of the Eocene, sometimes a little below the ocean level, never far above. Geologic change has been at no time great enough to prevent the easy reentrance of the sub-tropic vegetation, persistent in the United States at three points only—the Lower Colorado, the Lower Rio Grande, and the lower part of the "spruce pine," and *Pinus heterophylla* sections of Florida. In each of these widely separated regions larger continental features tend to create and maintain melior climatic conditions. The Colorado cuts deep, and holds its valley protected from the cold. The gulf warms the low coastal strip markedly as far north as the mouth of the Rio Grande; and Florida, though flung well out to sea, so blocks the warmer gulf waters that the southern half has long held to the favorable mean of dry days, rain-and warmth. Long coastal barriers afford further protection.

Even a cursory glance at forest distribution in Florida serves to throw into relief the belts and regions of change of first concern. The upper half of Florida is still favorable to the "long leaf pine" (*Pinus palustris*), and now undergoes marked variation in its winter temperatures. Facing the Atlantic, this forest sharply gives way to the "spruce pine," and not far below Vero the palmetto-cycad underbush begins. Along the southern-western coast, is the region of "pine islands and cypress straits," as Bowman says, "even more monotonous than the east coast." All the higher ground is invested by a *Pinus heterophylla* forest, with a nearly pure palmetto underbush, while the cycads also show a different facies. The *Zamia floridana* is rare in the open woods, although the *Z. pumila* grows more characteristically inside the mangrove fringes next the coast.

The Vero man thus occurs near the border of the "spruce pine" (*Pinus glabra*) forest, with its striking and unique underbush of cycads and bush palmetto (*Zamia floridana* and *Sabal serrulata*). The latter in places make up the underbush nearly in equal numbers. But that this striking forest facies earlier extended to the north of Vero is probable; while in any case Vero lies within a region locally characteristic for its old floral elements, and of generally soft climate since the Eocene.

Evidently the "spruce pine" country exemplifies a pronounced type of the so-called "asylum" or isolated and persisting habitat subjected throughout long periods of time to the minimum of environmental change. Especially the cats earlier tended to drift to the south; and there the man of Vero found them when he reached that soft climate and employed or developed arts admittedly recent. Seemingly too, the fossil plants and animals of Vero, after persisting beyond their geologically appointed time, were finally cut off by changes relatively slight.

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SCIENTIFIC BOOKS

Fossil Plants. By A. C. Seward. Cambridge Biological Series 1917. Vol. III., pp. xviii + 656, 629 figs.

The present volume, the third of Seward's great work, Volume 1 having been published in 1898 and Volume 2 in 1910, is appropriately dedicated to the late Professor Zeiller, the dean of paleobotanists. It is to be followed by a fourth volume, which it is stated is already in press, and which will discuss the remaining gymnosperms—the great group of angiosperms, so abundant in the fossil record from the mid-Cretaceous to the present, apparently not coming within the category of fossil plants in the mind of a British botanist, which is quite in keeping with British tradition and practise.

Volume 3 opens with a very satisfactory chapter devoted to a discussion of existing cycads, largely an abstract of already published data. Then follow three chapters devoted to the Pteridospermæ. These are divided into three families—the Lyginopteridæ, Medulloseæ and Steloxyleæ, and are rather fully and very satisfactorily discussed.

The remaining structural forms that are probably more or less closely related to the foregoing pteridospsrms are considered to represent the following seven families: Megaloxyleæ, Rhetinangieæ, Stenomyeleæ, Cyca-

doxyleæ, Calamopityeæ, Cladoxyleæ and Protopityeæ, and these are discussed in a separate chapter under the group term of Cycadofilices. These presumable pteridosperms, because of the dearth of conclusive evidence, are thus arbitrarily segregated. While caution is to be commended in dealing with fragmentary plant fossils it may be questioned whether judgment may not be suspended until it dies of inanition. It is also questionable how far it is desirable to introduce purely artificial groups, and if it be granted as desirable, it may be pertinent to ask what criteria are to decide such a question. That such a course does not make for clearness and that such questions rest after all upon personal equation rather than upon objective facts may be illustrated by Seward's reference of the genus *Steloxylon* to his Pteridospermæ and the scarcely to be distinguished genus *Cladoxylon* to his Cycadofilices. The fact that so many of the so-called families of the latter group are monotypic is convincing enough evidence that they illustrate chance discoveries and the imperfection of the geological record and that they have absolutely no other significance such as Scott has suggested.

