THURSDAY, JULY 30, 1885

THE UNIVERSITY OF LONDON

CONVOCATION met on Tuesday to consider the report and draft scheme submitted to it by Lord Justice Fry's Committee. After a somewhat lengthened debate the House adjourned till November 3, when no doubt their consideration will be resumed.

We do not think much is lost by the delay. As we pointed out last week, the scheme has at first sight an aspect of complexity. But this arises in great measure from the technical form and language with which it is necessary to invest provisions intended to receive legislative effect. We do not think the underlying principles are difficult to disentangle, but it could hardly be expected that such a body as Convocation would grasp them without considerable opportunity for explanation and discussion.

The particular date which the accident of circumstance determined for the meeting was in some respects unfortunate. Many of the medical graduates who might be expected to support the scheme were drawn away by the meeting of the British Medical Association at Cardiff. In November all the medical schools will be in full activity, the leading teachers in every faculty will be in town, and the preliminary ventilation which the scheme has now received, followed, as it will be, by the discussion and reflection of the vacation, will prepare Convocation for a definitive decision in the autumn.

What that decision should be there can hardly be any doubt in the mind of any reasonable person. The remarkable attention bestowed by the leading journals on a purely academic question goes far to prove that the ear of the public is ready to entertain any reasonable proposals for the development of real university work in London. It is for the graduates in Burlington Gardens to decide whether they will approach the task or leave it to some new organisation which may be created for the purpose. That the thing sooner or later in some shape or other will be done we have not ourselves a shadow of a doubt.

The Association for promoting a Teaching University for London has suspended to some extent its own efforts, pending the action of Convocation, to which in its first report it has given its cordial support. The Association and the Committee of Convocation do not, however, seek to attain their objects quite on the same lines, and the identification by some of the speakers on Tuesday of the views put out on behalf of the two perfectly distinct bodies introduced a certain amount of confusion into the debate which no doubt the present opportunity for further consideration will go far to remove.

Of the debate itself little is to be said. Lord Justice Fry's speech explanatory of the scheme had the quality of lucidity which every one expected from him. But more than this, he exhibited a largeness of view in contemplating the possible future of the University which might have been expected to carry with it a more enthusiastic sympathy from Convocation than it obtained. The criticisms which followed were mostly on points of detail, and, on the whole Convocation, without being adverse, evidently felt that it should like more time for reflection.

THE EVOLUTION OF THE PHANEROGAMS

L'Evolution du Règne Végétal. Les Phanerogames. Par MM. Marion et Saporta. (Bibliothèque Scientifique Internationale, 1885.)

SINCE the appearance of the first volume of this important work the views of the authors have been subjected to more than one attack, and they have turned aside to vindicate the correctness of their interpretation of the often obscure fossils upon which our knowledge of the earliest forms of plants is based. The wisdom of the delay is unquestionable, for it would have been useless to continue a work whose foundations had been shaken by adverse criticism. It is not to be expected that their views will even yet be universally acceptable, for the difficulties attending the study of fossil plants are such that its most experienced professors are still scarcely agreed upon some of the fundamental questions. It is well known that Prof. Williamson is opposed to the French school as to the gymnospermous nature of several groups of Carboniferous plants, and in addressing the British Association in 1883 (NATURE, September 20, 1884) he criticised in advance some of the main facts dwelt upon in this work. In contrast to the divergent views of English investigators, the greatest workers in France, including the honoured names of the late Adolphe Brongniart, and of MM. Grand'-Eury, B. Renault, Marion, and de Saporta, are in complete accord. Their work presents for the first time a complete outline of the evolution of the vegetable kingdom, and its importance and novelty are such as to demand a critical as well as friendly examination.

In the former volume it will be remembered (NATURE, May 26, 1881) the authors endeavoured to trace the development of vegetable life from the protoplasmic body, differentiated from animal life in no way other than through the conversion of a portion of its protoplasm into chlorophyll, to the heterosporous cryptogams. The present volumes prove that there is an almost direct passage from the latter to the far higher phanerogams.

