TWELFTH
SIR ALBERT CHARLES SEWARD MEMORIAL LECTURE
12 DECEMBER 1964

A GREAT FRIENDSHIP, ITS ORIGIN AND CONSEQUENCES

BY

JOHN WALTON
Professor Emeritus of Botany, University of Glasgow

Published by

BIRBAL SAHNI INSTITUTE OF PALAEOBOTANY
LUCKNOW

ISSUED MARCH 1965

A GREAT FRIENDSHIP, ITS ORIGIN AND CONSEQUENCES

BY

JOHN WALTON
Professor Emeritus of Botany, University of Glasgow

Published by

BIRBAL SAHNI INSTITUTE OF PALAEOBOTANY
LUCKNOW

ISSUED MARCH 1965

THE 12th SIR ALBERT CHARLES SEWARD MEMORIAL LECTURE

A GREAT FRIENDSHIP, ITS ORIGIN AND CONSEQUENCES

BY JOHN WALTON

Professor Emeritus of Botany, University of Glasgow

THE foundation of the Sir Albert Charles Seward Memorial Lecture in this Institution by Lady Seward not only honoured the memory of her husband but is also a reminder of a most harmonious and fruitful friendship which existed between him and Birbal Sahni. I should like to give some account of the circumstances in which this friendship developed at Cambridge.

I give first a brief account of some of the events in the early years of Seward's career for they are probably less familiar to most of my audience than those of Birbal Sahni and they certainly influenced the later relationship of the two men:

Seward was born in Lancaster in the North of England in 1863 and there received his schooling in a kindergarten and later in the Royal Grammar School. At one time he attended some Cambridge University Extension lectures in geology given by John E. Marr who later occupied the Chair of Geology at Cambridge, and was taught chemistry and geology among the other subjects of the normal school curriculum.

Seward left school for Cambridge in 1883 on an understanding with his parents that he should eventually enter the Ministry of the Church of England. It was agreed, however, that he should at first take a degree in Science and later study Theology. At St. John's College he made many friends including the petrologist Alfred Harker, a lifelong friend who greatly stimulated his interest in geology. He studied Chemistry, Geology, Zoology and Physics for the first part of the Tripos examination and it was not until his second year in Cambridge that he included Botany in this rather formidable programme of studies. With the exception of Physics he did well in the examination and was awarded first class honours. Before starting his third year of studies for part II of the Tripos he had been persuaded by Professor McKenny Hughes to take Botany and Geology as his two subjects for this examination as a preparation for the study of fossil plants which McKenny Hughes thought was a promising field for exploration. The Sedgwick (Geological) Club in Cambridge was an important factor in his education for he took an active part in it and contributed many papers to its meetings. He was shortly after elected a Fellow of the Geological Society of London and his father paid the composition fee for his life membership. It was a good investment because he read many papers to the Society and finally became its President in 1922. He did not become a member of the Linnean Society until many years after that.

He took an energetic part in games but had been persuaded by his mother when he left school to give up football so took up rowing, but later finding that it took up too much of his time played tennis, boxed and took part in cross-country running. In later life his main exercise was walking or cycling. In pursuance of his parents' wish that he should enter the Church he attended lectures by the Regius Professor Divinity but had to confess that it was with little enthusiasm. He was not attracted by the prospect of becoming a

priest and giving up science. He was also greatly influenced by the writings of Thomas Huxley. Finally with much regret he took the momentous step of telling his parents for whom he had a very great affection, that he did not wish to take up Orders in the Church. They acquiesced and did not in any way oppose his wishes.

His final Graduation in 1886 had left him in an uncertain position: he did not wish to teach in a school and hoped to get a University post. He was advised, again by Professor McKenny Hughes, to study fossil plants which offered a wide field for investigation, and arranged to work under Professor William Crawford Williamson of Victoria College, Manchester, Professor of Botany, Geology and Zoology, the then recognized authority in Britain on the subject. He lived in lodgings in Fallowfield, a suburb of Manchester, near to Williamson and spent most of the time studying Williamson's wonderful collection of sections of fossil plants in coal balls, working in his small den known as the " coal-hole ". Seward told me that Williamson had a very pronounced tremor of the hands and it was remarkable that he could make the delicate drawings which illustrated his famous memoirs. His hand with the pencil would oscillate in an alarming way until his wrist rested on the paper when his hand became perfectly steady.