Following the chapter devoted to Cycadofilices are two chapters dealing with the Cordaitales which are described under the three groups of Poroxyleæ, Cordaiteæ and Pityeæ. A succeeding chapter of 65 pages is devoted to Paleozoic gymnospermous seeds and the remainder of the book is taken up with a consideration of fossil Cycadophytes. These last chapters are, on the whole, a very satisfactory summary of the present state of our knowledge although the concluding chapter, devoted to the fronds, is much abbreviated and not especially noteworthy.

There can be no doubt of the usefulness of Seward's book, particularly in the case of mature students and professional morphologists. The author has a wide acquaintance with the literature, especially on the side of morphology and modern botany, and the book shows throughout the results of considerable original work and a large amount of reinvestigation of insufficiently described material of older workers. It may seem ungracious to criticize a noteworthy undertaking but it seems to the reviewer that throughout the three volumes already published there is a disregard of proportion and an unevenness of execution that seriously impair their value. It is impossible to discover the method of selection of matter to be included—unimportant and even doubtful forms are sometimes discussed, as under *Williamsonia,* among the seeds, or the frond genera of Cycadophytes, while more important material is not even mentioned. In a work spreading through four stout volumes one reasonably expects either completeness or a formulated method of selection. If the desire was to present in the main fossil plants based upon structural materials, why burden the pages with a very incomplete representation of other classes of plant remains.

The author assumes an oracular air that reminds one of Lowell's charming essay entitled "On a certain condescension in foreigners," and there is constantly displayed a readiness to pass judgment merely on the illustrations of other students' work, often in cases where most paleobotanists would be disposed to deny the author's competency, as for example in the case of the determination of American species referred to *Eremopteris.* There are also certain insular tendencies, as in the overemphasis of Carboniferous, Jurassic and Cretaceous horizons that have been studied in Britain, and the space devoted to the local history of important British specimens.

Professor Seward's position on the difficulty of founding well-marked botanical species on material preserved as impressions is well known and in the main sound. However, as has been pointed out recently by Halle, this does not justify the assumption that all fossils that are superficially similar belong to the same species regardless of geographical position or geological horizon. Such a method of treatment entirely obscures whatever real value such fossils may have for purposes of deduction concerning geographical distribution, the problems of paleogeography growing out of distribution, and the bearing of fossil plants upon stratigraphy.

As a contribution to morphological botany nothing approaching the present book from the paleontological side has ever been produced and I am not surprised that Scott[1] is enthusiastic about it. I would expect Professor Coulter to be equally enthusiastic. As a textbook of fossil plants intended for geological students as its subtitle indicates, or as an exposition of the geological history of fossil plants it is very inadequate, and I regard this as a serious defect since the great majority of students who will use the book, while they will gain a much wider morphological outlook, will scarcely learn that fossil plants have attributes other than anatomical, or if they do they will conclude that such attributes are worthless anyway. Nor will they gather the impression that fossil plants are found much anywhere except in the Carboniferous, Jurassic and Wealden.

The proofreading of volume 3 is not as good as in the preceding volumes and some of the illustrations are very poor; nor is the bibliography as complete as it might well have been made. A paper by White is credited to Knowlton, Vignier should be Viguier. Krammera (page 277 and elsewhere) should be Krannera. The statement on page 276 that there is no proof of Cordaites in the Arctic may be a statement of opinion—it is hardly a fact. The statement on page 276 that "it is by no means certain that Cordaites flourished before the Carboniferous" is also misleading. Apparently Seward wishes to restrict the Cordaitales in their earlier manifestations and extend them in their later manifestations as in the case of *Noeggerathiopsis* and similar remains. Surely *Callixylon Oweni* described by Elkins & Wieland from the Devonian of Indiana[2] is ample evidence for the presence of Cordaites in pre-Carboniferous rocks. It may be seriously doubted if the two types represented by *Cycadeoidea* and *Williamsonia* were not much more divergent than is indicated, or if the former were the Mesozoic lords of creation of the vegetable world that is assumed. Despite the similarities in the fructifications in these two lines, the reviewer would regard the former as a specialized sideline without issue and probably never more abundant or important than are cycads in the existing flora, while the latter constituted a more dominant and progressive line, more intimately connected with the Paleozoic pteridosperms and having points of contact with possibly the Ginkgoales or the Coniferophytes. The bulk of the frond genera were probably borne by plants of the *Williamsonia* rather than of the *Cycadeoidea* type. It may be noted that the American Cycadellas come from the Lower Cretaceous and not the Jurassic. The author is hardly justified in doubting the bisexual character of the so-called flowers of *Cycadeoidea Gibsoniana,* nor is it easy to follow him in his explanation of the corona of *Williamsonia gigas* as morphologically a whorl of connate stamens in a central terminal position.