There is no need to argue at the present day that if phanerogams were differentiated from cryptogams this must have taken place in very remote times; and it is equally certain that evolutionists will be disposed to anticipate that the initial differences between them must at first have been relatively imperceptible. An heterosporous cryptogam in which the microspores penetrate to a solitary macrospore in order to effect fertilisation, and in which the prothallus is enclosed and germination takes place *in situ*, is well on the road to become a phanerogam and, moreover, a gymnospermous one, if the macrosporangium be not protected by any leaf modified into a tegumentum. The change in the reproductive organs was accompanied and preceded by modifications in the vegetative organs, and the transformation is actually found to have progressed through three distinct stages—the *progymnospermous*, the *gymnospermous*, and the *metagymnospermous*.

The Progymnosperms are among the earliest plants known, and already occupied an important position in Carboniferous floras. Though they are now completely extinct, the Cycads have to some extent preserved their characteristics. They retained many characteristics of the cryptogamic stock whence they originated, which are completely lost to remote descendants of the present day. As the earliest connecting links between Cryptogams and Phanerogams their morphology is peculiarly interesting, and the exquisite preservation of many of their silicified or calcareous stems permits the minutest details of this part of their structure to be studied.

That Cryptogams reached a far higher stage of development in the Palæozoic time than exists in any living representative is one of the few facts that has not been disputed. One of the best-known of these is Lepidodendron, a tree-like plant allied to the Lycopodiaceæ. Its structure has frequently been described, and presents nothing unusual to Cryptogams. But in Sigillaria, a plant strongly resembling it in nearly every other respect, we find a radiating vascular cylinder or woody zone in the cellular stem, with unmistakeable exogenous growth. It is richly supplied with medullary rays, and, Prof. Williamson allows, presents clear evidence of interruptions to growth, succeeded by periods of renewed vital activity. The same writer also describes the prosenchymatous and the parenchymatous structure investing the woody zone as a bark, and remarks that, although not divisible into three layers, the enormous development of the elongated prosenchymatous fibres or bast-tissue in the inner layers of the epidermis of the fossil stems is a manifest foreshadowing of the presence of that same tissue in the bark of living exogens, especially the Cycads. In Diploxylon there is a further development, the woody zone being made up of an inner or medullary vascular cylinder, either interrupted or continuous, composed of large scalariform vessels without definite order, and an outer cylinder of scalariform vessels of smaller size arranged in radiating fasciculi. There is no difference of opinion as to the exogenous nature of the woody zone, which bears a relatively small proportion to the diameter of the stem, and as to the presence of medulla or pith and bark; but while Adolphe Brongniart and our authors class Sigillaria in consequence as a low form of exogen, a progymnosperm, Prof. Williamson and some of the German authors prefer to regard it as a highly-developed Cryptogam. He possesses specimens which conclusively prove to him that the exogenous wood is undeveloped in the young stages, and that young stems of Sigillaria are indistinguishable from Lepidodendrons; but though there is a gradual passage from one to another, the typical Lepidodendron never produced a ligneous zone. Sir J. W. Dawson, who has done much to elucidate this subject, believes that even some Lepidodendrons are exogenous, and that all Sigillarias are so. The evidence goes to prove that unquestionable Lepidodendrons in youth gradually acquire the internal features, notably the exogenous ring, characteristic of Brongniart's gymnospermous family of Sigillariæ. So far as its bearing on evolution is concerned, the differences of opinion scarcely affect the question. Whether they are looked upon as Cryptogams with exogenous growth, or exogens with cryptogamic characters, they are equally valuable as connecting-links, and if we agree with Prof. Williamson that they pass direct into true Lycopodiaceæ, the chain only becomes so much the more direct and complete. During growth the woody or exogenous zone increased for a certain period, but this was quickly arrested by the absorption or destruction in some way of the Cambium layer. The subsequent increase in diameter took place mainly in the cortical system, and to it the growth and solidity of the stem was principally due. The exogenous element in the oldest known trees is thus seen to have been transitory and subordinate, for had it persisted indefinitely, the continued generation of fresh layers or new rings of growth would have produced true dicotyledonous stems. It is suggested that until seasons, or alternations of activity and repose, replaced the earlier uniformity of climate, an exogenous growth would have been of relatively little use to the plant.

