

PRELIMINARY NOTICE ABOUT THE ECCA FLORA (LOWER PERMIAN) OF WANKIE, SOUTH RHODESIA

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ABSTRACT.—A quantitative comparison between the flora of the fire clays of Wankie, Rhodesia and that of the Middle Ecca Series from Vereeniging, South Transvaal, shows that they are near to each other.

Lycopodiopsis pedoramus Edwards (*Cyclodendron leslii*) and *Gangamopteris* sp. occur in both. They are only less frequent in Wankie. These forms are, according to du Toit, more or less characteristic of the Middle Ecca and are lacking in the Lower Beaufort.

The difference in the age of the fire clays of Vereeniging, South Transvaal, and the fire clays of Wankie cannot be great.

The upper coal seams of Wankie (much higher than the fire clays) are of Upper Ecca age as are the upper seams of the Waterberg District in North Transvaal.

The difference between the flora of these two fire clay layers can be explained by the distance between them of 1000 km in south-north direction. A parallel case can also be observed in the Permian flora of Australia (David, 1950).

INTRODUCTION

IN August 1955 I had the occasion to visit the coal layers in Rhodesia and the Union of South Africa for collecting coal samples and fossil plants. The examination of the coal samples will take a lot of time. I will only state here that I have come to opposite conclusions to those of B. Lightfoot. The coal seams of Wankie are doubtless of the same autochthonous origin as the coal seams in South Transvaal (Witbank, Vereeniging, etc.).



In this paper I shall give only a short preliminary notice about the celebrated Ecca Flora of Wankie. The Wankie plants are found in fire clay layers which lie about 50m over the main seam. The difference in age cannot be of any importance. These layers of fire clay have originated in a smaller lake into which leaves, branches and seeds of the shore vegetation were transported

in large quantities. In some parts the leaves of *Glossopteris*, especially *G. indica* Schimper, occur in such masses as the leaves of oaks and beeches in autumn time in some European forests.

It is a pity that the organic material of the fossils is destroyed, so that it is almost impossible to have cuticular preparations.

John Walton (1929) has given a beautiful description of this very interesting flora. I take this occasion to add a few remarks to his paper.

Walton says clearly that *Glossopteris indica* Schimper is the most common plant. But a true picture of the Wankie flora can be had only if we consider its quantitative composition.

THE WANKIE FLORA

Among the leaves which I collected in Wankie the *Glossopteris* constitute about 83% and in this *Glossopteris indica* dominates (80%). By comparison, my collection from Vereeniging, South Transvaal, contains 92% *Glossopteris* of which 61% is *G. browniana* Brogn. *G. browniana* here has the first place while *G. indica* is only about 9%.

Besides *Glossopteris indica* I have in my Wankie collection *Glossopteris browniana*, *Glossopteris* cf. *tortuosa* Zeiller, *Glossopteris* cf. *conspicua* Feistmantel and *Glossopteris retifera* Feistmantel with a low total of 3% together. (The same specimens I have collected also from Vereeniging).

In Vereeniging we have similar fire clay layers above the main coal seam, which contain the fossil plants. These fire clays differ only in the state of diagenesis which is lower than in Wankie, and in content of SiO_2 which is also lower.

The total number of Glossopterids in Vereeniging (92%) does not differ much from that in Wankie (83%).

The fossil flora of Vereeniging near the border of the Vaal river is, perhaps, the most celebrated of the *Glossopteris* floras in the world. From this unique material, which S. F. le Roux has collected and prepared in many years, Mrs. Edna P. Plumstead (1952) has described the fructifications of the genera *Glossopteris* and *Gangamopteris*. I can add nothing to this beautiful and very remarkable work. Perhaps it is only my opinion that the Glossopterids have nothing to do with the phylogeny of Angiosperms.

The three papers of Mrs. Plumstead are the most remarkable paleobotanical works in the last years. *Gangamopteris* in my collection from Vereeniging is about 13%. Mrs. Plumstead found in Vereeniging *Gangamopteris obovata* Carruthers (*G. cyclopteroides*) and *G. burdiardica* Feist. The Wankie *Gangamopteris* material is too badly preserved for the determination of species. In Wankie I could find only 3 specimens which is less than 1% of the entire Glossopterids. *Gangamopteris* was not found formerly in Wankie. For the stratigraphical position of the fire clays and the main coal seam of Wankie the presence of *Gangamopteris* is of importance. It is the leading fossil for the Middle Ecca in South Africa and occurs also earlier. The rarity of the genus in Wankie can perhaps be explained as due to its geographical position: 1000 km north of Vereeniging. Similar observations are recorded from Australia, where *Gangamopteris* (David 1950) is lacking in the Permian layers north of Clermont, Queensland. Rhizomes of *Vertebraria* type are also in my collection.

In the collection of Mr. Leache which is now in the possession of the Witwatersrand University in Johannesburg, I have seen beautiful branches of a few centimeters in diameter, which end with tufts of *Glossopteris indica* leaves.

Summarising, we have in Wankie a *Glossopteris* flora which differs from the South Transvaalian Middle Ecca only in the dominance of other species; *Glossopteris indica* in Wankie and *G. browniana* in South Transvaal. *Gangamopteris* is also present in Wankie.

Microspores (pollen) of *Glossopteris browniana* Brogn. (*Scutum leslium* E. Plumst.) are abundant in the clays of Vereeniging, South Transvaal.

