GENERAL ARTICLE

Correspondence between South African geologist Alex L. du Toit and Birbal Sahni concerning Gondwana Palaeobotany (1925–1944)

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ABSTRACT

Birbal Sahni (1891-1949) was well known as the first Indian palaeobotanist, and he established the Institute that was named after him, now the Birbal Sahni Institute of Palaeosciences. Alexander L. du Toit (1878-1948) was the most famous South African geologist, known internationally for advocating the idea of Continental Drift, and for his work on Gondwana geology and palaeobotany. Du Toit was introduced to Sahni by Albert Seward, who was Sahni's mentor at Cambridge University. They started a correspondence in 1925, involving the exchange of papers, books, and samples, which lasted at least until 1944. Du Toit and Sahni met in 1938 at the Indian Science Congress in Calcutta. Their preserved letters deal with the palaeobotany, correlations, and age of the Rajmahal beds, and later with the palynological investigations of Karoo Dwyka samples sent by du Toit to Sahni, which were worked on by D. D. Pant, who had been a student of Sahni. This correspondence reveals in detail just how these geoscientists involved with problems of Gondwana palaeogeography tackled these questions in spite of the long distances, and slow communications of the time. Information, especially that published in local journals, was disseminated by means of sending reprints, proof copies, and sometimes by handwritten lists of fossils. Although, initially, Sahni had obtained South African and Australian fossil material through the British Museum in London, he later obtained South African samples specially collected for him by du Toit. Samples were also exchanged between South Africa, England, India and Australia.

Keywords—Rajmahal, Karoo, palynoflora, Virkki, Pant.

INTRODUCTION

BIRBAL Sahni (1891–1949) was the first Indian to obtain a doctorate in palaeobotany. He studied at Cambridge University under the supervision of Professor Albert Seward (1863-1941), the most eminent palaeobotanist in Britain in the early 20th Century, obtaining a degree in 1914 (M. R. Sahni, 1952; A. Sahni, 2018). Sir Henry Hayden, Director of the Geological Survey of India, had sent a collection of fossil plants from the Indian Gondwana beds to Cambridge, where Seward and Sahni examined them in 1917–18, and later published a major revision of these flora (Seward and Sahni, 1920). Sahni returned to India in 1919 after obtaining a DSc from London University, worked in several institutions, and established a major international reputation as a palaeobotanist. He became a professor at Lucknow University, where he founded the renowned Institute of Palaeobotany that was named after him[1]. He was also the fifth Indian scientist and first Indian botanist to be elected as a Fellow of the Royal Society (Gupta, 1978).

Birbal Sahni

Albert Seward

South African geologist Alexander Logie du Toit (1878–1948) was an ardent supporter of the ideas of Alfred Wegener (e.g., Wegener, 1915, 1924) concerning the former existence of large supercontinents, and their breaking apart through the process of continental drift. He spent seventeen years mapping the entire Karoo basin, and parts of the Cape Fold Belt, becoming the pre–eminent authority

1 The Birbal Sahni Institute of Palaeobotany, established in 1946, has recently been renamed the Birbal Sahni Institute of Palaeosciences (Bajpai, 2016).

on the stratigraphy, lithology, and palaeontology (especially palaeobotany) of the Palaeozoic to Mesozoic rock successions of this enormous region in South Africa. In 1923, with support from the Carnegie Institution in Washington, D.C., he had spent four months doing extensive reconnaissance mapping in Brazil, Argentina and Uruguay. He was able to make detailed comparisons of geology, stratigraphy, facies, and paleontology between the rocks of the Sierra de la Ventana and Parana Basins of South America, with those of the Cape and Karoo Supergroups in the Cape Fold Belt and Karoo basin of southern Africa (du Toit, 1927a).

Alexander Logie du Toit

Du Toit had known Albert Seward and communicated with him since at least 1917, which is the date of their earliest extant correspondence, and their acquaintance lasted until Seward's death in 1941. In his obituary of Seward, du Toit (1942), stated that Seward first came to South Africa in 1905 during the joint meeting of the British and South African Associations for the Advancement of Science. It was probably during this meeting that du Toit and Seward may have first met, for du Toit was then working for the Geological Commission of the Cape of Good Hope (Gevers, 1950), and he had presented an overview of the Stormberg Formation of the Karoo Basin (du Toit, 1905), while his senior colleague Arthur Rogers[2] had presented an overview of Cape geology (Rogers, 1905) at that meeting. It was through Seward that du Toit was introduced to Birbal Sahni, with whom he started corresponding in 1925.

The du Toit–Sahni correspondence is preserved in the Alex L. du Toit papers (BC 722) held in the Jagger Library (JL) at the University of Cape Town, South Africa, and in the Birbal Sahni Papers held at the Nehru Memorial Library (NML) at Teenmurti, New Delhi, India. The Sahni papers had been donated to the NML by his widow, Mrs Savitri Sahni, who was a friend of Mrs Indira Gandhi, who had attended the opening ceremony of the Institute of Palaeobotany together with her father, then Prime Minister Jawaharlal Nehru, on 3 April 1949. The very existence of this correspondence, extending over a period of 19 years, is a surprise, since du Toit and Sahni had not produced any joint publications, and there is no mention of their friendship or contacts in existing biographies of both eminent scientists (e.g., Haughton, 1949; Gevers, 1950; Hamshaw Thomas, 1950; Sahni, 1952; Gupta, 1978). Their known correspondence started in 1925 when du Toit was awaiting the publication of his "Geology of South Africa", which eventually appeared a year later (du Toit, 1926). Sahni sent du Toit a reprint of his paper "The

Indian Prime Minister Jawaharlal Nehru, Mrs Indira Gandhi, and Mrs Savitri Sahni at the official opening of the Institute of Palaeobotany on 3rd April 1949.

ontogeny of vascular plants and the Theory of Recapitulation" (Sahni, 1925), based on his Presidential Address of the Indian Botanical Society, 14th January, 1924, Bangalore[3], which is inscribed "With the author's compliments". In the first preserved letter, du Toit replied to Sahni, thanking him for his paper, and indicating that several papers that had been requested were being sent in a separate post. Du Toit was anxious to send to Sahni lists of the fossils recorded from the South African Karoo beds, so he sent Sahni annotated type–written proof copies from his forthcoming book. Sahni then sent du Toit a copy of his 1921 Presidential Address to the Eighth Indian Science Congress, "On the Present State of Indian Palaeobotany" (Sahni, 1922). Du Toit in turn had a copy of his book sent directly from his publishers in Edinburgh to Sahni, who received it in late December 1926. This book is preserved in the Library of the Birbal Sahni Institute of Palaeosciences in Lucknow, and is signed by Sahni, with the date January 1927.

Although it is mainly the letters from 1925 to 1927 that are preserved in the du Toit and Sahni archives, du Toit kept in contact with Sahni for many years thereafter, through postcards and exchange of papers. There is a letter (from du Toit to Sahni) dated 18 February 1937 (19). Later that year (as recorded in his diary for August, du Toit, 1937b), du Toit received and replied to a letter from Sahni while he was in Russia attending the 19th International Geological Congress in Moscow. Du Toit visited India in December 1937–January 1938, during which time he attended the Indian Science Congress in Calcutta (Anon, 1938; Master, 2020a), and chaired a joint session on geology and palaeobotany on the 4th January 1938 (du Toit, 1938). Among those present was Birbal Sahni, as well as his younger brother M. R. Sahni (also a palaeobotanist, who later wrote a biographical sketch of his brother; Sahni, 1952), both of whose signatures appear in a list of attendees in du Toit's notebook. At this congress, du Toit also met many other Indian geologists with whom he

2 Dr Arthur William Rogers (1872–1946), South African geologist

corresponded for several years afterwards, most well–known among these being D.N. Wadia (Master, 2020b) and M.S. Krishnan (Master, 2020c). Some letters, including important exchange of papers and samples, from 1939 and 1944, make up the rest of the surviving correspondence between du Toit and Sahni. We lack du Toit's diaries from 1945–1946, so we don't know if he communicated any further with Sahni, in his last years. His diary for 1947 (du Toit, 1947) does not reveal any letters that were either received from, or sent to, Sahni. Du Toit died on 25th February 1948, a month short of his 70th birthday, and Sahni died on 10th April 1949, aged 57.

THE CORRESPONDENCE

(1) Du Toit to Sahni, 22 May 1925 [NML]

Union of South Africa
Irrigation Department
Post Office Annex
Pretoria
22/5/25

Prof. B. Sahni D.Sc.
Lucknow

Dear Sir

Many thanks for the copy of your important paper[3], which I had as yet been unable to obtain. In return I am forwarding under separate post the paper asked for and some others which deal in some measure with Gondwanaland. It has been a great pleasure to find that my general conclusions as to the age and correlation of the Indian Gondwana fit in so well with your more accurate determinations, particularly in respect to the U. Carboniferous age of the Kanharbari. A curious point is the sudden change in the flora between the Passora and the Rajmahal, suggestive of a break. Our Molteno flora is like that of Queensland–rich in Ginkgoales–and contains numerous species many as yet undescribed. Various factors have delayed the completion of my description of the Molteno Flora, but I hope to carry on again next year. We do not find such genera as *Otozamites*, *Ptilophylon*, *Dictyphyllon*, etc., so well represented in India and Australia, and the tendency is all to push the Molteno Flora well back in the Upper Triassic.