Sir J. W. Dawson has observed specimens of Sigillarian stems possessing still more definite exogenous characters, and in Poroxylon M. Rénault finds that the wood is dotted with areolated punctæ similar to those distinguishing the spiral vessels of Cycads and Araucariæ. Still the structure of their stems agree in so many respects with those of the highest heterosporous Cryptogams, the Lepidodendrons, that the difference between them remains almost insensible. Moreover, the Sigillarias are not supposed to be in the direct line of the evolution of Gymnosperms, but an offshoot which was quickly extinguished, and even in the Carboniferous time exogenous trunks were growing side by side with them. The construction of their stems was greatly varied, and it is evident that their plan of growth was susceptible of very considerable modification and development. It is now universally acknowledged that some Stigmarias are the roots of Sigillaria, yet here again we find a remarkable divergence of opinion, for while our authors regard them as rhizomes capable of bearing leaves as well as roots, Prof. Williamson contends that they are merely roots with rootlets. The Stigmarian rhizomes were procumbent and vegetated in the soft mud, Sigillarian stems budding from them occasionally, erect and cylindric, and crowned with a mass of long and linear leaves whose scars, impressed upon the bark, give rise to complex and beautiful tesselated designs. To how great an extent their fruiting organs preserved their cryptogamic attributes is unfortunately even yet imperfectly known.

The next type of progymnospermous stems, that of Calamodendron, is more remarkable because more abnormal, for it possessed a hollow fistular stem with verticillate leaves, closely resembling in appearance a gigantic Equisetum. Here again there is an irreconcilable divergence between the views of the French authors and those of Prof. Williamson. The former separate Calamites from Camalodendron, believing them to have been confounded simply because the casts of the interior of the hollow stems of both accidentally present the same grooved and articulate aspect, though morphologically they completely differ. Calamites they maintain to be a Cryptogam whose thin walls presented within and without the same structure as those of Equisetum. Prof. Williamson urges that no such Calamite has ever been found, but that, however thin the walls of a specimen may be, they always show the Calamodendron structure if any is preserved, and that the points of agreement are too remarkable to be a mere case of mimicry between a cryptogam and a gymnosperm. Our authors, however, lay stress on the fact that there are two very distinct types of articulated root, belonging respectively to the two genera in question, but although Prof. Williamson recognises them both, he does not specially comment on the fact. As to matters of fact relating to the structure of the Calamodendron stem, opinion does not differ, but the Professor, as in the case of Sigillaria, views them as Cryptogams of exogenous growth, without, however, admitting the close relationship to the Equisetaceæ advocated by Mr. Carruthers.

The stems of Calamodendron were filled in solid with pith or cellular parenchyma when young, but became hollow with age, the fistular interior of the stem consisting then of a linear series of oblong chambers, making an entire internode and separated from each other by transverse medullary diaphragms. The exogenous zone consisted of numerous woody wedges separated from each other by peculiar prolongations of the pith, to which Prof. Williamson assigns the name of primary medullary rays, while secondary medullary rays separated the constituent vascular laminæ of each wedge as in recent Exogens. These extended vertically from node to node, when they underwent a change. The apex or inner face of each wedge originates in a duct or canal. Investing this woody zone was a thick cellular cortical layer without vessels. The bark is very rarely preserved and is not exogenous in character, the tripartite division of existing Coniferæ not being present. The outer surface appears to have been smooth, and not fluted longitudinally, at the same time masking the articulations. Camalodendron thus possessed exogenous wood playing exactly the same *rôle* as in Sigillaria, surrounding the pith, and closely resembling the first year's shoot of a recent conifer; but it differed in the verticellate arrangement of its appendicular organs. The structure of the root hardly differs from that of the stem, this indicating, according to the authors, a peculiarly primitive type, and the rootlets grew from the nodes and were branching. Prof. Williamson states, on the other hand, that the root is adventitious and not a prolongation of the main axis. The leaves or branchlets were distributed on the trunk at regular distances on the line of the nodes, which were pretty close together, alternating regularly from one to another, so that the appearance resulting was that of a quincuncial arrangement, the more obvious on account of the concealment of the nodes by the bark. There is no direct proof, but the authors believe that the foliage known as Archæocolamites and Bornia, consisting of repeatedly dichotomosing acicular leaves arranged in verticels around nodes on slightly striated stems, really belongs to Calamodendron, in which case the male inflorescence was born in catkins something like those of the Taxeæ. Sir J. Dawson, however, states that he has found leaves like those of Asterophyllites attached to stems of Calamodendron. The fruiting organs are still very imperfectly known, but Prof. Williamson believes them to have been a heterosporous Strobilus like those of Lepidodendron. The authors, in conclusion, remark upon the resemblance between leaves of Bornia and those of Trichopitys and Bryon, which are true Salisburieæ, for, though the one is verticellate and the other spiral in disposition, the possibility of an easy transition from one to the other is exemplified in Calamodendron, and both modes occur together in existing Cupressineæ and the young Abietineæ.