The British Association met in Manchester in 1887 when he was with Williamson and he met many distinguished botanists including Asa Gray of Harvard, de Bary, Count Solms-Laubach and the Marquis de Saporta. Later, in 1892, at the British Association meeting in Edinburgh he met Kidston and Scott who remained lifelong friends. He studied in Manchester for nearly a year and was then awarded studentships by St. John's College and the University of Cambridge, supplemented by a contribution from a travel fund. These enabled him to spend a year on the Continent of Europe where he made the acquintance of many botanists including Schwendener and Kny of Berlin and also Roemer and Count Solms-Laubach the Palaeobotanists. He examined a number of palaeobotanical collections and must have made numerous notes on specimens that interested him. He writes, however, in his memoirs that the immediate results of his visit abroad were of little scientific importance but that he made friends with many distinguished botanists and geologists from whom he got ' a good general, if superficial, idea of the palaeobotanical field '. By the end of the 18th century Sternberg, Schlotheim and other writers had described and named a considerable number of fossil plants and it was becoming generally realized that not only were fossil plants of interest botanically but were of stratigraphical value to the geologist. Their work was mainly based on compression material and one of the most important events in the development of Palaeobotany was the publication of " *Histoire de Végétaux Fossiles* " by Brongniart in 1828-1830. Some petrifactions had by now been investigated by the examination of polished surfaces but it was not until 1831 that the Nicol method of preparing thin petrological slices was employed by Witham of Lartington to reveal the internal structure of fossil plants. The adoption by Williamson of this method in the investigation of the fossils in Yorkshire and Lancashire coal-balls and later by Sorby the petrologist, who learned the technique from Williamson, led to the spectacular advances in palaeobotany and petrology. Later Nathorst developed methods of revealing structure in compression material by taking casts in celloidin of the surfaces of fossil leaves. When it was realized that so-called ' impressions ' were not merely impressions on the rock but consisted of the compressed organic material of the original plants, a great advance had been made. In many

instances it was found that the cuticles were in an almost unchanged state so that by maceration they could be isolated from the other plant residues by using Schultz's solution which came into use about the middle of the 19th century and was first seriously used by Schenk in 1867. Seward gives an account of Schultz's method in Vol. I, *Fossil Plants* in 1898. He published his first scientific papers on the fossils he had seen in continental museums in the Geological Magazine and in the Proceedings of the Cambridge Philosophical Society. In 1888 Stur, head of the Austrian Geological Survey, asked him to accompany him, as an interpreter (for Stur could speak no English), to the International Geological Congress held in England and on a visit to Manchester and other places. The visit to Williamson in Manchester was memorable: "Neither of the old gentlemen could speak a word of the other's language" writes Seward, and he had a difficult time as interpreter because he dared not always translate some of Stur's rather uncomplimentary criticisms with complete accuracy for fear of upsetting Williamson too much. Williamson was, somewhat, intolerant of the views of others and Seward tells of an occasion when he was talking to Williamson about the pteridosperms and had ventured to say that Kidston's work on impressions did not support some view of Williamson's. Williamson instantly burst out with "Confound Kidston's impressions!"

Back in Cambridge in 1889 Seward delivered his first lectures in the Geological Department and in 1890 was appointed University Lecturer in Botany. His work was at first confined to advanced teaching on Cryptograms and Gymnosperms. He also gave lectures in various towns in England under the University Extension scheme. In his unpublished memoirs he writes:. . . . ." I owe much to the experience gained as an extension lecturer: the practice in lecturing and conducting conversational classes as well as contact with students of many kinds was most valuable. It was a revelation to meet students who were entirely self-taught and had enjoyed no such privileges as I had had at Cambridge and none the less knew enough to make me realize that a young graduate has still much to learn, a salutary lession which had a lasting effect." These extension lectures correspond to the extra-mural Adult Education classes given by several Universities at the present time.

In 1891 he won a prize for his essay "Fossil Plants as Tests of Climate", perhaps the best known of his earlier writings. In the same year he undertook during vacation the description of the Wealden Plants in the British Museum Collections. This two-volume book was published by the Museum in 1894-95 and in 1900-4 the two-volume Catalogue of Jurassic plants.

In 1895 he paid several visits to Stockholm to work in the famous Rijks Museum where he made friends with Professor Nathorst who was by then employing Schenk's methods of isolating fossil plant cuticles.

