A Fossil Nutmeg From the Tertiary of Texas*

By Edward Wilbur Berry

THE Nutmegs, with somewhat less than 100 existing and widely distributed tropical forms, constitute the family Myristicaceæ of the order Ranales. Satisfactorily determined fossil forms are entirely unknown so that the remains which form the subject of the present paper are not without interest.

These are found in the Catahoula formation of Trinity County in eastern Texas from which I described the fruits of a date palm some years ago,¹ and were collected by Charles Laurence Baker. The matrix of this material was the basis for a highly interesting study of the petrography of the Catahoula sandstone made by M. I. Goldman² and published in this Journal in 1915. The evidence of the flora and that furnished by the study of the sediments supplement one another in throwing considerable light on the physical conditions of Catahoula time which will be referred to on a subsequent page.

The fossil species of nutmeg, obviously new, is represented by characteristic remains of the pericarp and of the seeds. It may be described as follows:

MYRISTICA CATAHOULENSIS, SP. NOV.

Pericarp broadly ovate, slightly longer than wide, approximately circular in cross section, thick, two-valved, about 5cm in length and 3.75cm in diameter, enclosing a single large seed. The aril either decayed before fossilization or became separated from the seed and was not preserved in the same deposit and the perisperm is likewise missing. The seed is large, circular in cross section, evenly rounded proximad and shows a distinct hilum. It is slightly narrowed and bluntly pointed distad. The surface is ornamented by numerous irregular longitudinal corrugations marking the ruminating endosperm. These markings are in faint relief and much less prominent than the corresponding markings of the commercial nutmeg, due in a measure to the fact that fossils are all casts in a somewhat porous sandstone. Similar artificial casts of the strongly marked commercial nuts are scarcely to be distinguished from the fossil casts. The nuts, of which several have been found, are about 3cm in length by 1.7cm in maximum diameter, which is midway between the apex and the base.

This species is based on the single valve of the pericarp and on the partial remains of several of the nuts discovered, only one of which is perfect. The nuts were apparently relatively abundant, but since they were only discovered in the weathered sandstone there are few that are reasonably complete although there are several showing parts of the sides or ends, in some cases half complete.

As I have mentioned, all the plant remains at this locality are in the form of casts and the nuts must have been buried by wind-blown sand since they lie in the sand at all angles. The æolian character of the sandstone at this outcrop is of the greatest importance in explaining the absence of both aril and perisperm, and is, therefore, deserving of comment. The evidence for this conclusion is derived from several sources. Many of the leaf specimens are curled and not flat as they would almost invariably be if laid down in water. These and other associated nuts are jumbled in a confused mass at all angles. Violent currents could form such a jumble, but the nuts would not be heavy enough to be deposited under such conditions but would be carried away by water action strong enough to stand them on end, nor would water-logging in more quiet waters explain their varying positions. Associated with nutmegs are much more numerous large-ribbed nuts as yet unidentified. These lie at all angles in the sandstone but occur elsewhere in clays, in which case they invariably lie on their sides. The conclusions of Dr. Goldman, based on a petrographic study of the matrix, i.e., the proportion of different sizes of grains present, their rounding, the ratio of feldspar to quartz, the degree of weathering, absence of clay, proportion of heavy minerals, etc., for a detailed discussion of which the reader is referred to the paper cited, point to strong æolian action in a hot arid climate.

The nuts are fully matured and evidently were shed naturally and at no great distance from the sand flats where they subsequently became entombed. The sediments do not, according to Dr. Goldman, show characters of dune sands, and I infer that the winds which rounded and sorted the sand grains were not constant enough in direction to form dunes of any size. Under such conditions of blowing about the arils would soon

be lost, but the perisperm cannot be conceived of as being so readily dissipated although I know of no other method to account for its absence. It must be remembered that less than a dozen nuts are known, that much of the sand from near-by outcrops appears to

Cross section of poplar wood, showing the character of diffuse porous woods.

Cross section of fir, showing the character of non-porous woods.

Transverse section through a blaze on Douglas fir laid on since tree was blazed 30 years ago.

Transverse section through the stem of lodgepole pine, showing the healing over of an amputated branch.

have been blown into pools of standing water where the accompanying leaves were fossilized in a normal flat condition, and that the small percentage of nutmegs preserved in the wind-blown sands may thus be exceptional when the possibility is considered of large numbers fossilized in a normal way with perisperm intact.