Prof. Williamson believes that Calamites and Camalodendron are one and the same plant, and this a cryptogam. Against the exogenous wood he sets the cryptogamic bark, the Strobilus with Calamite structure full of spores, the adventitious roots and the verticellate arrangement of the leaves. It seems hardly possible, however, that such observers as A. Brongniart, M. Grand'-Eury, M. Rénault, and our authors can all be mistaken. In the former volume a graphic description was given of the growth of the Equisetum-like Calamites as they occur at St. Etienne. Prof. Williamson has not come across an undoubted Calamite, and very prudently disbelieves in their existence, but his evidence seems negative rather than positive, and we have already seen in several instances that coal-plants may have flourished in great numbers in one country and yet be exceedingly rare in another. The Carboniferous lasted over an immense period of time, and there appears less reason, as their plants become more completely known, to suppose that the forests were then composed of few types universally distributed. Development was proceeding actively, and it is quite conceivable that a gigantic primæval Cryptogam might take on phanerogamous characters without greatly modifying its external appearance.

Another remarkable cryptogam with exogenous wood is described by Prof. Williamson as Astromyelon. The stem was hollow, and except that it was not articulated, resembled that of Camalodendron. It appears that the stem and branches grew together under exactly the same relation as those observable in an ordinary exogenous tree, the latter not differing materially in their outward appearance from those of an ordinary pine. He appears to have felt hesitation in classing it, as he uses the expression "I am inclined to place" it among Cryptogams. Its affinities he considers to be with Marsilea, and we have thus—perhaps—in the coal-measures arborescent representatives of the Lycopodiaceæ in Lepidodendron, of Equisetaceæ in Camalodendron, and of Marsiliaceæ in Astromyelon, all of them having possessed rudimentary exogenous trunks.

J. Starkie Gardner

HARBOURS AND DOCKS

Harbours and Docks. By L. F. Vernon-Harcourt, M.A. (Oxford: Clarendon Press, 1885.)

In the author's previous work on "Rivers and Canals" the science of hydraulic engineering received a valuable addition and the subject was treated, as far as it was necessary for inland works, in a masterly manner, fully upholding the author's high standing in his profession. We have now another work by the same author, in which the sequel to "Rivers and Canals" is given. In "Harbours and Docks," sea-works and kindred engineering subjects receive full consideration, the two books containing together an excellent collection of data on hydraulic engineering generally.

Of all the many branches of the engineering profession, that of hydraulic engineering pertaining to sea works and similar constructions trusts less to theory and more by far to practice than any other. The hydraulic engineer for sea works has no convenient formulæ to guide him, but only previous experience and precedent. This is evident from the volume before us, for most of the sea works described are improvements on previous constructions.

The author commences with a description of the natural laws which govern the general movements of the sea, the causes and action of its waves, tides, currents, and consequent changes in the coast line, the knowledge of which is all important when any new works are projected; indeed, it is not too much to say that many sea-works have proved very expensive in their maintenance owing to ignorance of the above conditions when they were designed.