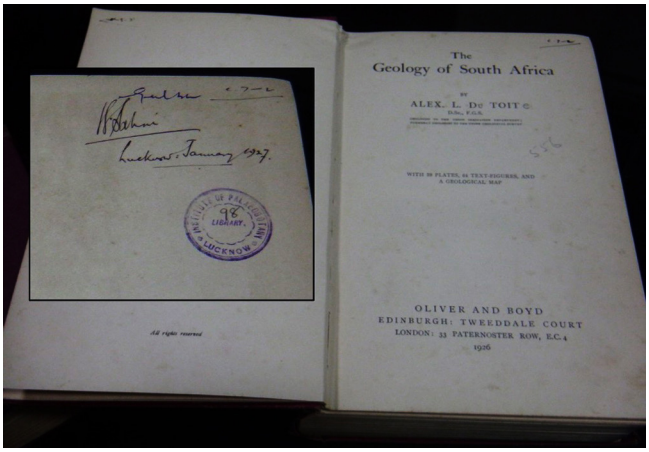
You will find a more satisfactory and revised list of forms in my "Geology of S. Africa" which ought to appear at about the end of the year.

With thanks
Yours truly,

Alex L. du Toit.

[In Sahni's writing a note: "Wrote on 25/6/25 asking for revised list of S. African fossil plants & whether exchange of duplicate fossils would be favourably considered. BS. 25/6/25"]

3 Sahni (1925)



Birbal Sahni's copy of du Toit (1926a), The Geology of South Africa, in the library of the BSIP.

(2) Sahni to du Toit, 25 June 1925 [Not in JL or NML]

(3) Du Toit to Sahni, 9 September 1925 [NML]

Union of South Africa
Irrigation Department
Post Office Annex
Maun, Ngamiland
9.9.25

Prof. B. Sahni
University of Lucknow, India

Dear Dr Sahni,

It was a great pleasure to hear of your intended work and that the extensive collections of the Geological Survey were to receive your attention. It has long occurred to me that a revision of those floras in the light of more recent work would be of inestimable value, since India had yielded the bulk of the descriptions of the Southern Flora. With regard to your request for advance lists, I am at the moment out in the field and far from the Union, but expect to be back at Pretoria in November and shall select such extracts from my book (in typescript) as would be of use to you. The proofs of the latter ought to be arriving at about that time too, but the work would not appear until early 1926. The plant lists have been revised, but I have hesitated to include in the Molteno Flora any of the new species, as it is I think inadvisable to print merely a list of advance names.

The correlation of the "Karroo" in S. Africa as well as in the equivalents elsewhere is much advanced by my recent work, so I look forward to seeing your views on the corresponding beds and floras in India.

The suggestion which you put forward regarding the exchange of specimens is an excellent one and on return to Pretoria, I shall sound Dr Rogers, Director of the Geological Survey, on the matter. He has already forwarded a small collection of Permian plants to Prof. Zalessky[4] only recently. Much more ought to be done in the way of collecting plant material here, for our stuff is very limited in amount and often highly fragmentary, but, as usual, the purely palaeontological side has always to be subordinated to practical and economic considerations.

In conclusion you may be assured that I shall post off to you the excerpts at the earliest date, realizing that the preparation of an address is often a tedious task and also appreciating the scarcity of direct posts between this country and India.
Believe me

Yours sincerely
Alex L. du Toit

(4) Du Toit to Sahni, 10 November 1925 [NML]

Union of South Africa
Irrigation Department
Post Office Annex
10/11/25
Dear Prof. Sahni

As promised, I take this earliest opportunity since my return of forwarding you some sheets giving the plant fossils obtained from the Karroo System. All species provisionally determined or as yet undetermined have been omitted from the list.
Trusting this will give you what you want.

Yours sincerely,
Alex L. du Toit.

[Three foolscap pages, and a fifth of a fourth page of the type written and heavily annotated proof copy of du Toit's "Geology of South Africa" was sent to Sahni, and is in the Sahni papers–Annotated by Sahni: "From Dr. A.L. du Toit (Received 1925–6).]

(5) Sahni to du Toit, 12 January 1926 [Not in NML, or JL]

(6) Du Toit to Sahni, 18 February 1926 [NML]

Union of South Africa
Irrigation Department
Post Office Annex

18/2/26

Dear Dr Sahni,

Sometime ago Dr Rogers gave me the letter which you had written him in Oct. last and I promised to attend to it by sending the papers asked for. Unfortunately I found I had run out of reprints of the more important ones and can only send the others. Hoping to find a spare copy led to this delay which has only crossed my mind again by the arrival of your letter of the 12th Jan.

The new forms which you are questioning are described in a paper by Walton in the "Annals of the S. African Museum". Vol. XXII, Pt. 1 1925, price [blank] which will be obtainable from West & Newman, their agent in London. I regret not having a spare copy to send to you.

I hope it may be possible to return to the description of the Molteno Flora in another six months time, as its new forms are very interesting, such as the several species of *Pseudoctenis*. We ought to gather more material, however, but means unfortunately do not permit the carrying out of much "uneconomic researches".
With best wishes,

Yours sincerely,
Alex. L. du Toit.

The letters from 1927 deal mainly with the Rajmahal flora, which were regarded by early workers such as Feistmantel (1877a), as well as by Sahni (1922, 1926) as being entirely of Jurassic age. Sahni (8) laboriously wrote out by hand long lists of the fossils obtained from these beds, a fact that was noticed and appreciated by du Toit in his reply (9). Du Toit, however, had detected certain forms from the Upper Karoo Beds in South Africa, which were Rhaetic (latest Triassic) in age, which were similar to many forms from the Rajmahal series, and he suggested that perhaps the lowermost shales from the Rajmahal district, which had not been tested for fossils, could turn out to be Rhaetic in age as well. Sahni (10) went to considerable lengths to get as much information about the Rajmahal beds as possible, and wrote to the Geological Survey of India about this (11). He made a copy of their reply for du Toit (12), and again included long lists of fossils, as well as a stratigraphic column. In a postcard dated 15 September 1929, Sahni (13) asked du Toit to send him a reprint of his paper on Zones in the Karoo (du Toit, 1918). Du Toit (14) replied that he had run out of reprints, but had an original typescript, which he sent to Sahni (without the accompanying map).

(7) Du Toit to Sahni, 2 January 1927 [JL]

Union of South Africa
Irrigation Department
General Post Office Annexe

4 Mikhail Zalessky (1877–1946), Russian palaeobotanist. Sahni (1933) named a species (*Dadoxylon zalesskyi*) in his honour.

Postcard from Sahni to du Toit, dated 15 September 1927

Pretoria
2/1/27

Dear Dr Sahni

I must thank you very much for your most valuable and interesting Address, which handles several problems in an illuminating fashion. I was particularly impressed with your argument that the so–called Northern types were probably survivors and not invaders of Gondwanaland.

I observe you have difficulties with respect to the conditions in Argentina, which are by no means simple, but I hope that my Report that has now gone to press on that part of the world may explain some of them and help to show the true relation of the older flora to that of Gondwanaland.

At the moment I am engaged on the description of the Molteno Flora and am finding a considerable number of new forms, some of which are known species from India or Tonkin; interesting are the number of species of *Pseudoctenis*, for example *P. carteriana* & *P.* cf. *balli*. I have for years been impressed with the close affinities displayed with the Rajmahal Flora & have not hesitated to correlate the Stormberg with that Series, the present investigation only serving to reveal some more Rajmahal species. Now the Rajmahal is always regarded as Jurassic, though as far as I can make out the bulk of the species described are confined to the Rhaetic or occur in both Rhaetic and Lias. Under the circumstances I shall be very glad of your experience and opinion as to whether the Rajmahal is not older than Jurassic. [This sentence highlighted with double lines in margin in pencil by Sahni]. As you are aware, we have been compelled to move the Molteno Beds back into the Trias–Rhaetic, while Walkom has also put the Ipswich Series into a similar position in the geological column. I should feel more satisfied if there were good evidence that the Indian plant horizons of the Rajmahal Hills were a bit older, Rhaetic even rather than Jurassic. Curiously in the Molteno Beds we have in addition to these forms with Rajmahal affinities, others of a distinctly earlier aspect, such as *Thinnfeldia narrabeenensis* & *Calliopteridium*.

