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GLOSSOPTERID LEAVES FROM THE EARLY MESOZOIC OF NORTHERN MEXICO AND HONDURAS

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ABSTRACT

Many years ago Newberry (1876, 1888) reported the occurrence of leaves resembling *Glossopteris*, the typical Gondwana fossil, in the Late Triassic — Early Jurassic of north-western Mexico and Honduras. Although, *Glossopteris* has been previously described a few times from areas like these outside the boundary of Gondwanaland the fossil occurs principally in the Permian and infrequently in the Early Triassic rocks of India and the southern continents, the now separated parts of Gondwanaland. The *Glossopteris*-like leaf from north-western Mexico is tentatively assigned to *Glossopteris* and the leaves from Honduras are assigned to *Mexiglossa* which was previously known only from the middle Jurassic of south-eastern Mexico.

Key-words — *Glossopteris*, Gondwana, *Mexiglossa*, Early Mesozoic, Northern Mexico, Honduras.

सारांश

उत्तरी मेक्सिको एवं हॉन्डुरस के अवर मीसोज़ोइक कल्प से ग्लॉसॉप्टेरिस-सदृश पत्तियाँ – सिडने ऐश

लगभग एक शताब्दी पूर्व न्यूबेरी ने उत्तर-पश्चिमी मेक्सिको एवं हॉन्डुरस के उपरि ट्रायेसिक-अवर जुरेसिक से ग्लॉसॉप्टेरिस-सदृश पत्तियों का वर्णन किया था। यद्यपि गोंडवानाभूमि की सीमा के बाहर इन्हीं जैसे क्षेत्रों से ग्लॉसॉप्टेरिस कई बार वर्णित किया जा चुका है, यह पादपाश्म मुख्यतया गोंडवानाभूमि के विभक्त भाग भारत एवं दक्षिणी महाद्वीपों की पर्मियन तथा कभी-कभी ट्रायेसिक कालीन चट्टानों में पाया जाता है। उत्तर-पश्चिमी मेक्सिको की ग्लॉसॉप्टेरिस-सदृश पत्ती को अस्थायी रूप से ग्लॉसॉप्टेरिस प्रजाति में रखा गया है तथा हॉन्डुरस से एकत्रित पत्तियों को मेक्सिग्लोसा, जो दक्षिण-पूर्वी मेक्सिको के मध्य जुरेसिक से ज्ञात था, में रखा गया है।

INTRODUCTION

THE present disjunct distribution of the distinctive fossil leaf *Glossopteris* in rocks of Permian to Early Triassic age in India and the southern continents, the now separated parts of Gondwanaland, is often cited as evidence for continental drift (Schopf, 1970, 1973). Occasionally *Glossopteris* or very similar leaves have been reported from areas beyond what are thought to be the boundaries of Gondwanaland, and in some cases in younger rocks. Because of their possible bearing on the concept of continental drift and plant evolution all such anomalous occurrences of *Glossopteris* need to be evaluated carefully in the light of modern palaeobotanical thought.

Most reports of anomalous occurrences of *Glossopteris* or *Glossopteris*-like leaves have been found to be erroneous when critically evaluated but several may be valid. For example Zimina (1967) and Meyen (1969a) have described typical *Glossopteris* leaves in the Upper Permian of Russia although earlier reports of the fossil in that country have been disproved (Edwards, 1955). Wieland (1913, 1914-1916) described some leaves from the Middle Jurassic of south-eastern Mexico which he thought might be *Glossopteris*. These leaves have recently been referred to the new genus *Mexiglossa* by Delevoryas and Person (1975) although they admit that it is difficult to separate *Mexiglossa* from some specimens of *Glossopteris* on the basis of morphology. The genus *Glossopteris* has been reported

(Zeiller, 1902, 1903) from the uppermost Triassic of Vietnam but the occurrence needs to be reconsidered. Some fossils from the uppermost Triassic of east Greenland were identified as *Glossopteris* by Harris (1932). However, that identification was strongly criticised by Florin (1933) and Harris (1937) later accepted their reassignment to *Anthrophyopsis*.