In 1898 the Cambridge University Press agreed to publish *Fossil Plants* Vol. I, and in 1906 he was elected Professor of Botany in Cambridge. In addition to all his teaching and administration he managed to devote a considerable amount of time to writing, even during the first World War when he was Master of Downing College and was also serving as a 1st Lieutenant in the 1st Volunteer Battalion of the Cambridgeshire Regiment. He spent much time in military training and exercises but managed to continue with some palaeobotanical work. After the war he resumed his normal activities and received many distinctions. He was elected President of the Geological Society in 1922 and Vice-Chancellor of the University of Cambridge in 1924.

By the time Birbal Sahni went to Emmanuel College, Cambridge, in 1911 there was a number of palaeobotanists in Britain and on the Continent, exploiting some of the newer techniques. In Cambridge were Hamshaw Thomas and E. A. Arber as well as Seward. Sahni, Professor Harris, Mrs. Plumstead and I owe a big debt of gratitude to H. H. Thomas; he was a craftsman of a very high order as his Caytonia work testifies, and very helpful and friendly. In London or the south of England were Oliver, Scott and W. T. Gordon. On the Continent the outstanding workers among several others were Nathorst, Halle and Florin in Scandinavia, Gothan and Potonié in Germany and P. Bertrand in France. Sahni was able to visit and become acquainted with most of these palaeobotanists and their work. He graduated M.A. in 1914 and took the D.Sc. degree of London University in 1919. He stayed for nearly nine years altogether and it was my misfortune that I did not meet him until years later. I went to Cambridge from school in 1914 but left in 1915 and did not return until after the war, graduating in 1921. Since I was then an undergraduate student I did not have occasion to meet him. I was taught by Seward, Sir Arthur Tansley and F. F. Blackman, the same botanists from whom Sahni had received his instruction in the Botany School and also attended lectures in Physics by Dr. Alec Wood of the Cavendish Laboratory, a Fellow of Emmanuel College, for whom Birbal Sahni had a great admiration and affection. At Cambridge the College system is particularly suitable for students from overseas, affording them the opportunity of making friends among their tutors, fellow students, professors and lecturers. Sahni was fortunate in making friends with the Master of Emmanuel Dr. P. Giles, as well as Dr. Alec Wood, and was of course on very special terms of friendship with the Seward family.

In 1921 Seward, accompanied by Dr. R. E. Holttum, a close friend and contemporary of mine at Cambridge, visited West Greenland and I had the good fortune to be taken as a botanist in the 1st Oxford Expedition to Spitzbergen, where I collected living plants and fossils from the same localities as Dr. Bose. Expeditions such as these and those undertaken by Birbal Sahni in the Himalayas, are of inestimable value, especially to young biologists and geologists, stimulating their interest most profoundly and giving them the opportunity of exercising independently their powers of observation and resourcefulness. They stand out in retrospect as notable and memorable chapters in their lives. Today, fortunately, there are even greater opportunities for undergraduates as well as graduate students to enjoy such experiences.

This visit to Greenland was one of the very few collecting expeditions made by Seward for he was not an ardent collector like Sahni, Hamshaw Thomas and W. T. Gordon whose work was chiefly based on the specimens they quarried out themselves. The output of published research which he achieved is immense and yet his main contribution to palaeobotany lies in his more general writings. He was the historiographer par excellence of palaeobotany and although *Fossil Plants* Vol. 1-4 is in parts out of date it is still an essential book of reference in any palaeobotanical library. To this the reprint in 1963 of the four volumes by Hafner of New York testifies. Among his other writings is what he intended as an extension of *Fossil Plants*, namely "*Plant Life through the Ages*", and an excellent little book "*Geology for Everyman*" which was completed just before his death.

He was an indefatigable worker and had that very precious ability of being able to resume his research work or writing after an interruption without seeming loss of continuity. As administrator of a large

botanical department and with many teaching and University commitments it was remarkable how he made use of any time available, even of short periods, to pursue his writing.

He was an excellent lecturer and always held the attention and interest of the class. He regarded the elementary practical classes as perhaps the most important part of the teaching and discussed the choice of material to be put out for study by the students at regular meetings with demonstrators. He always came round and talked to every student during these classes. The practicals for his advanced lectures on Gymnosperms were mixed with discussions and were partly of the nature of seminars: each student was given a piece of investigation to do and was required to give an account of it at the end of the term. I believe that Sahni too adopted some of these practices in his teaching.