I presume that you have had the opportunity of working through the Geol Surv. Collections and so would be well informed; if not, you might be in a position of informing me whether there are any insuperable objections to a pre–Jurassic age for the Rajmahal. I have an idea that the younger age has been instituted because of the association with the undoubtedly more recent beds of Cutch, etc.

If you are engaged on a revision of the Indian collections I should be very glad to have the inestimable opportunity of discussing the affinities of certain forms which appear to be closely related to some forms from the Molteno Beds.

My Geology has been published in Edinburgh & an advance copy has just come to hand; the work will I trust be the means of making the geology of this fascinating country known to the many workers in other parts of the world.

With kind regards & best wishes for the coming year,

Yours very truly,
Alex. L. du Toit

(8) Sahni to du Toit, 10 February 1927 [JL]

University of Lucknow
Botany Department

10th February 1927

Dear Dr du Toit,

Please accept many thanks for your kind letter of the 2nd January and for your kind wishes for 1927, which I sincerely reciprocate. I am glad you agree with me that the so–called northern forms in Gondwanaland were probably survivors from the Gondwana times and not invaders. With regard to the Sumatran flora referred to on p. 243 of my paper[5] I wish to inform you that Dr Posthumus'[6] view as to a Permian age has been contradicted by Dr Jongmans[7]. It was at his instigation that Dr Posthumus was collecting in Sumatra, and the material,

5 Sahni (1926)

6 Dr O. Posthumus, Dutch palaeobotanist who worked in the Dutch East Indies. His work referred to was Posthumus (1927).

7 Dr Wilhelmus Jongmans (1878–1957), Dutch palaeobotanist (Wagner and van Armerom, 1985). Jongmans' observations were published later in Jongmans and Gothans (1935).

which is now with Dr Jongmans, neither includes any Permian brachiopods nor any plant fossils that should be classed as Permian rather than Upper Carboniferous. Posthumus' "*Walchia*" turns out to be a *Bothrodendron*!

I hopefully look forward to receiving from you a copy of your Report on Argentina in due course. Shortly before your letter arrived I received my copy of your most valuable book on the Geology of South Africa, which fills such an important gap in geological literature.

Your suggestion that the Rajmahal flora may be older than Jurassic had never occurred to me. It is certainly worth carefully looking into. As far as it has been possible for me to do this at Lucknow I have formed an impression of this flora which I give below. With the exception of the petrifactions, which I am at present working at, all the specimens are now in Calcutta, and I cannot say that I have examined them all critically, certainly not from the point of view of geological age–but luckily several of the Rajmahal forms (especially the ferns and cycads) were examined by Professor Seward and myself at Cambridge, and I have recently done the conifers, so that the following list may be taken as more or less critical. It includes only the species recorded from the Rajmahal Hills and not those from Golapili (Madras) which have been correlated by the Indian Geological Survey with the Rajmahal Stage proper and which should be examined on their own merit. The provisional list I published in 1922 (in a paper[8] of which I sent you a copy about a year ago) includes both.

My own general impression of the Rajmahal flora is distinctly Jurassic. From the recorded occurrences of these species or of closely allied forms in and outside India it doesn't seem that we would be far wrong in assigning a Jurassic age for the whole assemblage. Several of the species, it is true, are known from the Rhaetic but all of them extend into the Jurassic, and nearly all were more widely distributed in the latter than in the Rhaetic. The Rhaetic occurrences, moreover, are counterbalanced by a number of Cretaceous one, especially where the same species ranges from the Rhaetic to the Cretaceous. Unfortunately I am still rather confused over the *Nilssonias*, which gave me a great deal of trouble at Cambridge; there may be more static forms among these and perhaps also *Taeniopteris*; and as these two genera are rather strongly represented it is possible they include considerable older elements, though even then the preponderance would be Jurassic. [Inserted] * Halle, indeed, thinks the Rajmahal Flora (including the Golapili one) my even be younger than Liassic (Graham Land Memoir 1913[9], p. 102; also Halle, Some Mesozoic plant–bearing deposits in Patagonia, K. Svensk. Vet.–Akad. Handl. Vol 51 No. 3, p. 10, 1913[10]).* I wish I could speak with more knowledge than I can at present claim. In my revisions of the Indian collections I am looking, to start with, more from a botanical standpoint, group by group, leaving a consideration of the floral assemblage till the systematic treatment is completed, when I hope to be on surer ground in discussing correlations. But when I am next in Calcutta during June and July I shall be very glad indeed to send you my descriptive notes, photographs and other information, as well as my impressions as to affinities, of any of the specimens which interest you. Most of the best specimens have been figured already, but not always correctly, by Feistmantel. By that time I am also hoping my first memoir (Indian fossil Conifers)[11] will have been published, and I will send you a copy as soon as I get my reprints.

With kind regards,

Yours sincerely,
B. Sahni.

Flora of the Rajmahal Hills (Rajmahal State)

{A fairly complete list of the species, with the occurrence of the some of the characteristics forms or of related species}
(Some types still to be revised)
Equisitales rajmahalensis Oldh., G (E. appispinatus Nath.). W (allied sp.)
Lycopodites gracilis (Morr.), Y (closely allied L. falcatus)
Sphenopteris hislopi (O.&M.)
Cladophletis denticulate Brogn., Y.U.K.G.J. Uit. JNZ. P(?)
Pecopteris lobata (O.&M.)
Marathiopsis macrocarpa (Morr.)
Danaeopsis rajmahalensis Fst.
Thinnfeldia indica Fst., G (T. constricta Halle). V(?).
Gleichenites gleicherides O.&M., B.
Coniopteris hymenopteroides (Brogn.), Y.G. JNZ. C. (var. australis). T. V.(var. australis)
**Taeniopteris lata* Oldh.
Taeniopteris morrisi Oldh.
?(*Taeniopteris ovalis* L.&H.)
Taeniopteris vittala Brogn.
Taeniopteris musaefolia Oldh.
Taeniopteris spatulata (Hall.), JNZ. K. RNZ. W. B. C. A. T. V. WA. Tonk.
Taeniopteris crassinervis (Fst.), JNZ. M. E. I. N. W(?).
Nilssonia rajmahalensis (Oldh.)
Nilssonia princeps (O.&M.), Y. (N. compta possibly identical with princeps)
Nilssonia fissa (Fst.)
Nilssonia morrisiana (Oldh.), G. (Pseudoct. Ensiformis Halle)
Nilssonia medlicottiana (O.&M.)
Nilssonia Brindabanensis Sew. & Sah.
Otozamites bengalensis (Oldh.), K. WA. Y(O.feistmanteli almost identical)

8 Sahni (1922)

9 Halle (1913a)

10 Halle (1913b)

11 Sahni (1928)

Otozamites abbreviates Fst., G.
Ptilophyllum antifolia Morris, W.U.J.K.JNZ.B.Tonk. LSM.Y(allied sp.)
Dictyozamites falcatus (MOrr.), K. BT(allied form).
Bucklandia indica Sew.
Genus in Uit and in Wealden of Engl.?
Williamsonia microps Fst.
Williamsonia indica Sew. J.
Williamsonia cf *W. setosa* Nath.
Williamsonia sp.
Retinosporites indica (O.&M.)
Slatocladus comporta (Morr.)
Coniferocaulon sp.
Strobilitas pascoei sp. nov. (Sahni)
Conites rajmahalensis sp. nov. (Sahni)
Conitis sessilis sp. nov. (Sahni)
Pagiophyllum cf *peregrinus* (L. & H.), J. B(?). T(?)
Brachiophyllum mamillara Brogn., Y.
Brachiophyllum expansum (Sternb.), U.J.K.

Index of abbreviations used in accompanying list.
G = Grahamland Jurassic
K Kota Stage Up. Gond. India Jurassic
J Jabalpur Stage, Up. Gond. India
U Umia Stage Lower Cretaceous
P Parsova Stage India (?Up. Trias)
M Molteno Beds (Up. Trias.)
Uit. Uitenhage Series (Weald.)
RNZ Rhaetic of New Zealand
JNZ Jurassic of New Zealand
E Esk Series Queensland Triass. Rhaet.
I Ipswich Series Queensland
W. Walloon Series Queensland Jurassic
B. Burrum Series Queensland Cretaceous
N. Narrabeen Stap. NSW (Up. Trias.)
C = Clarence [sic] Series
A Artesian Ser.
T Talbragar Ser,
V. Jurassic of Victoria
WA. Jurassic of Western Australia
Tonk. Tonkin (so–called Rhaetic).
Y. Yorkshire Jurassic
BT. Bahia Tekenika (Jurassic) (Halle's Patagonia paper)
LSM. Lago San Martin (Halle's Patagonia paper)
(Rio Fosiles locality) Jurassic or Lr. Cretaceous

(9) Du Toit to Sahni, 3 April 1927

[Note by Sahni: "Received end of April 1927"]

Union of South Africa
Irrigation Department
Union Buildings
Pretoria
3/4/27

Dear Dr Sahni,

Many thank for your reply with the long list of Rajmahal forms that you have been kind enough to compile, manifestly with some labour.