When it is remembered that throughout all of the *Cycadeoidea* species already investigated the megasporophylls become more or less sterile distad and that in some species, as Wieland has demonstrated, these, together with the prolonged interseminal scales, are modified to form a mop-like tuft at the apex of the receptacle, and also having in mind the ears or wings of the microsporophylls that formed a canopy over the apex of the receptacle in *Cycadeoidea colossalis,* it is quite possible to explain Seward's figures 546 and 547 in a variety of ways without recourse to the improbable hypothesis that we have terminal microsporophylls. In fact, there is no evidence that the so-called microsporophylls of *Williamsonia gigas* described on page 435 belong to that species. Fig. 549 no doubt represents a synangia-bearing disk of a *Williamsonia,* but there is not the slightest evidence that it belonged to *Williamsonia gigas* or that it should be placed on the end of a *Williamsonia* carpellary receptacle. Similarly the sterile disks or infundibuliform organs have not been demonstrated to have been borne on the apex of the receptacle.

On page 89 some poorly preserved *Myeloxylon*

[1] Scott, D. H., *New Phytologist,* Vol. 16, Nos. 8, 9, 1917.

[2] Elkins, M. G., and Wieland, G. R., *Am. Jour. Sci.* (IV.), Vol. 38, pp. 65–78, 1914.

petioles are appealed to as evidence of the existence of *Medullosa* in North America. Of course fronds are not evidence so it may be reassuring to state that characteristic sections of petrified stem material of *Medullosa* are contained in the collections of the U. S. National Museum, so that it may now be considered proven that *Medullosa* foliage was, in life, borne on *Medullosa* stems in America as well as in Europe. It may be questioned (page 87) whether leaf form is more protean than either vascular anatomy or floral morphology. Apropos of Seward's remarks on the genus *Schützia* it may be noted that in a paper which has apparently been overlooked, Schuster[3] describes specimens of *Schützia anomala* in the Dresden Museum, labelled in Geinitz's handwriting, which show definitely that these objects were spore receptacles as had been surmised.

The forms known as *Microzania gibba* (page 504) and *Zamites bohemicus* (page 534) come from the Upper and not the Lower Cretaceous. It would be far better if the term Wealden were used to denote a peculiar environmental facies as shown in the lithology and not a chronological unit. There is no more reason for calling deposits in all parts of the world Wealden than there would be for calling the English Wealden deposits Potomac.

On page 278 the genus *Pelourdea* is proposed for the long-known *Yuccites vogesiacus* of Schimper & Mougeot because the author considers it undesirable to retain a designation suggesting false ideas with regard to affinity. No one now supposes that this is suggested and such a proposal is entirely unwarranted and can only be confusing instead of clarifying. Moreover it is flying in the face of all canons of nomenclature. A name of a genus is simply a name, and we use generic names for convenience chiefly, and not in a descriptive or phylogenetic sense. I imagine that fully 25 per cent. of the names in systematic botany and zoology are equally inappropriate for one reason or another but this does not afford any justification for attempting to replace them. There is surely a difference between retaining a degree of personal independence in the face of codes and the persistent refusal to recognize the fact that practises of this sort serve only to confuse the subject.