In looking through the impressive list of Sahni's published work one notices that he showed a particular interest in gymnosperms and ferns which was no doubt due to the influence of Seward and Hamshaw Thomas. I remember, when working for my final examinations, studying his outstanding contributions to the knowledge of Acmopyle and Tmesipteris. It was in connection with his work on Acmopyle that he coined the term *Stachysperms* for plants which produced ovules on the extremities of stems or branches, and *Phyllosperms* for those with ovules on leaf structures, though one wonders now if there is much difference fundamentally as both stem and leaf are composed of cauloids or telomes according to Lignier or Zimmerman. Of course his main contributions to science were the results of his researches on fossil plants and in particular the fossil flora of India to the knowledge of which he added so much. He undertook collecting expeditions to the Rajmahal Hills in 1931 where he and his students discovered Ontheanthus and Ontheostrobus and the material of Pentoxylacae. In the Deccan rocks important discoveries were made, and Enigmocarpon, Pondicherria, Viracarpon, and other angiospermous fruits were described by him.

During the later years he undertook the study of microfossils and this led to widespread results in attracting attention in India to their importance in Stratigraphy and in particular to the exploration for oil. It also led to a long controversy about the age of the Salt-range Saline Series in which Sahni played the leading part. His activities in the field stress clearly the immense importance of collecting. The rate of progress in Palaeobotany is after all directly proportional to the amount of collecting done and the volume of sedimentary rock split open by the investigators. Sahni's publications reveal an amazing width of outlook and wide range of palaeobotanical interests. Not only this but he made some valuable contributions to Indian Archaeology. To most of those present these facts are well known but for those who may know less about them the information is available in the excellent articles in Vol. I of *The Palaeobotanist*, the Birbal Sahni Memorial Volume.

There is a remarkable resemblance between the careers of Seward and Sahni: one destined by his parents for the Church of England, the other for the Indian Civil Service, both non-scientific occupations. Both were enthusiastic researchers in Palaeobotany and both well equipped with geological and botanical training. They were inspiring teachers and at the same time great organizers of botanical education. Seward wrote on the use of plant forms in mediaeval Church architecture, Sahni on Indian Archaeology. They both obtained the highest academic honours and were good administrators; both also were active in University work and in the international organizations concerned with Botany and

particularly Palaeobotany. In this connection I may recall that T. M. Harris spent his first years in Cambridge studying medicine and I myself set out to be an industrial chemist.

In this place it is hardly necessary for me to tell you about Sahni's remarkable career and achievements in advancing the cause of Palaeobotany. This building stands as a monument in the history of this science to a man of the greatest charm and integrity and of the untiring devotion of Savitri Sahni in helping to achieve the establishment of the Institute and its development. Birbal Sahni inspired many by his example of selflessness and his passion for the study of fossil plants and fortunately the staff of the Institute are in a worth manner sustaining the high standards which he set and we can look forward to its continuing success.

During the lifetime of Seward and Sahni some of the most remarkable palaeobotanical discoveries were made and perhaps the most outstanding was that of the Rhynie Early Devonian Flora followed in 1923-1949 by that fine series of publications by Kräusel and Weyland which added so much to our knowledge of the Middle Devonian Plants. The simplicity in structure exhibited by Rhynia supported previous theories of the evolution of the plant body such as that of Lignier which as Bertrand (1940, p. 85) points out anticipated the " telome " theory. Lignier's cauloid is a more general term for an ultimate division or branch of the plant body than the term telome and embodies all essential features of the latter. Lignier, moreover, was I believe the first to suggest the evolution of a flat dorsiventral frond by planation of a branching system of cauloids. The telome theory as formulated by Zimmerman has received wide-spread attention by morphologists but Lignier's contributions to this unit-plan type of plant construction should not be forgotten.

During the latter part of the 19th century Lesquereux, Knowlton, Dawson and others added greatly to what was known of the fossil floras of the United States and Canada, not only of the Carboniferous and Devonian, but also of the Tertiary and Cretaceous. Rather later E. C. Jeffrey's work on fossil conifers was notable and there is the very fine memoir of Hollick and Jeffrey on the Cretaceous conifers from (Kreisherville) N.Y. in which they sectioned on the microtome most successfully the softened lignite remains. The sections got by these means look like sections cut from existing coniferous plants.

The evolution of the Abietinean cone occupied much attention during the first quarter of this century. There were conflicting theories but I think that it is now generally accepted view that the ovuliferous scale is a much condensed shoot, in other words a brachyblast. Florin's investigations have been largely responsible for this, and thanks to his work and that of others we have a much better understanding of the interrelationships of the conifers.

