

As I treat elsewhere¹ of the details of the correspondence between the various Graptolitic zones of Britain and foreign countries, it will be unnecessary for me to go more fully into the subject in this place. I trust, however, that the foregoing sketch will make it evident how greatly geologists are indebted to the author for the wide extent and minute accuracy of his researches, and the cautious and conscientious manner in which he has drawn his important and far-reaching generalizations.

(To be concluded in our next Number.)

NOTICES OF MEMOIRS.

REPORT ON THE FOSSIL FLORA OF SHEPPEY.² By Dr. CONSTANTIN BARON ETTINGSHAUSEN, Professor in the University of Graz, Austria.

ONE of the most important, if not the most important, locality for the Eocene Flora of Great Britain, and perhaps of the Tertiary formation generally, is the London Clay of the Isle of Sheppey, in which are found great numbers of plant remains belonging to many different kinds of fossil fruits and seeds. After an examination of the rich collection in the British Museum, I feel now sure that we possess, in the fruits and seeds of Sheppey, the key to a more precise determination of many of the genera and species of fossil plants which in other localities are known only by their leaves.

The literature of the Sheppey fruits is not very extensive; a detailed account of all the works relating to it is published in the Palæontographical Society, 1879, p. 11, Mr. Gardner's "Introduction to our Monograph on the British Eocene Flora." The only work on this subject with scientific determinations, and which need here be referred to, was published in the year 1840 by James Scott Bowerbank, and is entitled "A History of the Fossil Fruits and Seeds of the London Clay." He enumerates twelve genera, which are divided by him into nine families. The genera are as follows: *Nipadites*, *Hightea*, *Petrophiloides*, *Cupressinites*, *Cupanoides*, *Tricarpellitites*, *Wetherellia*, *Cucumites*, *Faboidea*, *Leguminosites*, *Mimosites*, *Xulinosprionites*. Of these only one (*Nipadites*) belongs to the Monocotyledons, and one (*Cupressinites*) to the Gymnospermæ, while the rest are Dicotyledons.

I am now able materially to advance the knowledge of this Flora. Since my investigation in the course of the winter 1878-9, at the British Museum, I have ascertained that the Fossil Flora of Sheppey contains, including those above mentioned, at least 72 genera and 200 species, which may be distributed into 41 families. Of these genera one belongs to the Thallophyta, 7 to the Gymnospermæ, 18 to the Monocotyledons, 43 to the Dicotyledons, and 3 are indeterminate.

The existence of this Flora and generally of the Eocene Flora of Great Britain required, we believe, at least, a sub-tropical climate. This

¹ *Lapworth*.—Geological Distribution of the Rhabdophora, *Annals and Mag. Nat. Hist.* 1879.

² Abstract of the Proceedings of the Royal Society, Nov. 27, 1879.

is indicated by many of the Ferns and Palms, and by the Musaceæ, Pandanæ, Cinchonaceæ, Loganiaceæ, Sapotaceæ, Ebenaceæ, Büttneriaceæ, Sapindaceæ, etc.

Only a part of the fossil fruits and seeds of Sheppey can be placed in living genera; but with regard to the rest, forming a considerable proportion, it has been found impossible, notwithstanding a careful comparison. I therefore assume that some of the fruits and seeds belong to genera which no longer exist in the present Flora of the world. In several of these extinct genera, however, I recognize their affinity with living genera, or at least determine the family to which they belong. I have expressed this in the name of the genus. But with many even that was impossible, and these I have placed in the mean time under the provisional name *Carpolithes*. It is an important fact that the number of such extinct forms is relatively much larger than it is in any of the already known Miocene Floras. I have also discovered fruits, but chiefly leaves, belonging to many of the genera of the Sheppey Flora in the Fossil Floras of Bournemouth and Alum Bay in the collections of the British Museum, and that of Mr. John Starkie Gardner, indicating that in age these are not far removed. It is well known that the Sheppey Flora preceded the other two. The genera which, I feel sure, are common to Sheppey and Bournemouth are: *Sphæria*, *Sequoia*, *Cyperites*, *Smilax*, *Sabal*, *Iriarte*, *Aronium*, *Quercus*, *Juglans*, *Liquidambar*, *Proteoides*, *Laurus*, *Nyssa*, *Cinchonidium*, *Apocynophyllum*, *Sapotacites*, *Diospyros*, *Magnolia*, *Acer Sapindus*, *Cupania*, *Eugenia*, *Eucalyptus*, *Metrosideros*, and *Bauhinia*.

