

P-273



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EOCENE PLANTS FROM RESTIN FORMATION
 OF PERU

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In 1926 I described¹ some calcified palm-nuts from the Eocene strata of northwestern Peru, which I referred to the genus *Astrocaryum*. At that time the horizon from which they came was known as the Lobitos formation.² The Lobitos formation, which was named by Bosworth, has since been segregated into several formations, and the lower part containing the fossil plant material being now known as the Restin formation.

According to the statement of Iddings & Olsson³ the Restin formation constitutes the top of the middle Eocene in northwestern Peru, and is separated from the upper Eocene by an erosional unconformity. It is named from Restin, a locality on the west coast about 27 miles north of the locality from which the fossil plants were collected. At the type-locality the Restin beds are largely dark-colored, highly fossiliferous sandstones and shales, becoming more sandy to the northward and more shaly southward.

South of Talara the formation is predominantly shale containing thin lenses of limestone, sand, and conglomerate, weathering in light colors, and from 400 to 1100 feet in thickness. It contains a considerable molluscan fauna, which has been described by Olsson.⁴

¹ Proc. U. S. Natl. Mus., Vol. LXX, Art. 3, 1926.

² Geol. Tertiary and Quaternary Periods in Northwest Part of Peru, London, 1922.

³ Bull. American Assn. Petroleum Geol., Vol. XII, pp. 15-16, 1928.

⁴ Bull. American Paleont., Vol. XIV, No. 52, 1928.

The lower shales contain a profusion of small foraminifera, which have been described by Willard Berry.⁵

The plant locality, which I visited in 1927, is a hillside exposure just south of Punta Arena on the coast and south of the Talara tunnel. The materials are light-colored clays and sands, from which a few marine invertebrates, quantities of palm-nuts, and fragments of small twigs and branches of calcified (not silicified, as stated by Iddings & Olsson) wood up to 3 or 4 centimeters in diameter weather out.

No specimens of the wood are sufficiently well preserved for generic determination, consequently no sections have been cut. One fragment in the collection shows dicotyledonous structure; another is monocotyledonous and is probably palm-wood; but the majority are practically structureless. One shows *Teredo* boring. These beds also contain quantities of clay-galls a centimeter or two in diameter, usually with a calcareous crust, and some of these closely simulate seeds or fruits (figures 1 and 2).

The most abundant fossils are the nuts of an *Attalea* palm. These are of all sizes, are frequently much deformed, and show no internal structure. In addition to *Attalea*, the fruit of an *Iriartealike* palm is sparingly represented, and a single specimen is believed to be that of the Euphorbiaceous genus *Jatropha*.

The abundance of *Attalea* nuts throughout the section appears to me to indicate a great abundance of palms along the Eocene coast of northwestern Peru. In the paper previously alluded to I indulged in some speculations as to whether these palm fruits were endemic in the region, or had drifted from the coastal region farther north, or had been brought down to the coast from the interior of the country by streams. I believe that the parent trees grew in the vicinity of where the fossils are found, and the probability of this conclusion is heightened by the great variety and abundance of arborescent forms that occur at Belen which is a few miles farther south and at a horizon which is either slightly older or slightly younger than the Restin horizon.

*Attalea Olssoni*⁶ (Berry), figures 4 to 10. This species was described by me in 1926 and referred to the genus *Astrocaryum*. At that time I had only a few specimens which had been sent to me by Dr. A. A. Olsson of the International Petroleum Company,

⁵ *Eclogæ geologicæ Helveticæ*, Vol. XXI, pp. 130-135, 1928.

⁶ *Proc. U. S. Natl. Mus.*, vol. LXXX, Art. 3, p. 1, pl. 1, figs. 1-4, 1926.

Ltd., and the species was named in his honor. During 1927, in company with my sons, I collected in the area, and secured a large amount of material. This adds but little to the knowledge of the present species beyond illustrating the large amount of variation in the form and size of these fruits, but shows that they had a basal peduncle and lacked the three germinating pores so characteristic of *Astrocaryum*. The accompanying figures, together with those previously published, will give an adequate idea of the range of variation.

Among the twenty-five or more existing species of *Attalea* I have seen fruits of only *Attalea cohune* Martius, *Attalea gomphococca* Martius, and an unnamed species from Colombia, so that I am not prepared to make adequate comparisons with recent forms. The slightly larger fruits of the first named are, superficially at least, exceedingly similar to the fossil. *Attalea* is unknown in the fossil state except for a form, quite different from the present fossil, discovered recently in the Ocala limestone of Florida. In the existing flora species of *Attalea* are found from Costa Rica and the Antilles to the Amazon basin, to which region they are now confined. None are known from the country lying to the west of the front ranges of the Andes in Peru.