During the first quarter of the century one of the problems that exercised the minds of palaeobotanists was the nature of the Pteridosperms. The almost complete synthesis of one, *Calymmatotheca hoeninghausi* had been effected. (The pollen-bearing part is still to be identified.) Its vascular organization and that of some obviously related types had been worked out in detail. Scott arranged the Pteridosperms into a number of groups: (1) Lyginopterideae, (2) Medulloseae, (3) Rhetinangieae, (4) Megaloxyleae, (5) Calamopityeae, (6) Stenomyeleae, (7) Protopityeae, (8) Cladoxyleae. Of these only the Lyginopterideae and Medulloseae have been proved to have been seed-bearing. There is no evidence of a reliable nature to prove that the others were seed producing. There is, however, some evidence that the Protopityeae for example were a distinct group: their secondary

xylem and many of their tissues are very different from the other groups. There is a suggestion that Protopitys was heterosporous. The proof of the connection between the fronds known as Archaeopteris and Callixylon given by Charles Beck and the demonstration that at least one species of Archaeopteris was heterosporous suggests that there were in the Devonian plants whose vascular structure and general organization was like that of gymnosperms but were as regards reproduction pteridophytes. The name progymnosperm suggested by Beck is apt. It seems likely that Protopitys falls into the same category as Archaeopteris and Callixylon.

Thomas's description of the Jurassic Caytoniales published in 1924 was a much-discussed topic. At first they were thought to be possible forerunners of Angiosperms for their ovules seemed to be enclosed in the sporophylls or parts of the sporophylls, in other words angiospermic. Prof. Harris, however, showed that pollen had direct access to the ovules. It is now supposed by some that the group may have originated from some Palaeozoic pteridosperm forebears, and this view I would support myself.

Sahni witnessed and indeed took part in the increased interest in microfossils which have become so important today. This is undoubtedly mainly due to the great value of microfossils in stratigraphy, particularly in its application to oil exploration. It will enlarge our knowledge of floras during long periods when great thicknesses of strata were deposited with but scanty macrofossils and will lead to a much wider knowledge of palaeoecology.

There is one aspect of the many branches of Palaeobotany in which I believe further progress can be made and that is a more critical study of the form in which we find compressions. More accurate deductions can then be made as to the original form of the plant from which the compression has been formed. Modification of its dimensions and chemical composition are the result of having been embedded in sediment and subjected to vertical pressure during the consolidation of the sediment and later effects of pressure and temperature. I think that with the newer techniques available such fascinating problems and suggestions as those put forward by Mrs. Plumstead as to the nature of the Glossopteris fructifications may in time be taken further. The Glossopterideae are such important constituents of fossil floras in India that any information which can be wrung out from them by further research will be of great importance and interest and will, we hope, add to the knowledge of Glossopteris and its associates to which Sahni contributed so much. It is very encouraging that much is being done in this Institution to further this research.

I have in this tribute to Seward and Sahni made a selection of facts which I myself have found of special interest. I have neglected very many other important matters. I have also made no attempt to refer to all the important work being done in other countries or to mention more than a few of their many friends and palaeobotanical colleagues some of whom are present here today. Sahni regarded Seward as his guru but as the years passed, and the passing of years has a levelling effect on the relationship of man to man, I think that my father-in-law must have come to regard Sahni in several of their fields of common interest as his guru.

I feel specially honoured in having been asked to deliver this lecture. My wife Dorothy sends her greetings to her many friends here, and I should like to take this opportunity of thanking the Government of India, the Institute and particularly Savitri Sahni and Dr. Surange for their great kindness in providing the means of my coming and for their generous hospitality. I greatly enjoyed having one of Institute Staff, Dr.

Lele, as a colleague in Glasgow and I like to think that there is one material link as well as others of friendship between the Institute and the University of Glasgow which was so closely connected with Bower, Kidston and Lang, and that is the Stigmaria which stands here in the Fore-hall. It was excavated from a quarry which once existed in what is now the Glasgow University Campus, whence stone was obtained for a large part of the new building in 1867. It is possibly part of the same forest as that exposed in the Fossil Grave in Glasgow. Its trunk is here but its roots are still firmly fixed in the rock over which the University stands. When Professor and Mrs. Sahni were visiting Glasgow some years ago the Stigmaria was standing outside the front door of the Botany building as alterations to the building were in progress. Sahni admired it. I happened to say that I did not know where to put it when the alterations were finished and he at once said: "Let me have it for Lucknow." It was an excellent suggestion for after all we could spare it as Glasgow has a forest of them in the Fossil Grave. The Court of the University gladly gave its consent and the Stigmaria was presented to Professor Sahni for the Institute.

9 Windsor Street
Dundee
SCOTLAND