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COCOS AND PHYMATOCARYON IN THE PLIOCENE OF NEW ZEALAND.

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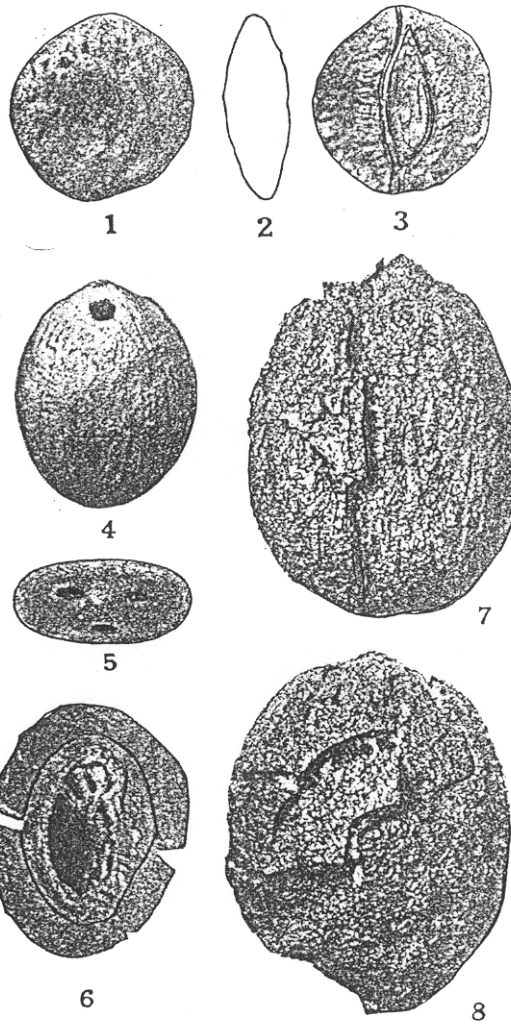
During the summer of 1924, Mr. John A. Bartrum of University College, Auckland, New Zealand, sent me a collection of fossil fruits obtained at Mangonui, North Auckland. Other duties have delayed the study and description of these interesting forms until the present time. I am greatly indebted to Professor Bartrum for the opportunity of studying this material.

Shortly after the sending of these fossils an article appeared in the New Zealand Herald Supplement of June 27, 1924 which stated that specimens from the same outcrop had been submitted to Professor F. W. Oliver of University College, London, who stated that they represented a palm allied to *Cocos nucifera*. The article also states that specimens of the same or an allied species, found at Oamaru, are in the Canterbury Museum.

The collection in my hands is of very great interest in view of the divergent views among botanists regarding the place of origin and the paths of dispersal of the Coconut palm, and also from the fact that a second fruit in the collection has a somewhat precise bearing on the age of the deposits at Mangonui. The palm fruit shows no features by which it can be differentiated from the existing genus Cocos. It may be described as follows:

Cocos zeylandica Berry, *n. sp.* Figs. 4-8.

Nut (seed) of relatively small size, originally a prolate spheroid, but invariably flattened as preserved, with the following dimensions: Length about 3.5 centimeters, maximum diameter 2.5 centimeters, minimum diameter 1.3 centimeters. The "nuts," which apparently had lost their husks before being covered by sediments, are more flattened and slightly smaller than those preserved with more or less of the husk, since a



Figs. 1-3.—*Phymatocaryon bivalve* von Mueller.
1.—Surface view. 2.—Profile. 3.—View of interior of one of the valves.

Figs. 4-8.—*Cocos zeylandica* Berry, n. sp.
4.—Side view of seed.
5.—Proximal view of seed showing foramina and amount of compression.
6.—View of median section showing husk and contained seed.
7, 8.—Side views of compressed and more or less macerated husks.
All of the specimens are from the Pliocene of Mangonui, North Auckland.

transverse section of one of the latter shows the contained nut with maximum and minimum diameters of 2.75 and 2 centimeters respectively. That the original cross section was approximately circular is not an inference, but is checked by the compression of the pores of the seed coat in the same plane as the compression of the whole. Approximately the same degree of compression is shown by the associated lignified twigs in the collection.

The preservation of the naked nuts is also different from those in their husks, the latter being impregnated with pyrite, rendering them exceedingly impermanent unless kept submerged in fluid lacking oxygen. The three sub-equal and typical foramina are about 7 millimeters apart and equally spaced around the bluntly pointed proximal end; they were approximately round and about 3 millimeters in diameter. The shell consists of elongated fibrous cells and is about 4 millimeters thick in the equatorial region. Several pyritized specimens with their enclosing husks are in the collection. These were somewhat oxidized when received and in no case are they entirely complete. They are less compressed than the isolated "nuts," are prolate spheroidal in shape, and were from 5 to 5.5 centimeters in length, and about 3.75 centimeters in diameter.

The husk is of the typical loosely fibrous *Cocos* type and is, as preserved, 5 millimeters thick, although the outer surface appears to have been more or less eroded before fossilization. There are indications that the distal end was bluntly pointed and that the proximal diameter was somewhat greater than the equatorial diameter.