Iriartites restinensis Berry, *n.sp.* (figure 3). An asymmetrical nut, narrowed to the truncately pointed peduncular base, and unsymmetrically inflated distad to the broadly rounded apex. About 2.5 centimeters long; 1.9 centimeters in maximum, and 1.5 centimeters in minimum, equatorial diameter. Surface reticulately lined. No trace of germinal pore visible.

The species is based upon the single specimen figured, which is quite inadequate for a complete characterization. It is referred to the form genus *Iriartites*, which genus includes three previously named species, one based upon a nut from Miocene beds of the Canal Zone, Panama,⁷ and the other two based upon foliage from lower Miocene strata of northwestern Peru,⁸ and Pliocene beds of Bolivia,⁹ respectively. Hollick¹⁰ has recently described a nut from the Tertiary rocks of Porto Rico which he calls *Iriarteia collazoensis*. In his discussion of this species he seems to imply criticism of my

⁷ Proc. U. S. Natl. Mus., Vol. LIX, p. 21, figs. 1-3, 1921.

⁸ *Idem.*, Vol. LV, p. 285, pl. 14, 1919.

⁹ Johns Hopkins Univ. Studies in Geology, No. 4, p. 167, pl. iii, fig. 2, 1922.

¹⁰ N. Y. Acad. Sci. Scientific Surv. Porto Rico, Vol. VIII, pt. 3, p. 187, pl. lvi, fig. 1, 1928.

having referred both fruits and foliage to the same genus. If Iriartites were a real genus and not a convenient designation for fossil palm-remains believed to belong to the tribe Iriarteæ I would entirely agree with him; but since we are forced to use such form genera in dealing with incomplete fossils, it seems to me to be better practise not to multiply vagueness, since all palms have both foliage and fruits, and it is a simple matter to re-name any of these species so soon as there are any evidences for definitely referring them to one of the existing genera of the tribe.

The genus Iriarteæ, to which the present fossil species may possibly belong, consists of about a dozen existing species, ranging from Costa Rica to Colombia and southward east of the Andes to Bolivia and Brazil.

Carpolithus jatropaformis Berry, *n.sp.* (figures 11 and 12). A single somewhat deformed specimen from the Restin formation is strikingly like a large capsule of *Jatropha*, of which a well characterized, silicified species has been discovered at the near-by locality of Belen. The present specimen is referred to the non-committal genus *Carpolithus*, because it fails to exhibit any conclusive features which would exclude it from the family Arecaeæ. I am confident that it does not represent a nut of *Elæis*, in which genus the stones are trilobate ditsad and pored, since in the present fossil the three seeds appear to be entirely separated from one another. It might possibly be a dwarf, three-seeded *Attalea*, although this genus usually has six-seeded nuts, and the partitions between the seeds in the fossil have the appearance of capsular partitions rather than the fibrous ground-mass of a palm-stone.

The present specimen can not be adequately described, but it may be incompletely characterized as follows: Capsule (?) a somewhat prolate spheroid, about 2.5 centimeters in length and 1.8 centimeters in maximum diameter. With three cavities. Walls and partitions about a millimeter in thickness and apparently composed of dense tissue. Seeds three in number, one in each cavity, shaped like a large coffee bean, *i.e.*, sub-hemispherical with the inner face flat, or somewhat concave. The seeds are large, full and rounded on the outside, and broadly rounded at one end, the other ends being concealed. About 2 centimeters in length; 1.1 centimeters in maximum width; and 6 or 7 millimeters in maximum thickness. These seeds and the whole organization of the fruit are exceedingly like that of the genus *Jatropha*.



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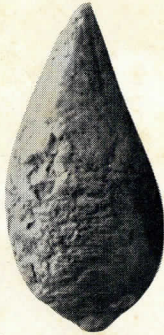
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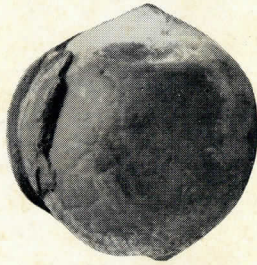
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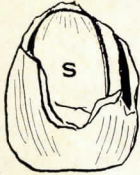
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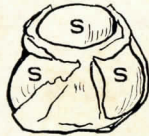
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