That the fossils are unmistakably those of a species of *Myristica* I think no botanist will dispute. No leaves that I can identify as those of *Myristica* have as yet been determined, but the leaf material is scanty, and I have not enough recent material of this genus for intelligent comparison of the foliar organs.

The recent species of this family which number about 90 forms are variously treated. De Candolle³ referred them all to the single genus *Myristica* which he segregated into 13 sections, and this is the method followed by Prantl⁴ in *Die Natürlichen Pflanzenfamilien*. Other authors raise a number of these sections to generic rank, quite rightly so it seems to me. I have, however, preferred to refer the fossil to *Myristica* since comparative recent material for closer discrimination is lacking. The nutmeg of commerce belongs to the section *Eumyristica* with about 15 existing species of the Asiatic tropics. It is a small tree, endemic in the Moluccas and has long been under cultivation judging both from the numerous varieties extant and the historical records, since Europe has been receiving nutmegs from this region, beginning with the trade through the Arabs in the 6th century. The nutmeg has been introduced into other East Indian islands as well as on Bourbon, Mauritius, Madagascar and in tropical America, usually with indifferent success.

While the Texas fossil is much like the commercial nutmeg in size and characters it is also similar to existing American species, of which there are about twenty-five. These are mainly South American, but the sections or genera *Virola* Aublet and *Compsonura* De Candolle both occur also in Central America. The fossil nuts are remarkably like those of *Myristica* (*Compsonura*) *costaricensis* Warburg, but the pericarp is much larger and more massive.

Beyond the fact that they are tropical I know little regarding the habitat of the recent species. Many are certainly insular and coastal forms, their range in the Pacific extending eastward to the Fiji, Tonga and Samoan islands, the former having 4 or 5 species. Schimper records 4 species in his Indomalayan strand flora. *Myristica subcordata* Blume of New Guinea and *Myristica littoralis* Miquel of Java are both members of Barringtonia or beach-jungle association. Both Gaudichand and Guppy record unopened *Myristica* fruits in the Pacific sea-drift although their floating powers are not great and they are normally dispersed by fruit pigeons (Moseley, Hemsley, Guppy).

Referring to the foliage it may be noted that contrary to the opinion of Hooker and Thomson (*Flora Indica*), De Candolle found that the flowers and fruits were much alike throughout the family and that the leaves furnish the most useful characters for differentiation, especially in their venation, and this opinion was also shared by Miquel. It would seem that the lack of comparative material has hitherto prevented the recognition of fossil foliage of *Myristica*. Certainly no definite evidence of extinct species has heretofore been published although the distribution of the existing species in tropical Asia, Africa and America is convincing enough evidence that the group had an extensive, even if unknown, Tertiary history. The only previously known fossil records are based on a very few and indifferently characterized leaf impressions from the Miocene of Labuan (Borneo) described by Geyler⁵ as *Myristicophyllum majus* and *minus*, and by equally unconvincing leaf fragments described by Engelhardt as *Myristica fossils*⁶ and coming from beds in Ecuador and Chile considered to be either Eocene or Oligocene in age.

On the other hand, the family Anonaceæ, which is closely related to the Myristicaceæ, is represented in the fossil record by over a score of species of *Anona*, *Asimina*, *Guatteria*, etc., ranging in age from the early Upper Cretaceous through the Tertiary. Both *Anona* and *Asimina* are represented in the Lower Eocene flora of the Mississippi embayment area.

Myristica catahouleensis comes from a cut on the International and Great Northern Railroad in southern Trinity County, where a spur to the Government lock leaves the main line, and the Catahoula formation in this area is either late Eocene of early Oligocene in age. The flora is a coastal one and strictly tropical in character.

³Ann. Sci. Nat., 4th ser., Bot. tome iv, pp. 20-31.

⁴Teil III, Abth. 2, 1891.

⁵Geyler, *Vega Exped.*, vol. iv, p. 498, pl. 23, figs. 3-6, 1887.

⁶Abh. Senck. Naturf. Gesell., xvi, Heft 4, 1891, p. 663, pl. 6, f. 9, pl. 7, fig. 12, 1891. *Ibid.*, xix, p. 13, pl. 1, f. 21, 1895.

*Am. Journal of Science.

¹Am. Journal of Science (4), xxxvii, pp. 403-406, 1914.

²Ibid., xxxix, pp. 261-287, 1915.