I have felt no doubt as to the general Jurassic aspect of the Rajmahal flora, but examination of the Molteno flora has shown several forms common to them, which suggested either an older element in the Indian series or a Rhaetic age for the latter possibly. Among those forms are the following: *Taeniopteris eraroinervis* Feist., *T. spatulata*, *T. lata*, *Pseudoctenis carteriana* (Old.); *Zamites cf. rajmahalensis* (Morr–pars) & in the Stormberg of Rhodesia *Taeniopteris mcClellandi* (Old. & Morris)

From other lines of evidence the Molteno flora which in addition to Rhaetic forms contains Permo–Triassic elements, is being regarded as probably Keuper and hence the alliances with the Rajmahal have caused me to question the age generally ascribed to the latter. It is true that the Rajmahal consists of a thickness of up to 2000' of volcanics with intercalated plant bearing sediments and I am not certain whether the material described comes from more than one horizon or not. Possibly you may be able to advise me on this highly important point, for there is just the possibility that the basal portion may possess a slightly different floral character and that the common forms recorded above may have been derived from that particular section.

Anyhow I merely throw out these suggestions for criticism. It is certain that the majority of the Rajmahal genera are not even represented in S. Africa, such as *Lycopodales, Gleichenites, Coniopteris, Nilssonia, Otogamites*, *Stilophyllum, Drityogamites, Williamsonia*, etc. Curiously, I have found a *Pseudoctenia* that I am comparing with *P. balli* of the Lower Gondwana.

My paper on the Upper Karroo Flora[12] is now completed, though as to when it will be published is a little uncertain. My small collection from Argentina has revealed in the "Rhaetic" of that land several more Molteno or Australian species and the Molteno flora is now found to display strong affinities with that country as well as with Tonkin, Queensland and Tasmania.

I must thank you very much for your kind offer of help when visiting Calcutta, but from the above remarks you will observe that the problem at issue is more a stratigraphical than a palaeobotanical one, since so many of the Rajmahal forms have been already figured and described.

With much appreciation for your kindness in furnishing the detailed list and explanation,

I remain yours sincerely,
Alex. L. du Toit

12 du Toit (1927b)

(10) Sahni to du Toit, 10 August 1927

University of Lucknow
Botany Department
10th August 1927

Dear du Toit,

I have before me your letter of the 3rd April in which you had raised the important question as to whether the described Rajmahal plants came from one horizon or more, and whether, in the latter case, some of them might belong to a Rhaetic horizon.

I must thank you for drawing my attention to this stratigraphical question which had not struck me, for I assumed that the fossils all belonged to one lot. As a result of your letter I wrote officially to the Director of the G.S.I. a copy of whose reply I now enclose for your information. I have not gone carefully into the synonymy of the species named in this letter (and there are no references to Feistmantel's[13] or Oldham and Morris'[14] figures of these species, so that some doubt will remain as to identities in a few cases) but on the whole neither of the two sets of species (Burio and Murrero) appears to indicate a Rhaetic rather than a Jurassic horizon. I must, however, refrain from giving an opinion on this matter without going into it more carefully, and would be grateful to know (in course of time) what conclusions you arrive at on this very important point.

The remaining fossils, that is, those which cannot definitely be consigned to one or the other horizon, do not appear to be numerous, but it would be worth while knowing what they are, by comparing the full list.

Since you had raised the question in the case of the Rajmahal Hills flora I also asked the G.S.I. to say on what grounds they correlated the Golapili Beds of the Madras coast (described in a special memoir by Feistmantel[15], as a part of his "Gondwana flora") with the Rajmahal Stage of the Rajmahal Hills. His reply is given in para 2 of his letter.

I am very grateful for your leaflet on a Geological comparison of South Africa with S. America[16] and will look forward to see the detailed results of your S. American work[17]. I also hope your work on the Upper Karoo flora will soon be accessible to other workers. I expect my first paper on Indian conifers[18] to be out in a few months but I fear the others are still unfinished. With kindest regards and many thanks for the valuable gains the opportunities of corresponding with you have brought me.

I remain
yours sincerely,
B. Sahni.

(11) Sahni to the Director, Geological Survey of India, 11 July 1927 [NML]

The University,
Lucknow
Simla
11 July 1927

The Director
Geological Survey of India
Calcutta

Dear Sir,

In a recent letter to me Dr A.L. du Toit has raised the question as to whether the Rajmahal beds of India, commonly regarded as Jurassic, may not be, in part, of Rhaetic age. While there seems no doubt of the Jurassic aspect of the flora as a whole, the question is whether the species recorded all come from one horizon or from more than one. The problem at issue being a stratigraphical rather than a palaeobotanical one, I shall be grateful if you would kindly advise me on the subject. In case there are more plant bearing horizons than one in the Rajmahal Hills (Rajmahal Stage), I shall be glad if you could furnish me with lists of the species collected from each.

I may add that Dr du Toit believes he has discovered in the Molteno beds (which from other lines of evidence he has reasons to refer to a Keuper age) several species of plants which have been described from the Rajmahal beds.

I shall be obliged if you could state whether there are any reasons other than palaeobotanical for correlating the Golapili beds (Madras) with the Rajmahal Stage.

Thanking you in anticipation,

I remain
Yours faithfully,
B. Sahni.

(12) Director of the Geological Survey of India to Sahni, 28 July 1927 (NML)

No. 3038

From
The Director,
Geological Survey of India

13 Feistmantel (1876; 1877a)

14 Oldham and Morris (1863)

15 Feistmantel (1877b)

16 du Toit (1926b)

17 du Toit (1927). This book is in the library of BSIP, with Sahni's signature.

18 Sahni (1928)

To
Dr. B. Sahni, D.Sc.,
Professor of Botany,
University of Lucknow,
Lucknow.

Dated Calcutta, 28th July [1927]

Dear Sir,

With reference to your letter dated 11th July 1927, para. 1, the following is the general section of the strata of the upper beds of the Rajmahal Hills in descending order (Pal. Ind. Ser. II, Vol. I, p. 2).

1. Basalt
2. Hard quartzose grit.
3. Trap, compact
3(a). Trap softer and more largely crystalline.
4. Beds of white shale and sand stone.
5. Trap–olivinic.
6. Similar to N. 4 but without sandstone.
7. Columnar basalt.
8. Black carbonaceous shales.
9. Trap–columnar.
10. Sandstone, coarse and ferruginous.
11. Trap, generally soft, rather earthy and abounding in olivine.
12(a). pisolitic iron ore
12(b). Carbonaceous black shale.
13. Trap, soft and olivinic.

These rest upon grits (Dubrajpur group) coal bearing rocks (Damuda Series), or gneiss. It is stated (Pal. Ind. Ser. II, Vol. I, p. 4) that "the next sedimentary beds in a descending order (viz. Nos. 4 & 6 of the general section p. 2) are by far the most interesting and important of all these intertrappean series inasmuch as it was from these that nearly all the very beautiful fossils that have been obtained from the Rajmahal Rocks were collected."

From the sections given on pages 210 & 212 of Memoirs Geol. Surv. India, Vol. XIII, one can deduce that the fossils collected from Burio and Morrero were derived from No. 4 bed, and hence the following list has been compiled from Pal. Ind. Ser., II, Vol. I, pages 148–150:

Bed No. Locality Name of Fossils
4 Burio *Equisetites rajmahalense*, Sch.
Sphenopteris arguta, I. & H.
Hymenophyllites Bunburyanus, Fstm.
Sphenopteris membranose, Fstm.
Thinnfeldia indica, Fstm.
Angiopteridium McClellandi, Schimp.
Angiopteridium Spathulatum, O.M.
Angiopteridium ensis, Fstm.
Pterophyllum fissum, Fstm.
Echinostrobus Rajmahalense.
4 Murrero *Angiopteridium Spathulatum*, O.M.
Macrotaeniopteris crassinervis, Fstm.
Pterophyllum Medlicottianum, O & M.
Pt. princeps, O. & M.
Zamites proximus, O. Fstm.
Zamiostrobus.
Angiopteridium McClellandi, Schimp.
Asplenites macrocarpus, O. & M.

For no other localities is there sufficient information to enable one to allocate the plants to any particular bed, either No. 4 or No. 6 and consequently it is not known whether any of the above plants occur also in bed 6 and all that one can say of the remainder of the plants is that they come either from bed 4 or 6 or from both.

2. There are no grounds other than Palaeobotanical for the correlation of the Golapili Beds (Madras) with the Rajmahal Stage.

Yours faithfully

(signed) E.L.G. Clegg
for the Director
Geological Survey of India.

