is 14 mm long, with maximum width 12 mm at the base.

The leaf is slightly asymmetric. The midrib is distinct, extending through the surface, broader at the base and gradually narrowing above the seed towards the apex. The surface of the midrib is longitudinally striated, with rows of fine tubercles in specimen "A", but appears as an amorphous surface in specimen "B". This rough surface is definitely not the imprint of the cuticle, which is missing, but of an inner tissue. Similar rough midrib surface was found in several species of *Glossopteris* and bears no taxonomic significance.

Secondary venation is fine. The meshes are very regular in shape and size through the whole leaf, being shorter and narrower only near the margin. The veins leave the midrib at an acute angle and then curve to the margin. The density of the veins is about 20—26 per cm.

Glossopterid fructifications have been identified and described by Plumstead and by other investigators on several occasions. In view of the present evidence it would appear that these should be interpreted as male organs. Both they and the organs now described and considered to be female organs are attached to the midrib of the leaf.

The specimens described are preserved in the Collection of the Geological Survey, Pretoria, under the catalogue numbers H I 74 and H I 99.

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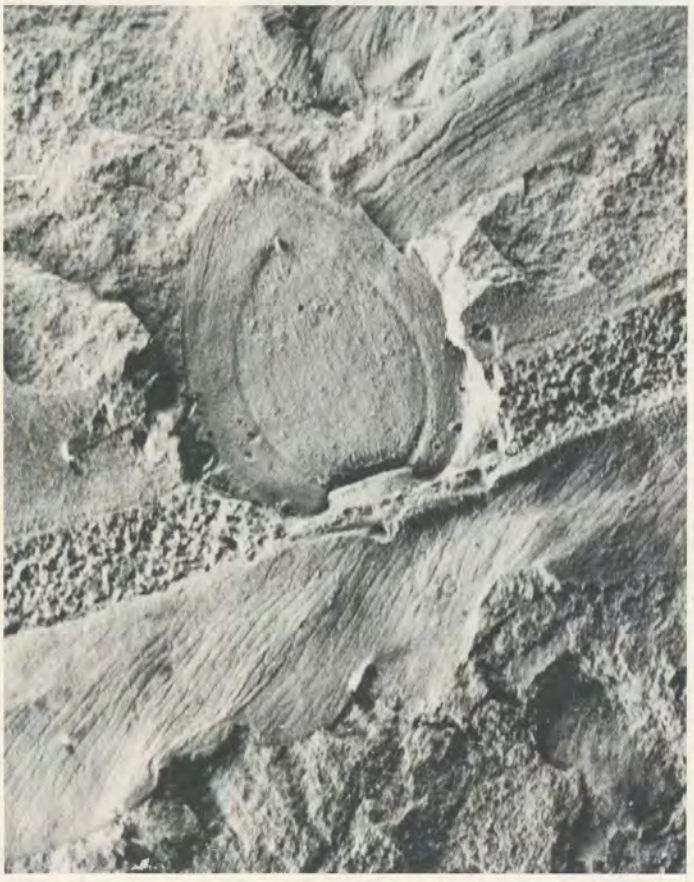



Fig. 3 A section of the seed-bearing *Glossopteris* leaf as marked on figure 1. (specimen "A", cat.no. H I 74).
Fig. 4 Enlarged picture of the *Glossopteris* seed in semivertical illumination showing the connecting tissues of sarcotesta to midrib (specimen "A", cat.no. H I 74).
Fig. 5 *Glossopteris* seed in intact connection with the midrib of the leaf (specimen "B", cat.no. H I 99).
Fig. 6 Enlarged picture of the *Glossopteris* seed in intact connection with the midrib (specimen "B", cat.no. H I 99).