What might represent this species, and doubtless the material referred to in the newspaper article as preserved in the Canterbury Museum, is figured by Park in his Geology of New Zealand[1] after Hector, as coming from the browncoal or Kaikorai beds in the Oamaru district of New Zealand. This figure was probably taken from one of the unpublished plates illustrating the browncoal flora prepared by Hector.

The second type of fruit in the collection from Mangonui cannot be distinguished from the form described from the auriferous drifts of Australia by Ferdinand von Mueller as *Phymatocaryon bivalve*.[2] One of the specimens from Man-

[1] Park, Jas., The Geology of New Zealand, Fig. 58-3 on page 124. Melbourne and London, 1910.

[2] Mueller, Ferd. von., Ann. Rept. Dept. Mines, N. S. Wales, p. 170, pl. 3, figs. 2, 1878; Geol. Surv. Victoria, p. 9, pl. 15, figs. 6-9, 1883.

gonui is shown in Fig. 1, and an interior view of one of the valves showing a seed on one side and the aborted seed cavity on the other is shown in Fig. 3. These fruits are thoroughly lignified and much compressed, although they were clearly not spheroidal in life, and all the specimens are compressed in the same plane, indicating a naturally elliptical or lenticular cross section. The present specimens add nothing to von Mueller's account of the Australian specimens. The botanical position *Phymatocarpon,* despite its apparently characteristic organization, is entirely problematical.

The Kaikorai beds of New Zealand which contain the browncoal in the Oamaru district are considered by Park to be of Miocene age. Marshall, in his account of the geology of New Zealand, considers that the so-called Oamaru system represents all of the pre-Pliocene Tertiary of New Zealand. I cannot say whether or not the beds outcropping at Magonui, North Auckland, should be correlated with the Kaikorai beds of the Oamaru district, but it would certainly seem that if the auriferous drifts of Australia are Pliocene, as they are generally considered to be, then the Mangonui beds from which these fossil fruits were collected are also Pliocene in age.

Most botanists have accepted the verdict of DeCandolle that the coconut palm was of Asiatic or Polynesian origin, in spite of the fact that all the other existing species of *Cocos* and allied genera, except a single West African species of *Elaeis,* are natives of America. Grisebach was a believer in the American origin of the coconut, and more recently O. F. Cook has marshalled a vast amount of evidence in support of this view.[3] There is no need of attempting a summary of the evidence here since it is given in great detail in the papers cited.

Nor does the existence of a fossil species in the late Tertiary of New Zealand necessarily have any conclusive bearing on the question, other than to place the origin and dispersal of the genus in a far more remote period than students of recent floras have realized, and effectively precluding the agency of primitive man in its original distribution, although that agency at a much later time may be responsible for the present distribution of the coconut as a food crop.

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[3] Cook, O. F., The Origin and Distribution of the Cocoa palm. Cont. U. S. Nat'l. Herbarium, 7, No. 2, 1901; Idem., 14, Pt. 2, 1910.

NOTES ON CYCLOCERAS AND ASSOCIATED GENERA.

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It is evident to anyone who has attempted to identify annulated orthoconic cephalopods, particularly from the Carboniferous, that the genera *Cycoceras* and *Protocycloceras* are poorly defined, hence unscientifically employed. In this paper the present status of these generic terms is indicated and redefinitions are proposed.

In 1844 McCoy[1] erected the genus *Cycloceras* to include "those conical species marked with prominent concentric rings, and having the surface frequently sculptured with transverse scaly laminae, and often decussated; siphuncle dorsal." Although McCoy did not indicate a genotype, there were listed from the Carboniferous of Ireland three species of this genus, *Cycloceras annulare* McCoy, *C. laevigatum* McCoy, and *C.* (*Orthoceras*) *lineolatum* (Phillips). Griffith,[2] in 1860, also used the generic term *Cycloceras* in describing *C. laevigatum,* but in 1878 Bigsby[3] referred the same species to *Orthoceras* and apparently McCoy's genus was little known. Hyatt,[4] however, in 1883, redescribed *Cycloceras* as "transversely striated Paleozoic longicones, which at some stages of growth have annular costae. The young are invariably smooth, that is, marked only by transverse striae of growth, as in *C.* (*Orthoceras*) *agassizi,* sp. Barr., and the annulations are subsequently introduced. It includes group 9 of M. Barrande. Sil., Dev., and Carb."

In other words, *Cycloceras,* as first amended by Hyatt, was identical with the original *Cycloceras* of McCoy. But later, in 1899, Hyatt[5] erected the new genus *Protocycloceras* which he described as: "Annulated orthoceracones and cyrtoceracones without longitudinal ridges. Siphuncle large. Type *P.* (*Orthaceras*) *lamarki* sp. Billings. Ordovician." At the same time he limited *Cycloceras* to those forms with discontinuous longitudinal ridges, and gave their range as Ordovician to Permian.

It is no doubt this citation to which Girty refers in the following discussion of annulated cephalopods from the Wewoka

[1] McCoy, Fos. Carb. Ire., 6, 1844.
[2] Griffith, R., Jour. Geol. Soc. Dub., 9, 55, 1860.
[3] Bigsby, J. J., Thesaurus devonico-Carboniferous, 343.
[4] Hyatt, A., Proc. Bos. Soc. Nat. Hist. 22, 275.
[5] Hyatt, A., Eastman-Zittel Textbook of Paleontology. First Ed., 1899.