[Handwritten note, at bottom of page: "Copy to Dr. A.L. du Toit for information. B. Sahni 10.8.27"]

(13) Sahni to du Toit, postcard in envelope, 15 September 1927 [JL]

[Card posted in envelope, postmarked "(All)ahabad 15 Sep.27", and "Pretoria 18 Oct.27". Addressed to Dr A.L. du Toit, F.G.S., Irrigation Department, Union Buildings, Pretoria, S. Africa (Transvaal). In a different hand, address was scratched out, and replaced with "Consulting Engineer, De Beers, Kimberley"]

Dear Dr du Toit,

If you can spare for me a copy of your work on the Zones of the Karoo System in Sth Africa 1919[19] I shall be very grateful as I have not seen it yet and am unable to obtain a copy. Separately I am sending you two reprints for your kind acceptance.
With kind regards,

Yours sincerely,

B. Sahni
Lucknow University 15.9.27.

["Repl. 20.10.27. Sent proof. ADT"]

19 du Toit (1918)

(14) Du Toit to Sahni, 20 October 1927 [JL]

20/10/27

Dear Dr Sahni,

I have still to thank you for the very valuable report from the Director of the Geol. Surv. of India that you were good enough to send me. Not having access at the moment to the original accounts it was an aid to me to read what is known about the Rajmahal plants.

I quite agree with you that the lists of the plants from Burio & Murrero would indicate that from zone 6 upwards the strata represent the Jurassic & that the Rhaetic does not seem to be present. On the other hand there is no record of plants from the lower zones though from the description one might suspect that 12a might be plant–bearing.

Now it is a curious thing that the only forms common to S. Africa & the Burio & Murrero beds should be *Taeniopteris spathulatus* & *T. mcClellandi*. On the other hand the lists supplied by the Director do not include several forms mentioned by Oldham & Morris for example *Taeniopteris lata*, *Pseudoctenis (Pterophyllum) carteriana, Zamites (Pterophyllum) rajmahalensis, Clado–phlebis (Pecopteris) concinna* & *Pterophyllus propinquum*, which occur in the Molteno or have allied species therein.

Presumably these last were obtained from some other locality & quite possibly from a different horizon to the bulk of the described flora. I feel therefore that there is just a possibility that they came from a lower level & may represent the Rhaetic. Anyway the suggestion is thrown out for what it is worth & perhaps someone may be able to follow it up in the near future.

I have just sent back the final proofs of my plant paper[20] & hope that it may be possible to forward you a copy thereof at Xmas time together with the S. American one.

Many thanks for the two papers that arrived yesterday, more particularly that on *Dadoxylon arberi*.[21] I was interested in the remark that Walton was intending to place *D. pedroi* under *Trigonomyelon*. So far as I recollect the latter shows affinities with *Rhexoxylon* a S. African Triassic genus & there is a distinct possibility that the beds from which comes the Brazilian stem are not Permian but Triassic.

With reference to your request for a copy of my "Zones", I have unfortunately run out of separates, but have been able to dig up a proof, which lacks the map, however. You will nevertheless find that information incorporated in the recent Geol. Maps of S.A. so that the loss will not be of much importance.

Please note the change in my address.

It is a great pleasure corresponding with you in this way & interchanging ideas & I am grateful for these opportunities.

With best wishes,

yours sincerely,
Alex. L. du Toit

On 20th October 1927, the same day that du Toit had written to Sahni (14), he also wrote a letter to Prof. Albert Seward, Sahni's old mentor at Cambridge University, mentioning "Sahni, who corresponds frequently with me" (du Toit, 1927c).

(15) Du Toit to Sahni, 26 March 1929 [NML]

De Beers Consolidated Mines
Kimberley
South Africa
Mar 26 1929

Dear Dr Sahni,

Permit me to thank you profusely for the papers sent and particularly for the beautifully illustrated monograph on *Clepsydropsia* with its full description of so novel a plant. I am looking forward to your next installments of the Indian fossil plants, which should contain revisions of many forms occurring in our Karroo Beds.

We shall have as visitors to the I.G. Congress in July several palaeobotanists such as Thomas[22], Edwards[23], Walkom[24] and Høeg[25], and probably others that I do not yet know of. Some are hoping to collect material, so that S. African palaeobotany should shorty be enriched by the careful descriptions of many new forms. I regret that pressure of other duties prevents my examination of some of our undescribed material but there should be room for everybody. Haughton and I would probably be reviewing the Karroo fauna and flora before the IGC. On the latter question there is admittedly not much new to record but I think that a few general remarks might be of service. In this connection your two papers read before the Indian Science Congress have proved very stimulating and I am often referring to them.

Schuchert (Bull. Geol Soc. America 1929)[26] has been having a tilt against me upon the age of the Permo–

20 du Toit (1927b)

21 Sahni and Singh (1926)

22 British palaeobotanist at Cambridge, Hugh Hamshaw Thomas (1885–1962).

23 Wilfred Norman Edwards (1890–1956), palaeobotanist at the British Museum.

24 Australian palaeobotanist, Arthur Bashe Walkom (1889–1976).

25 Norwegian palaeobotanist/palynologist Ove Fredrik Arbo Høeg (1893–1998).

26 Published 3 years later as Schuchert (1932). See also Newman (1995) for detailed discussion of this paper.

Carboniferous tillites which he asserts are positively not older than Middle Permian, but the argument seems to rest almost entirely upon the succession in the Salt Range, where quite possibly there might be a palaeontological break. He ignores the evidence of Argentina where *Rhacopteris* and *Cardiopteris* overlie the glacial tillite. It is regrettable that South Africa has not furnished more plant material from the Witteberg and Dwyka Series–one lower age limit is indefinite.

I trust that you will be able to get your plant horizons in the Rajmahal Hills fixed by the GSI when you work out your new material.

With kind regards and many thanks,

I remain,
Yours sincerely,

Alex. L. du Toit

(16) Du Toit to Sahni, 12 June 1931 [NML]

De Beers Consolidated Mines
Kimberley
South Africa
June 12 1931

Dear Dr Sahni,

I am deeply indebted to you for the gift of your two fine papers, especially the monograph on the Indian Coniferales, which contains such a lot of research. I have read through the very instructive account of the past distribution of the coniferales in India & am more than interested in your far–reaching conclusions. In S. Africa, as you are no doubt aware, *Dadoxylon* makes its appearance pretty low down. Certainly well in the Lower Permian, together with some allied stems, described by Kräusel[27].

I presume that now you are back in Lucknow, you will carry on the good work and produce further revisions of the plants of the Gondwana System. The Indian Survey must have a vast amount of material including a lot of undescribed specimens. I have been studying with the keenest interest Fox's revision of the Gondwana System and am looking forward to reading his accounts of the stratigraphy of the separate coalfields. Considerable advances have undoubtedly been made of late. I had an amusing letter from Schuchert recently in which he hints that he will at the I.G. Congress next year metaphorically wipe the floor with us & prove that the Palaeozoic glaciation was not earlier than Middle Permian! And that in the face of post–glacial strata with *Rhacopteris* & *Cardiopteris* in Argentina and *Rhacopteris* in N.S. Wales! Truly he is a strange man!

I am endeavouring to finish off a couple of short papers, but there are far too many interruptions for efficient work; it is provoking to have to hang up a thing for week at a time. I have recently been examining material from Uganda & have got *Gangamopteris* therein.

With kind regards & best wishes,

Yours sincerely,
Alex L. du Toit.

(17) Du Toit to Sahni, Postcard, 15 September 1931 [NML]

To
Dr. B. Sahni,
Dept. of Botany
The University
Lucknow,
India

15 Sep. 1931 (Postmarked Lucknow, 12 Oct 1931)

Dear Dr Sahni,

Please note that my address for the future will be
P. O. Box 4565, JOHANNESBURG.

Yours truly,
Alex. L. du Toit

By the early 1930s, Sahni had begun to establish quite a reputation for himself. Palaeobotanist W. N. Edwards of the British Museum (Natural History), wrote to du Toit on 21 March 1932, in which he stated:–

"I did some collecting in the Rajmahal Hills, but Sahni has a paper on the stocks, so I handed my specimens to him for further examination. There are several new things, most of which, however Sahni had already found." (Edwards, 1932).

(18) Du Toit to Sahni, Postcard, 24 December 1932 [NML]

To
Prof. B. Sahni,
Dept. of Botany
The University of Lucknow,
India

P.O. Box 4565 Johannesburg,
24.12.32 (Postmarked 6 Jan 33)

Dear Dr Sahni

Many thanks for the two fine papers recently to hand containing much that is new. With kind regards and best wishes for the New Year.