Two anomalous occurrences of *Glossopteris*-like leaves which have never before been properly re-evaluated are considered in this paper. Both occurrences were originally noted many years ago by Newberry. In 1876, he described a single *Glossopteris*-like leaf from the Upper Triassic rocks in north-western Mexico and called it *Taeniopteris glossopteroides* n. sp. Later he (1888) described several additional such leaves from the Upper Triassic-Lower Jurassic rocks in Honduras and assigned them to the same species. Most workers have ignored the occurrences although a few (e.g., Knowlton, 1918; Schuchert; 1935; Mills *et al.*, 1967) have mentioned them without comment.

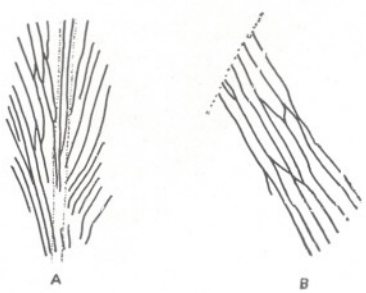
DESCRIPTION OF MATERIAL

The *Glossopteris*-like leaves described by Newberry from Mexico and Honduras are in the collections of the New York Botanical Garden (NYBG), Bronx, New York. I have examined the fossils and the following description is based on that examination.

The leaf from Mexico is preserved as an impression in hard, fine grained sandstone and although no organic matter is preserved the venation and form of the fossil is clear (Pl. 1, figs 1, 2). The impression apparently represents a thin leaf. Both the base and apex are missing but the leaf appears to have been about 4-5 cm broad originally and judging by the taper of the sides it could have been 15-20 mm long. The margins appear to be slightly wavy in places but this may be a feature of preservation. A midrib marked by several veins and a groove about 1·5 mm wide occurs in the lower part of the leaf but it gradually disappears upward near the top of the fossil. The veins in the midrib region appear to anastomose in a few places but this character is unclear. The lateral veins arise at an acute angle (10°-15°) to the midrib but gradually change their course and cross the lamina at a more obtuse angle (35°-40°). Some of the lateral veins can be traced into the midrib (Text-fig. 1A). The lateral veins are parallel throughout the lamina except where they fork and anastomose. Forking and anastomosing occurs somewhat irregularly but appear to be most common in the marginal parts of the leaf. The resulting vein meshes are long, narrow and angular (Text-fig. 1A, B).

This fossil occurs in the Santa Clara Formation which is thought to be of Late Triassic age (DeCserna, 1961). The locality is about 150 km south-east of Hermosillo, in the state of Sonora near the deserted mining camp of Los Bronces. It is associated with a large but poorly known impression flora which include *Neocalamites*, *Thaumatopteris*, *Cladophlebis*, *Pterophyllum*, *Zamites* and *Taeniopteris* (Silva-Pineda, 1961), an assemblage which compares more closely with early and middle Mesozoic floras of the northern hemisphere than with typical Gondwana ones.

The Honduran fossils are preserved in fairly hard argillite. They are the remains of large (4-5 cm wide and 15-20 cm long) entire spatulate leaves which have smooth to slightly wavy margins and tapering apices and bases (Pl. 1, figs 3, 4). The midrib is represented by a groove about 1 mm wide which disappears upward. The lateral veins are indistinct but they seem to be as in the *Glossopteris*-like leaf from north-western Mexico described above.



TEXT-FIG. 1 — *Glossopteris* sp. from the Late Triassic of Sonora, Mexico. **A.** Details of the venation in the midrib region × 2, NYBG 9252A. **B.** Details of the venation in the marginal area. The midrib is to the right and the dotted line on the left represents the broken edge of the leaf × 2, NYBG 9252A.

These leaves occur at a locality about 20 km north-east of Tegucigalpa, Honduras, near the small mining town of San Juancito. That locality is in the base of the El Plan Formation of Late Triassic to Jurassic age (Mills *et al.*, 1967). According to Newberry (1888) the leaves are associated with a small Early Mesozoic impression flora which includes *Otozamites*, *Anomozamites*, and *Nilssonia* (Newberry, 1888). The flora does not compare with typical Gondwana floras. Instead it compares more closely with Early and Middle Mesozoic floras of the northern hemisphere.

DISCUSSION

The true relationships of these fossils are impossible to determine but one of the first genera they do bring to mind is *Glossopteris*. However such an identification must be considered carefully when the age and geographic position of the localities is taken into consideration.