The author divides the various types of harbours into five classes—(1) estuary harbours; (2) harbours with back-water; (3) harbours partly sheltered by nature; (4) harbours protected solely by break-waters; (5) peculiar types of harbours with detached break-waters. After having given long and clear descriptions, with excellent illustrations of the several types, the author remarks with reference to the first three classes and their shelter from the sea:—"Some natural shelter exists in all the harbours referred to above, but it will be noticed that the amount of shelter varies considerably. Thus whilst at Cherbourg, Plymouth, Wick, Genoa, and Barcelona the entrance alone of a complete bay requires protection; at Holyhead, Table Bay, and Alexandria only a portion of the extensive bays in which the harbours are situated can be utilised, though the existence of the bay diminishes considerably the exposure; and lastly, at Dover, Newhaven, and Colombo projecting points of the coast, rather than regular bays, are taken advantage of for the site of a harbour." After discussing the last two classes of harbours, we have the conditions which govern the size and position of the entrances to harbours explained. We commend these chapters to the careful perusal of those who take an interest in the proposed harbours of refuge, for here will be found considerable information concerning the advantages of the several sites proposed.

Chapter V., and those following, until the end of Part I. of the book is reached, deal with perhaps the most important of all sea-works—viz. break-waters. The author classifies their several modes of construction into three classes—(1) mound of rubble and concrete blocks; (2) mound with superstructure; (3) upright wall. Under these heads we find all the principal break-waters, each being well described, the construction explained, and reason given for any special work.

It is interesting to follow the gradual increased use of Portland cement concrete in the place of natural stone, and, as the latest break-water, we may take the one at Newhaven now in construction. This break-water is practically one solid mass of cement concrete. It is built on the upright wall system, with concrete in bags deposited from hopper barges on the chalk bottom up to low-water, and concrete-in-mass above. The bags each contain about 104 tons of concrete, the concrete being mixed by a special machine consisting of a screw working in an inclined cylinder, the materials being added at one end, water being added during the transit, thoroughly mixed concrete coming out at the other end.

In Part I. of the volume is to be found every information with regard to sea-works generally; the descriptions and details of the construction of the Manora break-water, Madras harbour, and Alderney break-water among the many others, are extremely interesting, being as well written as they are good. Of the American break-waters described, those constructed in the large lakes, are, as may be expected, principally constructed of wood, some being bound together by means of iron ties. The form taken is generally crib-work, floated out to the site in sections, and filled with stone. Before leaving the subject of break-waters we will quote the author's opinion on floating break-waters; this is interesting at the present time on account of the late experiments at Eastbourne and other places. He says:—"Various schemes have been suggested from time to time for arresting waves by means of floating break-waters moored in position. It has been imagined that the undulation being on the surface might be stopped or reduced considerably by an obstacle at or near the surface, and thus the cost of building up a break-water from the bottom could be saved; though, in the case of large waves, the undulatory motion is not simply superficial, yet, undoubtedly, the power of the waves would greatly diminish if the upper portions could be arrested in their progress; and the gain in dispensing with a solid structure founded on the bottom of the sea would be very great." He then tells us of several forms tried which were not successful in reducing the waves, and in conclusion says:—"The force of waves is so great, as indicated by its effects in moving huge masses, that no fragile floating moored construction could possibly oppose an adequate resistance. The accumulated power of the wind, acting through the medium of the waves, cannot be evaded, but must be met; and this can only be effectually accomplished by a solid break-water." This part of the book concludes with a chapter on lighthouses, beacons, and buoys; the construction and cost of all the important lighthouses is given and admirably illustrated.

In Part II. "docks" receive very full consideration, Chapters XIX. and XX. dealing with sites, preliminary works for docks and dock walls; suffice it to say that all these are treated in such a way as to render it evident that the author is thoroughly master of his subject. In Chapters XXI. and XXII. the usual fittings pertaining to docks are discussed, their entrances and locks, dock-gates and caissons of all kinds thoroughly described, and their varied construction under different conditions explained. All the following chapters, which occupy the last 150 pages of the book, are taken up with a general, and in some cases a detailed, description of some of the more important English and foreign docks; it is needless to say that they are all thoroughly well treated, and the trade statistics are carefully given and useful comparative distinctions drawn.

As a work on hydraulic engineering we can confidently recommend it to all those who are interested in the subject, feeling convinced that it will be found a most useful book. The author has produced, and students will profit by, a book well written, sound, and most useful in forwarding the science. Both volumes do credit to the publishers, the plates are good and well executed. These volumes ought to find a place in every technical library in the country.