27 R. Kräusel, German palaeobotanist.

Yours sincerely,
Alex L. du Toit

After the postcard from du Toit (18), there appears to be a gap in the correspondence for a couple of years. There is, however, in du Toit's papers, a copy of Sahni's obituary of English palaeobotanist Dunkinfield Henry Scott (Sahni, 1934), sent "With the author's compliments". In late 1936 or early 1937 Sahni sent du Toit reprints of two of his recent papers, both touching on Continental Drift (Sahni, 1935, 1936). Du Toit, in his reply dated 18 February 1937, informed Sahni that these papers lent support to the theory of Continental Drift on palaeobotanical grounds, and that he had cited them in a book he had just completed (i.e., "Our Wandering Continents"; du Toit, 1937a). This also indicates that he had not been in touch with Sahni during the writing of that book, otherwise Sahni would have already been aware of it. The first of Sahni's papers was on Permo–Carboniferous Life Provinces (Sahni, 1936). The second, "Wegener's theory of continental drift in the light of palaeobotanical evidence" was published in the Indian Botanical Society Journal (Sahni, 1936), and would be further elaborated upon (Sahni, 1937) during the Indian Science Congress of January 1938, which du Toit also attended.

(19) Du Toit to Sahni, 18 February 1937 [JL]

Third Floor
Anmercosa House
Johannesburg
Feb. 18, 1937

Dear Prof. Sahni,

Very many thanks indeed for your two papers on "Permo–Carboniferous Life Provinces" & "Wegener's Theory" which I have found particularly interesting to read & to which I have been able to cite in a book which has just been completed. It is indeed noteworthy that you have been led to support the Hypothesis of Drift on palaeobotanical grounds.

I have been endeavouring to review the subject comprehensively & from every angle & while reaching various generalisations, must be far from the truth in respect to sundry doubtful areas, more particularly the Burma–Indo–China portion about which you have arrived at certain more or less definite views. However, it is just in respect to the "border land" regions that we require more definite information & the assistance of other workers such as yourself.

Your second paper came to hand just after my text had gone so I cannot do full justice to it beyond reference thereto in the final proofs. I am immensely pleased to know that you have had to support the hypothesis, which I now find to form the only possible explanation to the structure & evolution of the Earth.

Palaeobotany has had to take a back seat, though I trust to return to the subject towards the end of the year, if I do not visit India with the British Association.

With kind regards & many thanks,
Yours sincerely,
A.L. du Toit

(20) Sahni to du Toit, 20 May 1937 [Not in NML or JL]

(21) Du Toit to Sahni, 30 July 1937 [NML]

Moscow
USSR
July 30th 1937

Prof. B. Sahni
The University,
Lucknow, India

Dear Dr Sahni,

Very many thanks for your invitation of the 20th May and of the list of subjects, etc. of the 19th May–which have only just reached me here during the Session of the I.G. Congress. No one regretted more than myself that you were not able to be present[28], as your views would have been much more appreciated, when presented in person, though Dr Fox[29] interpreted them well. We had among others, Edwards, Jongmans, Zalessky, Krystofovich[30] and Gordon[31]; Walkom would not come.

The invitation to contribute to your discussion (Subsection (L)) is most tempting, though I am in a quandary as to how such could be done. We are setting out tonight on a month's tour of Siberia, after which I return to S. Africa by air so as to be back there in Sept., and then shall be involved in much arrears of official and other work. Anyhow I shall closely consider the request during the next few weeks and see what can be done, but there is no getting away from the fact that this congress, both on excursion and session, has been experiencing a strenuous time. We usually retire about midnight or later, as "suppers" frequently last from 8 to nearly 12 PM! Our "Time" is "Geological Time"!

Several interesting palaeobotanical ideas have nevertheless emerged which should advance our ideas on past floras appreciably. These I hope to discuss with you personally.

With kindest regards and many thanks again,

Yours sincerely,
Alex. L. du Toit.

28 Sahni, together with D.N. Wadia, was prevented from attending the 17th IGC by the Geological Survey of India (Gee, 1937; Master, 2020b).

29 Dr Cyril S. Fox, of the Geological Survey of India, later to be Director (1939–1943).

30 Dr Afrikan N. Kryshtofovich, Russian palaeobotanist.

31 British palaeobotanist William Thomas Gordon (1884–1950).

Following their meeting at the Indian Science Congress in January 1938, du Toit and Sahni continued to exchange publications. Du Toit (1938) noted in his diary that he received a card from Sahni on 29 August 1938, and that he wrote to Sahni by airmail on the 30th August, regarding a paper. Du Toit and Sahni must have agreed to co–operate through an exchange of specimens for scientific study. At his institute in Lucknow University, Sahni had a PhD student, Miss Chinna Virkki, who had started a project on examining spores from shales associated with glacial tillites at the base of the Gondwana succession at Bacchus Marsh in Victoria, Australia (Süssmilch, 1914), and to compare these with spores associated with the Talchir glacial beds from the lowermost Indian Gondwanas. Du Toit had visited Bacchus Marsh in 1914, and his own material (*Glossopteris* fossils) collected there ended up in the collection of the South African Museum (now Iziko SA Museum) in Cape Town. The material that Virkki worked on was obtained from the collections of the British Museum (now Natural History Museum) in London. Virkki presented preliminary accounts of these studies (Virkki, 1937, 1938)[32], before she had completed her PhD studies. Sahni wrote to his old friend from his Cambridge days, William Noel Benson at the University of Otago in Dundedin, New Zealand, in November 1938 (24) requesting material from the oldest *Glossopteris*–bearing beds in the Gondwana basins of South Africa and other places, so that Miss Virkki could include these in her comparative study of Gondwana flora from India and Australia. Du Toit made a special trip to Vereeniging to revisit the classic locality of *Glossopteris*–bearing shales associated with the Dwyka glacial tillites, which had been described by Seward (1897) and Leslie (1903, 1921). Du Toit (26) sent this material accompanied by a letter dated 30th May 1939. This material arrived in Lucknow during Sahni's absence, and he was only able to acknowledge receipt on 28 August 1939 (27). By this time, however, Miss Virkki had felt she had enough material from her work on the Indian and Australian material to write up her PhD, and she had left Lucknow. Miss Virkki was later to write up the full results of her PhD investigations, the comparative study of Lower Gondwana spores from Australia and India (Virkki, 1946), a pioneering work in Gondwana palynology. She married a fellow palaeobotanist, Kurien Jacob, and subsequently published under her married name (as "Mrs. C. Jacob"). Sahni wrote to du Toit telling him he would engage another student to work on du Toit's material. This student was to be D.D. Pant.

32 Virkki's palynological studies on Gondwana floras was pioneering, and she is mentioned in histories of palynology by de Jersey et al. (1987) and Sarjeant (2002), p.281. In her honor, Lele (1964) created a new genus of palynomorphs, *Virkkipollenites*, found in the Talchir beds first studied by Virkki (1937, 1938).

(22) Sahni to du Toit, August 1938 (received 28 August 1938) [not in NML, nor JL]

(23) (Du Toit to Sahni, 30 August 1938 [not in JL, nor in NML]

(24) Sahni to Prof. Benson, Otago University, New Zealand, 9 November 1938 [NML, JL]

University of Lucknow
Botany Department
9th November 1938

My dear Benson,

A research student here, Miss C. Virkki, has recently discovered at a very low horizon (only 1½ feet above the Talchir Conglomerate) in the Gondwanas, some characteristic spores which she has also found associated with a Glossopteris flora higher up in the same section. I suggested that she should look for similar spores in the glacial matrix itself, not only from India but from other Gondwana tillites. We have practically no material of the Australian tillites which it is important to investigate for spores. The interest of the investigation is that it will enable us to compare the spore flora contemporaneous with the Gondwana glaciation, and possibly throw light on my idea that some members of the pre–Gondwana flora persists through the ice–age.

I would deem it a great favour if you could send us a few samples from your museum collections. Any old fragments would serve this purpose, but they should be authentically labelled as to the locality and horizon, and of course there should be part of the original matrix, nt a matrix resorted by water action at a later date so that there is no object ion on the ground that any spores found in it belonged to a post–glacial flora and not one contemporaneous with the ice. Naturally you would find it easier to send samples of the Australian and South African tillites, than any from South America, but if from among your collections you can spare even small chips of other countries we should be especially grateful. If we can do anything in return it would be a pleasure.

With kind regards,
Yours sincerely,
B. Sahni

(25) Prof. William Noel Benson (Dunedin, New Zealand) to du Toit, 25 March 1939 [JL]

University of Otago
Dunedin, N.I., N.Z.
March 25 1939.

Dr A. L. du Toit,
P. O. Box 4565,
Johannesburg,

Transvaal.

Dear Sir,

Would you pardon me if I were to take advantage of the privilege of having met you in Australia with the British Association in 1914, to send forward to you a request made to me by my Cambridge College friend Prof. Birbal Sahni, F.R.S., who is head of the very active school of palaeobotanical research in Lucknow, India. Unfortunately I have nothing in the relatively small collections of the Geology Department of this University which would meet his needs, but have written to the Mining and University Geological Museums in Victoria, and to me friend Dr L.C. King Lecturer in Geology in Natal Univ College, in the hope that they may be willing and able to be helpful to Prof. Sahni. It has struck me that with your close association with South American Geologists, you might be able to put Professor Sahni in touch with those in that country who would be able to help him. If he has not already made direct appeal to you in this matter, and if his proposed line of research commends itself to you, I should be very grateful if you were able to do anything to facilitate the investigations he has under his supervision in this direction.