It has been suggested (Edwards, 1955) that in order to establish the relationship of anomalous Glossopterid leaves to *Glossopteris* it is necessary to demonstrate their association with a characteristic reproductive structure. However, nearly all of the vast numbers of leaves which have been identified as *Glossopteris* both before and after 1955 are impressions showing only leaf shape and venation. Attempts are being made to make *Glossopteris* a more satisfactorily known genus. The cuticle of a few species have been described (Pant & Gupta, 1969) and we know but do not yet completely understand the reproductive organs of others (Plumstead, 1956; Holmes, 1974; Gould & Delevoryas, 1977). Nevertheless, the great majority of species are still like the present fossils at the first stage of knowledge and they would be placed in *Glossopteris* with little hesitation except that they occur outside of what are thought to be the boundaries of Gondwanaland and in addition they are too young, Late Triassic or Early Jurassic instead of Permian to Early Triassic in age.

The *Glossopteris*-like leaves from Honduras do look like some of the figures of *G. browniana* and *G. communis* given by Plumstead (1962, pls. 5, 8). They also resemble very closely some specimens of *Mexiglossa* from the Middle Jurassic in south-eastern Mexico in that they have about the same shape and proportions, anastomosing lateral veins and broad midribs which do not show any anastomosing veins. The lateral veins in the Honduran fossils, however, lie at a slightly more acute angle to the midrib than in *Mexiglossa*. The Honduran leaf illustrated here in Pl. 1, fig. 3 does look very much like the base of the specimen of *Mexiglossa varia* given by Delevoryas and Person (1975, pl. 2, fig. 1). That particular specimen of *Mexiglossa* is larger than the Honduran fossil but it and all the other *Glossopteris*-like leaves described here from Honduras do fall within the size range of *Mexiglossa* (Delevoryas & Person, 1975, p. 118).

The *Glossopteris*-like leaf from Sonora, Mexico looks very much like the figure of *Glossopteris* sp. given by Maheshwari (1965, pl. 1, fig. 3) from the Lower Gondwana of India. It also looks like the leaf called *G. indica* by Saxena (1963, pl. 1, fig. 3) from the Permian of India. The fossil compares fairly closely with some of the specimens of *Mexiglossa* given by Delevoryas and Person (1975, pl. 2) except that midrib is made up of several veins in the fossil from Sonora and is not just a groove. Also the lateral veins lie at a more acute angle in the Sonoran fossil than in *Mexiglossa*.

Several other genera in addition to *Glossopteris* must be compared with the present fossils as a few somewhat similar leaves are known, including *Tatarina*, *Pursongia*, *Zamiopteris*, and *Glossopteropsis* from the Permian of Russia (Meyen, 1969b). All of these have essentially the correct shape but they lack a midrib and anastomosing lateral veins; evidently they are unrelated to the present fossils. *Plaeovittaria* also from the Permian of Russia and *Linguifolium* from the Triassic of Australia, New Zealand, Chile, and Argentina have the correct shape and midrib but the lateral veins of these fossils do not anastomose. They might be thought to be isolated leaflets of *Sagenopteris* as they do have the same general shape, midrib, and venation although the venation does differ in detail. Also the fossils are more or less symmetrical whereas in *Sagenopteris* the pinnae are asymmetrical with the midrib lying closer to one side of the leaf than the

other. Finally neither a complete *Sagenopteris* leaf or other parts of the *Caytonia* plant are known to occur in either the Santa Clara or El Plan Flora. *Anthrophyopsis* from the Triassic of Greenland, Australia and elsewhere is another possibility as it has a midrib and anastomosing veins. The shape, however, is different as *Anthrophyopsis* has a cordate base and a broad lamina that apparently was thick and coriaceous. Also in that genus the veins are at nearly right angles to the midrib and the anastomosing of the veins occur in the marginal area of the lamina. As a result the vein meshes are large and well spaced, not small and irregular. It appears that none of the fossils listed here are related to the fossils described by Newberry so many years ago from northern Mexico and Honduras.

CONCLUSION

The *Glossopteris*-like leaves from Honduras are here called *Mexiglossa varia* because they resemble that leaf fairly closely. The *Glossopteris*-like leaf from north-western Mexico is here called cf. *Glossopteris* sp. That fossil would be placed in *M. varia* but has a midrib composed of several veins which may anastomose whereas that structure is a simple groove in *M. varia*. To place the Mexican fossil into *Mexiglossa* would clearly expand its definition so that age would be the only obvious character separating it from *Glossopteris*.