I believe that even some species of these genera are the same in both Floras. It is surely probable that the fruits and seeds of Sheppey were related to the leaves found at Bournemouth and Alum Bay; and it would be, therefore, undesirable always to propose separate specific names for the related fossils found in these different localities.

Among the plant-fossils of Bournemouth and Alum Bay I also found many leaves which I could not class with existing genera. There is probability that these partially correspond with the extinct fruit- and seed-genera of Sheppey.

Before I enumerate the genera and species of the Fossil Flora of Sheppey, I have to remark as follows:—

Amongst the Sheppey fossils are now and then found fragments of the basis of the leaf of a Palm, probably of *Sabal major*. On such a fragment I found the apothecia of a *Sphæria*. Of the Gymnospermæ of Sheppey there were found fruits and seeds of the *Sequoia Bowerbankii*, also fragments of twigs. The seeds of the *Cupressinæ* and *Abietinæ* had lost their wing-like expansions, which shows that the fruits and seeds of Sheppey were carried some distance in water, consequently their delicate membranous wings were injured and broken off by rubbing. There are therefore no perfect winged fruits and seeds to be found. In fact, even the firmer wings of the *Acer*-fruit have been entirely lost, and it is impossible to determine the species of the *Acer*-nucules, which remains.

The appearance of the *Salisburia* seeds is interesting. They are very remarkable for their sharp, prominent edge. The easily-

determinable leaves of this genus have not as yet been found in the Eocene Flora of Great Britain.

The *Agave* is indicated by a valve of its fruit; *Smilax*, of which leaves are not unfrequently found at Bournemouth, is indicated by a berry. Of *Musa*, of which only leaves had as yet been found, there are seeds. Of *Anomum*, two kinds of fruit have been found. These have hitherto been mistaken for smaller fruits of the *Nipadites*. Of particular interest are the many species of Palms. The fruits and seeds of some, for instance, *Sabal major*, *Trinax Bowerbankii*, *Elæis eocenica*, *Iriartea striata*, *Livistona eocenica*, have been found. Of the *Sabal* and *Iriartea* the leaves are found at Bournemouth. The *Elæis eocenica*, the most common Palm of the Sheppey Flora, is nearly allied to the *E. melanococca*, and the *Livistona eocenica* to the *L. chinensis*.

I do not yet know whether the *Aroidea* seed, which I have placed in *Aronium*, might be united with the *Aroidea* leaf of Bournemouth. On the other hand, I think it is very likely that some of the kinds of oak fruits correspond with some of the kinds of oak leaves, which are to be met with at Bournemouth. Two of the Bournemouth species are also found in the Miocene Flora, and one of these, *Quercus lonchitis*, also in other Eocene Floras.

A small nut shows all the characters of the *Corylus*, which is found in the Miocene Flora. The absence of *Fagus* is very remarkable, as two kinds of leaves, which can only belong to this genus, have been found in Bournemouth. *Fagus* is frequently found in the Miocene and Post-Tertiary formations, and also in the Cretaceous formation, and I believe, therefore, that it may still be found in Sheppey.

The fruit of *Liquidambar* from Sheppey may belong to the same species as the inflorescence of *Liquidambar*, which I found amongst the fossils of Bournemouth. The berry of *Laurus*, which I have found amongst the Sheppey fruits, is placed by me in *Laurus Lalages*, the leaves of which have been not only found in Bournemouth, but also in the Austrian Eocene (Sotzka, Hæring), where they occur associated with berries.