Very sincerely yours
W.N. Benson.

(26) Du Toit to Sahni, 30 May 1939 (written on Air Mail letterhead of H.T. Dickinson, Consulting Engineer, which du Toit forgot to cross out) [NML]

Third Floor
Anmercosa House
Johannesburg
May 30, 1939

Dear Prof. Sahni

Last month I received a letter from Prof. Benson of Otago University sending me a copy of your appeal to him for material for Miss Virkki & asking whether I could possibly co–operate in her investigation. Also there came to hand two papers from her & your notable contribution of the Relation of the *Glossopteris* Flora with the Gondwana Glaciation, for all of which, many thanks. I have perused them all with the highest interest; they certainly have advanced our knowledge materially.

With such a fine cause, so ably presented, I could not remain indifferent & so I duly made a special trip to Vereeniging, south of Johannesburg, as soon as the opportunity presented itself, & I have sent off under separate parcel post a series of five samples from a section which is probably the most likely to yield results of consequence. This is the locality where Leslie collected his fine specimens described by Seward. It is also the place where *Gangamopteris* was found beneath the Tillite, resting directly on the ancient Dolomite, in a shaly layer passing above into glacial matter. The original quarry is now overgrown & the actual layer largely worked out or weathered, so I have selected another section near by, where the enclosed section is to be seen. This will indicate the exact sections from which the samples were gathered.

Importance attaches to the impersistent layer just above the base of the glacials from which sample 2 was got, since it may well represent the thin band in which Leslie got his fronds. If not, then the latter must be still lower (the base is very uneven here & deeper horizons could be preset in pockets). Anyhow you will have the opportunity of studying stuff from within as well as above the glacials.

Sample 5 comes from the post–glacial Ecca beds, which a short distance away has coal seams as well as sandstone bands from which come all the various species of Ecca Flora described by Seward in Ann. S. African Mus. IV,i, as well as by Seward & Leslie in Q.J.G.S. My reading of the section is that there is a disconformity between the tillite & the post–glacials, but such question will probably not be of any importance. In other parts of S. Africa the tillite is far away from any plant layers & scarcely likely to carry spores.

Please thank Miss Virkki & convey my sincere hopes that she may find something of importance. If more material is wanted, just ask.

With kindest regards & best of wishes,
Yours sincerely,
Alex. L. du Toit.

(27) Sahni to du Toit, 28 August 1939 [JL]

28 August 1939

Dr A.L. du Toit,
P. Box No. 4565
Johannesburg (S. Africa)

Dear du Toit,

I am most grateful to you for your letter of the 30th May forwarding a valuable series of five specimens of glacial tillite and other rock specimens from the base of the Karroo beds at Vereeniging[33]. The specimens and the letter were received in due course at Lucknow, but I have been away during the summer vacation and I am afraid that I have been much delayed in consequence in writing to thank you for your great kindness in making a special trip to the locality for the sake of collecting this material. Miss Virkki, I am sorry to say, left Lucknow before the vacation and is now unlikely to return to complete the investigation, but as soon as an opportunity arises I propose to entrust the work to another research student who is likely to stay here longer. We now have a fine series of tillite samples from Australia and S. Africa and the whole material is well worthy of investigation.

I am especially grateful to you for the careful way in which you have marked each of your five samples with the

33 Du Toit (1939) mentions in his diary entry for 29 May 1939 that he had sent a parcel to Sahni. On the 30th May he wrote the letter (mentioned by Sahni) which was sent separately.

exact horizon from which it comes. Specimen no. 2 should be particularly promising because it comes from a stratified layer near the very base of the tillite.

Miss Virkki now feels she has enough work finished to submit it as a thesis for a Ph.D.[34] and therefore she is not likely to return to Lucknow, but I shall write to her of the generous way in which you have responded to our request for material. With kindest regards and remembrances also to Mrs. Du Toit from my wife and myself.

I am
Yours sincerely,
B. Sahni (signed)

There is an entry in du Toit's (1939) diary for 9 September 1939 (a week after Hitler had invaded Poland at the start of World War II), to the effect that he had sent a letter, to Sahni. This letter (not preserved) was probably a reply to Sahni's letter of 28th August 1939.

Except for a couple of postcards from du Toit regarding a change of address (25), and acknowledgement of receipt of papers (26), there then appears to be a genuine lack of substantial correspondence for the next five years (because of disrupted postal services during the Second World War[35]), until 1944, when Sahni belatedly received a 1943 copy of Nature in which was announced the election of Alex du Toit to the Fellowship of the Royal Society. He then wrote to du Toit on 22 March 1944 (27), congratulating him on the award, and also telling him about developments since their last communication of 1939, when du Toit had sent samples from the Dwyka beds from Vereeniging to Sahni, and asking for permission to reproduce a sketch section du Toit had sent him. Du Toit replied on 28 May 1944 (28) to Sahni (who was also a Fellow of the Royal Society), remarking "I was indeed surprised that the Society was liberal enough to admit me to the small circle". Interestingly, he equated the Royal Society's recognition of his work as admitting of a "liberal" attitude, presumably in contrast to the illiberal intolerance of those who were implacably opposed to his ideas of continental drift (e.g., Master, 2016).

Sahni (27) mentions work done on the Dwyka material collected by du Toit from Vereeniging (and earlier by Dr Thomas Nicholas Leslie, 1858–1942). The Vereeniging fossil flora had originally been studied by Seward (1897) and Leslie (1903). After meeting Seward in South Africa in 1905, when he came for the British Association Meeting, Leslie collaborated with him on a paper on the Vereeniging flora (Seward and Leslie, 1908). Leslie (1921) made the Vereeniging flora as the subject of his Presidential Address to the Geological Society of South Africa. Du Toit knew Dr Leslie, and Haughton (1949) ended his obituary of du Toit with the following paragraph, which tells of the relationship between Leslie and du Toit:–

All too seldom did du Toit relax into conversation on subjects remote from his scientific pursuits. He thought the span of life far too short to enable a man to absorb all the knowledge available and to synthesize it into a philosophy. That he could, if he would, delight in good companionship is reflected in his reminiscences of Dr T. N. Leslie, of whom he wrote, 'We used to enjoy his tales of the early history of Vereeniging, such as the linking of the railways of the Cape and Transvaal in 1892, the disastrous sinking of the first shaft of the Cornelia Colliery, the Anglo–Boer war and its aftermath or the British Association visit of 1905. Not less instructive were his sidelights on Transvaal political history, on municipal reform and, in later years, his commendable philosophy of Life.' The words 'not less instructive' throw a clear light on the mentality of a man who will, for many years to come, be thought of, and rightly so, as South Africa's greatest and most eminent geologist.

Sahni mentions that the research student who had been investigating the material from Vereeniging that had been sent by du Toit in 1939 was D.D. Pant, who published his work on the spores (Pant, 1942, 1943). Divya Darshan Pant (1919–2001) was to carry on the palynological studies of the Bacchus Marsh material from Victoria after Sahni's death in 1949 (Pant, 1949, 1955; Pant and Mehra, 1963), and was later to become Professor and Head of the Department of Botany at Allahabad University. He became an internationally recognized palaeobotanist, especially for his work on *Glossopteris* flora (Srivastava, 2001), and recipient of the Birbal Sahni Gold Medal of the Indian Botanical Society for 1976 (Gupta, 1978; Joshi, 2001).

In 1997, the Indian Post issued a set of four postage stamps featuring plant fossils (Palaeophilatelie, 1997),

Indian postage stamp from 1997 depicting the fossil fructification Birbalsahnia divyadarshani, named in honor of Birbal Sahni and Divya Darshan Pant

34 Sahni (1946) wrote an introduction to her paper (Virkki, 1946) on spores from the lower Gondwanas of India and Australia.

35 Du Toit (1943) records in his diary that he wrote to Sahni on 9th September 1943, but Sahni clearly did not receive this letter, as his letter of 22 March 1944 shows, referring only to their previous correspondence in 1939.

one of which depicted a fructification called *Birbalsahnia divyadarshanii*, named in honor of Birbal Sahni and his most famous protégé, Divya Darshan Pant (Bajpai and Maheshwari, 1991).

In his letter of 22 March 1944 Sahni asked for permission from du Toit to reproduce du Toit's sketch showing the position of the *Glossopteris* fossils that had been collected from Vereeniging. Although du Toit gave his permission, it does not appear as if Sahni had managed to get the diagram published. Sahni (1945) discussed the Vereeniging locality with its *Glossopteris* flora associated with glacial tillites, but did not include a sketch. Sahni mentions another sketch from the Vereeniging locality, drawn by Dr. T.N. Leslie (whose plant material had been obtained through the British Museum, according to Virkki, 1938). Leslie's sketch was eventually published 43 years later, by Pant (1987). Pant (1942, 1943, 1987) had studied the palynoflora from the Vereeniging locality, but he was under the impression that the material had all been originally collected by Dr T.N. Leslie. He was unaware that the samples he had worked on (which were given to him by Birbal Sahni) were additional samples, from the same locality, which had been specially collected for this work in 1939 by Alex du Toit.