Cordaianthus Pitcairnæ figured on page 266 is merely a type of inflorescence and is scarcely entitled to a specific name. At *B* in the same figure (Fig. 480) there is figured from the Kidston collection, a specimen which is called *Cordaianthus Volkmanni*. The latter belongs to the type of inflorescence which Grand'Eury called the *gemmifer* group, to which this specimen does not belong, although it does belong to Grand'Eury's *baccifer* group, and should probably be identified as *Cordaianthus subvolkmanni*. The genus *Holcospermum* (page 361) is hardly an improvement on *Carpolithus*, and it would seem that if form genera for seeds are worth anything at all then *Holcospermum* should be referred to Zalessky's genus *Polygonocarpus*. This last genus is mentioned under *Polypterospermum* on page 323 where we are told that *Radiospermum* or *Polypterospermum ornatum* should probably be referred to it, while on page 358 we are told that this species affords another example of *Polypterocarpus* as this generic name is employed by the author. Nowhere is the genus *Polygonocarpus* discussed (it is not even in the index) although it is of some importance, and, if one may judge from Scott's figures of *Trigonocarpus Parkinsoni*, is the proper name for his specimens of the latter. If the reader will turn to Seward's Fig. 426 *C* he will see that the sclerotesta of Scott's *Trigonocarpus Parkinsoni* is of exactly the type of *Polygonocarpus*. Now if this figure be compared with Fig. 425 on the opposite page, also called *Trigonocarpus Parkinsoni*, it must be apparent that the two do not represent the same seed or the many angles of the former would show through the partially preserved sarcotesta of the latter, which is not the case, nor is it desirable on general principles to refer structural material to form genera based upon casts.

[3] Schuster, J., "Uber die Fruktifikation von *Schuetzia anomala*," *Sitz. k. Akad. Wiss. Wien*, Band 120, Heft 8, Ab. 1, pp. 1125–1134, Pls. 1, 2, 1911.

As an instance typical of that unevenness of treatment previously mentioned the genus *Samaropsis* may be examined with some slight detail. In Fig. 502 *A* on page 350 are shown three figures copied from Dawson of *Samaropsis fluitans*. This species is apparently selected for discussion and illustration since this name appears in many lists of Carboniferous fossils from various localities. Dawson's figures are notoriously unreliable, as is very well known on this side of the Atlantic, and his types of *Samaropsis fluitans* scarcely deserve to be taken up as the types of anything. Now if we turn to *Samaropsis fluitans* as identified by Weiss we find that it represents an altogether different object. Similarly Kidston's and Zeiller's *Samaropsis fluitans,* while they are identical with one another, can hardly be considered as identical with either Dawson's or Weiss's objects so named and Grand'Eury's *Samaropsis fluitans* is a still different object. Turning to the second species shown in this figure, namely *Samaropsis emarginatum* of Goeppert & Berger, we find that the type figures are absolutely unrecognizable. We find that Geinitz referred two totally different forms to this species, Hoffman & Ryba's determination of it is questionable, Feistmantel's forms of this name are still different, and Kidston's figures of 1902, 1908 and the present work can scarcely be regarded in any single instance as representing any of the previous determinations. If we turn now to *C* and *D* of this same figure, supposed to represent *Cordaicarpus Cordai* of Geinitz we find that Geinitz figured a variety of things under this name, but he expressly states in his text that these seeds are 2 cm. in diameter and sometimes twice that size and tumid. When we turn to Zeiller's, Kidston's or Vernon's figures called by this name we find a tiny, often flat, form, totally unlike anything that Geinitz figured. It may also be suggested that *E* of this figure is upside down and that instead of having a *Samaropsis bicaudata* we have a *Samaropsis bicornuta,* for which there are analogies in other species of *Samaropsis*.

These instances may be taken to illustrate my criticism that unsatisfactory forms were selected for figuring in the present work without any digestion of the subject simply because the names occur frequently in the literature, a method of procedure which not only entirely obscures any chronologic value that these objects might have, but crowds out figures or discussion of really good material. The case may be stated something as follows: The poorer the type material of a species the more readily will other things be confused with it and so in the course of time it is always the least recognizable and the poorest types that become credited with the greatest range, both geological and geographical.

This sort of criticism might be legitimately applied to many other items in the present volume. These are almost always subjects outside of Professor Seward's own specialty, and subjects in which I fancy he is not greatly interested, and while they do not detract from the value or accuracy of that part of the work where the author is on familiar ground, an author should not pose as an authority on phases of work in which he shows no apparent interest or willingness to give the labor necessary to the mastery of the literature, so much of which it is admitted is of minor value.

For this very reason and the further reason previously mentioned of Seward's attitude regarding what constitutes a fossil species, it may be considered very fortunate that the author has been unable as yet to carry out his intention of discussing the geographical and geological distribution of fossil plants.

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SPECIAL ARTICLES

THE GLASS SANDS OF PENNSYLVANIA

At present in the manufacture of glass, nearly pure quartz sands are used almost exclusively as the source of the silica which is the major constituent of all the common varieties of this useful substance. An ideal glass sand would be one made up entirely of grains of the mineral quartz. Sands containing 100 per cent. silica, however, are not found in nature, although some very nearly approach