The occurrence of a species of *Nyssa*, I think, may be also accepted for the Bournemouth strata. Of the Proteaceæ, besides *Petrophiloides*, a seed belonging to the Proteæ occurs, perhaps corresponding with the leaf which I have seen among the fossils of Alum Bay. In Bournemouth and Alum Bay were found the seeds of some other Proteaceæ which are not in Sheppey, as they have delicate wings. Some of the cones referred by Bowerbank to *Petrophiloides* belong to *Sequoia*.

The Gamopetalæ are represented by many genera, of which almost all appear also in the Miocene Flora. The fruit of *Cinchonidium* of Sheppey and the leaves of a species of *Cinchonidium* from Bournemouth may belong together. I accept the same for the *Apocynophyllum* fruit of Sheppey and the corresponding leaf of Bournemouth. This last accords in all its characters with *A. Reussi*, which also appears in the fossil Flora of Sagor. But I have not found up to the present time, in the Eocene Flora of Great Britain, any leaf belonging to the cha-

racteristic genus *Strychnos*, the seeds of which are met with at Sheppey.

Of the Sapotaceæ there are two species of seeds, which perhaps correspond with two species of Sapotaceæ leaves of the Bournemouth Flora. One of these extends throughout in the Tertiary Flora; the other, on the contrary, seems to be peculiar to the Eocene Flora. Also peculiar to this Flora are two species of *Diospyros*, which are common both to Sheppey and Bournemouth.

The species of *Symplocos* is common to Sheppey and Sagor. In these two localities the putamen of this species were found. In corresponding abundance are represented the Dialypetalæ. They are specially characteristic of the Eocene Flora in general, and of the Sheppey Flora in particular. To the first belong species of *Magnolia*, *Eugenia*, *Sapindus*, *Metrosideros*, and *Bauhinia*, whose leaves or fruits are to be found associated together in Bournemouth. To the last belong the genera *Menispermacites*, *Victoria*, *Thlaspidium*, *Corchorites*, *Theobroma*, *Lausonia*; and species of *Illicium*, *Nelumbium*, *Cucumites*, *Cotoneaster*, *Prunus*, *Amygdalus*, *Podogonium*, etc. Belonging also to other Eocene Floras and to the Miocene Flora we have here only the Dialypetalous plants, *Nelumbium Buchii*, and *Eucalyptus oceanica*.

Amongst the fruits and seeds of Sheppey we find also some species of herbaceous or tender plants whose leaves would not be preserved in the Tertiary strata. To these belong the seeds of *Solanites*, *Menispermites*, *Cucumites*, the fruits of *Thlaspidium*, and of *Corchorites*.

And in conclusion I desire to express my thanks to the Royal Society for the important assistance it has rendered me by the grants from its funds by which I have been enabled to prosecute my investigations in England; and for personal assistance in this work I desire to record my indebtedness to Sir Joseph Hooker, C.B., Dr. Henry Woodward, F.R.S., Mr. William Carruthers, F.R.S., and Mr. John Starkie Gardner, F.G.S., etc.

The descriptions and illustrations of the species, here enumerated, will appear in the Monograph now in course of publication by the Palæontographical Society.

Genera and Species of the Fossil Fruits and Seeds of Sheppey.

THALLOPHYTA.

Sphæria, 1 sp.

GYMNOSPERMÆ.

Cupressinæ.—*Callitris* (*Cupressinites*, c. Bowerb.), 2 sp. *Solenostrobus* (*Cupressinites*, s. Bowerb.), 4 sp. *Hybothya* (*Cupressinites*, c. Bowerb.), 1 sp. *Cupressinites*, Bowerb., 4 sp.

Abietinæ.—*Sequoia* (*Petrophilides*, Bowerb.), 1 sp. *Pinus*, 1 sp.

Taxinæ.—*Salisburia*, 1 sp.

MONOCOTYLEDONES.

Cyperaceæ.—*Cyperites*, 1 sp.

Liliaceæ.—*Agave*, 1 sp.

Smilacæ.—*Smilax*, 1 sp.

Najadeæ.—*Caulinites*, 1 sp.