The occurrence of *Mexiglossa varia* in the Late Triassic or Early Jurassic of Honduras provides a link between the typical *Glossopteris* of the southern continents and *Mexiglossa* in the Middle Jurassic of southern Mexico. The significance of the *Glossopteris*-like leaf in the Upper Triassic or Lower Jurassic of north-western Mexico is a bit difficult to access. It too may actually represent *Mexiglossa* or possibly some other *Glossopteris*-like leaf and not *Glossopteris*. In any case the fossils described here indicate that plants bearing *Glossopteris*-like leaves, whatever their affinities, were widespread in the Early Mesozoic of Mexico and vicinity.

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EXPLANATION OF PLATE

PLATE 1

Glossopteris-like leaves from the Late Triassic-Early Jurassic of Sonora, Mexico and the San Juancito area, Honduras.

1. cf. *Glossopteris* sp. from Sonora, Mexico, XI, NYBG 9252G.
2. Counterpart of 1, XI, NYBG 9252A.
3. Base of *Mexiglossa varia* from San Juancito area, Honduras, XI, NYBG 9119.
4. Apical region of *Mexiglossa varia* from San Juancito area, Honduras, XI, NYBG 9112.

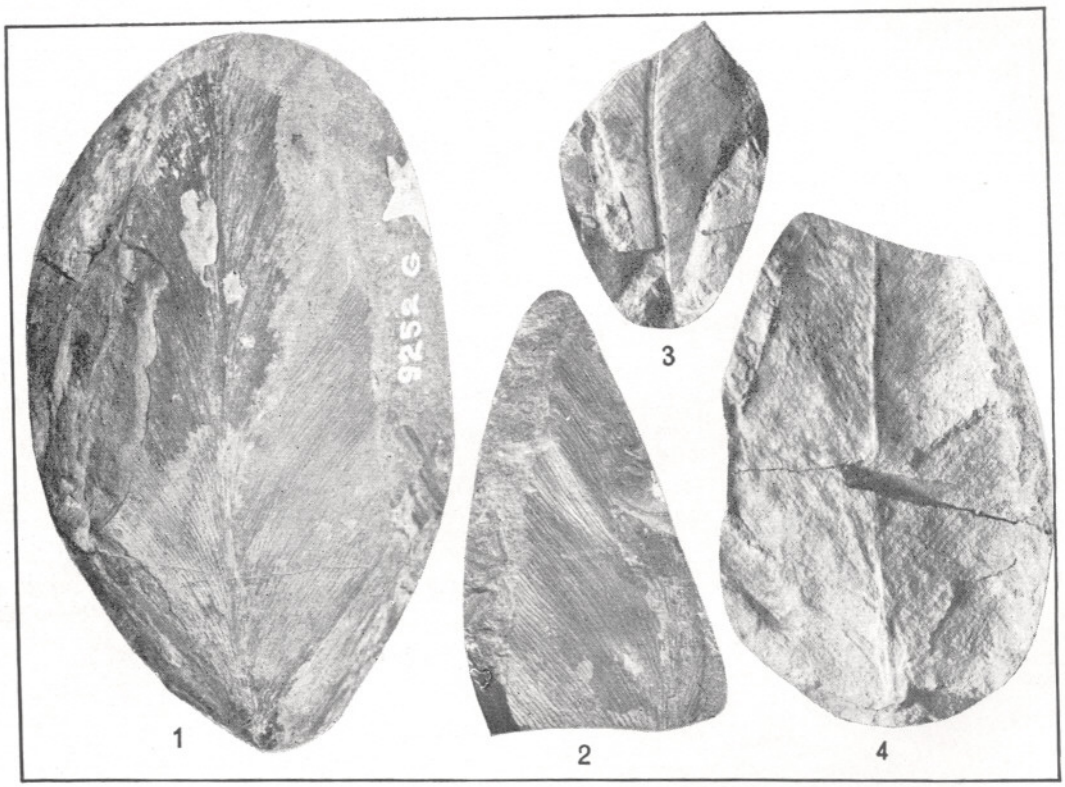

PLATE 1