Lycopodiopsis pedoranus Edwards (W. N. Edwards 1951) is represented in Wankie and also named by J. Walton (1929) as *Cyclo-dendron leslii* Seward. It is only more common in my collection from Vereeniging (about 3%).

One peculiarity of the fossil flora of Wankie is the relatively frequent occurrence of the genus *Sphenophyllum*. In my collection I have the same species described by J. Walton: *Sphenophyllum* cf. *thonii* Mahr (incl. var. *minor* Sterzel), *Sphenophyllum* cf. *oblongifolium* Germ. and *Sphenophyllum speciosum* Royle. The number of *Sphenophyllum* (compared with *Glossopteris* and other leaves) is about 5%. More than half of it is *Sphenophyllum speciosum* Royle (46 specimens). In the collections of Mr. Leache I have seen also fructifications of this species which are not well preserved (now in Witwatersrand University, Johannesburg). If we consider the fact that *Sphenophyllum speciosum* Royle is found often with several rings of leaves on the stems, the role of *Sphenophyllum speciosum* is greater compared with other species of *Sphenophyllum*, which are found mostly in fragments.

In the list of the fossil plants of South Transvaal the genus *Sphenophyllum* is lacking. In Australia according to David (1950) *Sphenophyllum* occurs in the Permian layers only in Queensland and is lacking farther to the South (New South Wales, etc). It can be explained by the same reasons: Wankie is also about 1000 km north of Vereeniging, South Transvaal.

Some of the *Psymphyllum* sp. leaves named by A. C. Seward and T. N. Leslie (1908) can be perhaps isolated leaves of *Sphenophyllum* cf. *thonii* Mahr which are found very often in isolated condition also in Wankie.

Sphenophyllum cf. *thonii* Mahr is a Lower Permian form in Europe. It seems not to be identical with the South African form described by J. Walton.

Phyllothea sp. is common in the fossil flora of Wankie. I found, comparing the percentage of leaves about 2% (25 specimens) of *Phyllothea* sp. casts and one specimen with a rosette of *Phyllothea* leaves (*Asterophyllites* type) not named by J. Walton. *Phyllothea* sp. should be identical with *Equisetites* found in Vereeniging. Only the frequency of occurrence in Wankie is greater. According to Walton this species can be compared with *Phyllothea australis* Bgt.

The genus *Schizoneura* has not been found till today in the Middle Eccla layers of South Transvaal and Wankie, Rhodesia, but occurs in the upper coal seams in Rhodesia. According to David (1950) *Schizoneura* occurs in the Permian of Australia also and is found only in the upper beds.

FERNS

Perhaps the greatest peculiarity (more than the presence of *Sphenophyllum*) is the occurrence of the Marattiales (cf. *Pecopteris arborescens* Schlotheim) in Wankie together with fructifications of *Asterotheca* type from which J. Walton named 2 species. This group is represented by more than 3% (44 specimens). But also in Vereeniging, South Transvaal, Pecopterids of the arborescent type and *Asterotheca* fructifications are found (A. L. du Toit and S. H. Houghton 1944, pp. 349). They are represented in the collection of Mr. S. F. le Roux in Vereeniging, South Transvaal, but are very rare in the Middle Eccla from Transvaal compared with their frequent occurrence in Wankie, Rhodesia.

Pecopteris cf. *unita* Bgt. (cf. forma *emarginata* Gopp). is less common in Wankie. I have found only 7 specimens,

These Pecopterids are very near to the European forms which are common in the Lower Permian and in the uppermost part of the Carboniferous (Stephanian). They allow a connection of the Eccla with the Lower Permian.

cf. *Chansitheca*

J. Walton describes (1929, plate B fig. 10, 11) a fern which he compares with *Chansitheca kidstoni* Halle from the Lower Shihhotse Series, Shansi (Kathaysia flora). I found three beautiful specimens in my collection.

cf. *Cladophlebis*

J. Walton describes also fern leaves with very flat and thin pinnules. Each pinnule has a well marked midrib. The secondary veins are curved and forked.

This type is very near to or identical with *Cladophlebis Roylei* Arber which has been collected from Queensland and India. I have collected several specimens of this type.

A. C. Seward and T. N. Leslie (1908) described from Vereeniging under the name *Callipteridium* sp. a fern (the typical genus *Callipteridium* is a pteridosperm) which they compared also to *Cladophlebis Roylei* Arber. It is certain that these two types are very near to each other, so that this type of fern occurs also in South Transvaal, where, however, it does so only very seldom. It is more common in Wankie, Rhodesia.

In my collection I have some specimens where the pinnules are completely obliterated, so that we can see only the sori (clusters of sporangia on both sides of the midrib). It is possible that this type is near to *Cladophlebis*. The preservation is too bad for a closer examination. Such sori (or sporangia) are often found isolated.

Gondwanidium

In Wankie I found 4 specimens of pinnules of *Gondwanidium validum* (Feist.) Gothan. These are identical with those found in Vereeniging, South Transvaal; *Gondwanidium* is not named by J. Walton (1929).

Cordaites

Leaves of *Cordaites* type cf. *Noeggerathiopsis hislopi* Feist. are common in Wankie. They are also very common in Vereeniging here and there and constitute about 7-8% of the total number of the leaves.

Winged seeds which belong probably to *Cordaites-Cardiocarpus* sp. are very common in Wankie. I found about 400 specimens. In Vereeniging, South Transvaal, they are less common.

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