Divya Darshan Pant

In the exchange of letters between them in 1944, Sahni sent greetings to du Toit and his wife (Mrs Evelyn du Toit), from himself and his wife (Mrs Savitri Sahni); and du Toit reciprocated with greetings from himself and his wife to the Sahnis. Du Toit was accompanied by his wife during their trip to India in 1937–1938, and they met the Sahnis during the Indian Science Congress in Calcutta in January 1938, in which Sahni (1938) presented a paper in the session that du Toit had chaired (Master, 2020a). Du Toit became close to Sahni during this Congress, since his diary (Du Toit, 1938) reveals that on 12th January 1938, he spent a day in Calcutta, after returning that morning from a visit to a coalfield, and had afternoon tea with Dr and Mrs Sahni, Dr D.N. Wadia, and a Mr Evans, before catching the night train to Bombay (now Mumbai).

(28) Du Toit to Sahni, 13 May 1941, Postcard [NML]

13.V.41 Johannesburg
Sent to Lucknow, forwarded to postmaster Binsar, Postmarked Almora 15 Jun 41, Binsar 15 Jun 41.

Dr & Mrs A. L. du Toit are leaving Johannesburg and have pleasure in announcing their new address as:–

2 BYE WAY, PINELANDS
CAPE TOWN.

(29) Du Toit to Sahni, 2 February 1943, Postcard [NML]

POSTCARD (depicting an Elephant in Kruger National Park)

From
2 Bye Way, Pinelands, Cape Town, 2.2.43

To
Prof. B. Sahni,
Dept. of Botany,
The University,
Lucknow,
India.

Dear Prof. Sahni

Many thanks for your most instructive presidential address and the two botanical papers that, despite the war, I have enjoyed reading. It is clear that, despite the war, you are able to carry on with some success. We are pretty busy with other needed developments in natural resources and so far I have not had the opportunity of renewing my studies of our palaeobotanical material. These must wait awhile. With admiration for what your great country has done in the war effort and with all good wishes,

Yours most sincerely,

Alex L. du Toit.

(30) Sahni to du Toit, 22 March 1944 [JL]

University of Lucknow
Botany Department
22 March 1944

My dear du Toit,

Allow me to offer my heartiest congratulations on your election to the Royal Society last year. I am sorry to be so late, but I only received the news a few days ago when the copy of Nature in which the announcement was made came to hand. Somehow this particular copy of Nature failed to arrive by the regular mail last year.

Your election to the Royal Society has given me very special pleasure and I hope that this event is only a precursor of further honours to come.

You will remember that some years ago you very kindly sent me some material of the Dwyka tillite collected specially by you, evidently with considerable trouble. This material has proven to be of great interest. It is being investigated by Mr D.D. Pant, a research student here, partly also by myself. In an address given before the National Academy of Sciences at Allahabad last year but not yet published, I exhibited some of the plant remains recovered from this material and from other specimens of tillites received from various other Lower

Gondwana areas. I would very much like to reproduce the pencil sketch of the section near Johannesburg which you kindly sent me along with the material. This sketch, and another similarly sent me by the late Dr T.N. Leslie long ago, are both very useful in showing the exact mode of occurrence of the tillite in contact with the basement rock. Presuming that you have no objection I am inserting your sketch as one of the figures illustrating my address on "Gondwana microfloras", but since this will not be published for a few months yet it will still be possible to delete the sketch in case you think it is inadvisable for me to publish it. The section shows the exact levels and positions from which your several tillite specimens were taken.

With renewed congratulations and kind regards also to Mrs. du Toit from my wife,

I am,
Yours sincerely,
B. Sahni (signed)

(31) du Toit to Sahni, 28 May 1944 [JL]

2 Bye Way, Pinelands
Cape Town
28 May 1944

Dr B. Sahni
Dept. of Botany
University of Lucknow

Dear Dr Sahni,

Many thanks for your unexpected letter of the 22nd March, which arrived yesterday containing your congratulations in connection with the Royal Society, which are much appreciated. I was indeed surprised that the Society was liberal enough to admit me to the small circle.

I have of course been much intrigued by the finding of spores in the samples from the Dwyka sent you some time ago, & am more than pleased that a detailed account is to come from you. In regard to the sketch sent by me you are quite welcome to reproduce it, though I am afraid that it was not prepared very neatly. Not improbably this permission will not reach you in time, but I trust that you will have been bold enough to take things into your own hands & include the drawing in your text.

Pressure of other duties has prevented any active work in Palaeobotany for years, but I hope to do something again in 1945. We have some interesting stems from the Upper Dwyka Shales (L. Permian) in which the inner portions have been preserved in phosphorite with some chances of having the finer structure preserved. They seem to be of the *Cordaites* type, but are certainly peculiar.

With kindest regards to your wife & self, in which my wife joins whole–heartedly,

Yours sincerely,
A.L. du Toit

DISCUSSION

The du Toit–Sahni correspondence is important in several ways. Firstly, its very existence is a surprise, since this two decades–long, and very close, collaboration is not mentioned in previous biographies of either du Toit or Sahni. Sahni is referred to briefly in a new biography of du Toit by Chetty (2021), but even here, no mention is made of the lengthy correspondence between du Toit and Sahni. The correspondence exposes the nature of the contact networks that existed between the colonial metropole (London and Cambridge, personified by the central figure of Albert Seward), and the far–flung peripheries of the British Empire, in places like South Africa (with du Toit, T.N. Leslie, A.W. Rogers and L.C. King), India (with Sahni, D.N. Wadia and M.S. Krishnan) and New Zealand (with A.N. Benson). It reveals that aside from contacts between the periphery and colonial centre, there were vigorous connections between the different territories on the periphery, and new nodes of knowledge accumulation (or "centres of calculation", to use the terminology of Bruno Latour, 1987) were concentrating around Sahni in Lucknow, with respect to Gondwana palaeobotany, and du Toit in South Africa, with respect to Gondwana palaeogeography. These new centres were the sites and institutions responsible for gathering and assessing new data, formulating new theories, and advancing further researches. Du Toit corresponded with Sahni, Wadia, Krishnan and other Indian and Ceylonese geologists (Master, 2020b,c), while Sahni corresponded with Rogers and Leslie in South Africa, and with his old Cambridge friend Benson in New Zealand. Benson wrote to du Toit, as well as his old acquaintance Lester C. King, who had moved from New Zealand to South Africa. Du Toit stood at the centre of this new network of collaboration, since he knew, and corresponded with, everybody else.

In his quest for specimens from glacial beds associated with the Talchir conglomerates and correlated sequences elsewhere in the Gondwana continents, Sahni first approached the British Museum in the colonial metropole of London, which was the centre of knowledge and material accumulations, for his first samples from the Karoo beds of South Africa, and from Bacchus Marsh, Victoria, Australia. But then he used his contact network, and got in touch with Benson in New Zealand, who in turn approached his friends and acquaintances L.C. King and Alex du Toit in South Africa. Du Toit then collected samples specially for Sahni, whose student D.D. Pant eventually worked on them after Sahni's death, not knowing their true provenance, while labouring under the impression that they were Leslie's samples that had been obtained from the British Museum. It is interesting to note that many of the participants in the collaborative network (Seward, Sahni, Rogers, du Toit, Benson, Wadia) were also to become, eventually, members of a very distinguished group, as Fellows of the Royal Society. While such all–male networks were typical of their time, Sahni's Institute paved

the way for women palaeoscientists–in the form of his own wife and successor, Mrs Savitri Sahni, as well as his student Miss Chinna Virkki, who became one of the first female palynologists.

Another aspect that stands out from the du Toit–Sahni correspondence is the different, more leisurely, pace of interaction necessitated by postal delays of up to months, exacerbated by the unreliability of postal services during the Second World War. Also, the lack of cheap means of reproduction meant that long lists of fossil names had to be laboriously copied by hand or typed, leading in one instance to du Toit sending an annotated proof copy of his book to Sahni. Postcards were sent to request, and to acknowledge receipt of, papers and books. Du Toit also went to the field specially to collect samples which he sent to Sahni. From the long–neglected archives, on different continents, have been unearthed a treasure of information concerning the collaborations and scientific discoveries that led to du Toit in South Africa, and Sahni in India, playing major roles in the advocacy of a Gondwana Supercontinent. Two decades after the passing of these giants of the first half of the Twentieth Century, their ideas were vindicated by the advent of the new paradigm of Plate Tectonics.

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