Musaceæ.—*Musa*, 1 sp.

Zingiberaceæ.—*Amomum*, 2 sp.

Pandaneæ.—*Nipa*, 5 sp.

Palmæ.—*Oenocarpus*, 1 sp. *Areca*, 2 sp. *Iriartea*, 2 sp. *Livistona*, 1 sp. *Sabal*.
4 sp. *Chamærops*, 1 sp. *Trinax*, 1 sp. *Bactris*, 1 sp. *Asterocaryum*, 1 sp. *Élæis*, 1 sp,
Aroidæ.—*Aronium*, 1 sp.

DICOTYLEDONES.

APETALÆ.

Cupulifera.—*Quercus*, 3 sp. *Corylus*, 1 sp.
Juglandæ.—*Juglans*, 1 sp.
Euphorbiacæ.—*Euphorbiophyllum*, 1 sp.
Balsamiflæ.—*Liquidambar*, 1 sp.
Protencæ.—*Petrophiloides*, 1 sp. *Proteoides*, 1 sp.
Laurinæ.—*Laurus*, 1 sp.
Nyctagineæ.—*Nyssa*, 1 sp.

GAMOPETALÆ.

Cinchonacæ.—*Cinchonidium*, 1 sp.
Loganiacæ.—*Strychnos*, 1 sp.
Apocynacæ.—*Apocynophyllum*, 1 sp.
Solanacæ.—*Solanites*, 1 sp.
Sapotacæ.—*Sapotacites*, 2 sp.
Ebenacæ.—*Diospyros*, 2 sp.
Symplocæ.—*Symplocos*, 1 sp.

DIALYPETALÆ.

Menispermacæ.—*Menispermacites*, 1 sp.
Magnoliacæ.—*Magnolia*, 1 sp. *Ilicium*, 1 sp.
Cruciferæ.—*Thlaspidium*, 1 sp.
Nymphaeacæ.—*Nelumbium*, 2 sp. *Victoria*, 2 sp.
Cucurbitacæ.—*Cucumites*, 1 sp.
Büttneriacæ.—*Theobroma*, 2 sp.
Malvacæ.—*Hightea*, 8 sp.
Tiliacæ.—*Apeibopsis* (*Cucumites*, Bowerb.), 1 sp. *Corchorites*, 2 sp.
Acerinæ.—*Acer* sp.
Sapindacæ.—*Sapindus*, 1 sp. *Cupania* (*Cupanoides*, Bowerb.), 8 sp.
Myrtacæ.—*Eugenia*, 1 sp. *Eucalyptus*, 1 sp. *Metrosideros*, 1 sp.
Lythraricæ.—*Lawsonia*, 1 sp.
Pomacæ.—*Cotoneaster*, 1 sp.
Amygdalæ.—*Prunus*, 2 sp. *Amygdalus*, 2 sp.
Papilionacæ.—*Podogonium*, 1 sp. *Bauhinia*, 1 sp. *Faboidea*, 26 sp. *Legu-*
minosites, 18 sp. *Xulinosprionites*, 2 sp. *Mimosites*, 1 sp.

PLANTÆ INCERTÆ SEDIS.

Wetherellia, 1 sp. *Tricarpellites*, 7 sp. *Carpolithes*, 37 sp.

REVIEWS.

GEOLOGY OF THE PROVINCES OF CANTERBURY AND WESTLAND,
NEW ZEALAND. By JULIUS VON HAAST, PH.D., F.R.S. (Christ-
church, 1879.)

THIS report is the result of a series of explorations carried on by
Dr. Haast from 1860 to 1876, and embodies in a condensed
form a description of the chief geological and physical features of
the provinces of Canterbury and Westland in Southern New Zealand.
Owing to the other official duties of the author as Director of the
Canterbury Museum interfering with the continuous preparation of
the work, the publication has been unavoidably delayed.

It is divided into three parts—the first part, on the progress of
the geological survey, contains a descriptive account of the various
journeys in different parts of the provinces, pleasantly written and
in a popular form, so that the general reader may obtain a great deal