

# Letters between Geologists A. L. du Toit and M. S. Krishnan (1946–1947) on the Palaeoposition of Ceylon in Relation to Gondwana

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## Abstract

In the first half of the twentieth century, Alexander Logie du Toit (1878–1948) was the most famous South African geologist, known internationally as the foremost supporter and fearless advocate of Alfred Wegener's hypothesis of Continental Drift, especially in his 1937 book, *Our Wandering Continents*. Indian geologist Maharajapuram Sitaram Krishnan (1898–1970), was a geologist with the Geological Survey of India, who became well known for his 1943 book on the *Geology of India and Burma*. Du Toit and Krishnan met in 1938 at the Indian Science Congress, after which they continued an intermittent correspondence, interrupted by the Second World War. Only a few of their letters are preserved, dating from 1946–47. Their letters reveal du Toit's continuing preoccupation with regards to the fit of Ceylon (Sri Lanka) in relation to other Gondwana fragments like India, Madagascar and Antarctica. Krishnan was at this time attending a course on radioactive minerals in London, and took almost a year to reply to du Toit, giving information that supported du Toit's ideas of a more westerly position of Ceylon with respect to South India.

**Key words:** Alexander Logie du Toit, Continental drift, Gondwana reconstruction, Granulites, Maharajapuram Sitaram Krishnan, Sri Lanka.

## 1 Introduction

South African geologist Alexander Logie du Toit (1878–1948) (Figure 1) was, in the first half of the twentieth century, the foremost supporter and fearless advocate of Alfred Wegener's hypothesis of Continental Drift, which was generally strongly opposed in Europe and North America. However, in the southern continents and India, there was more support for the Drift Hypothesis, based on the similarities of geology, palaeontology and

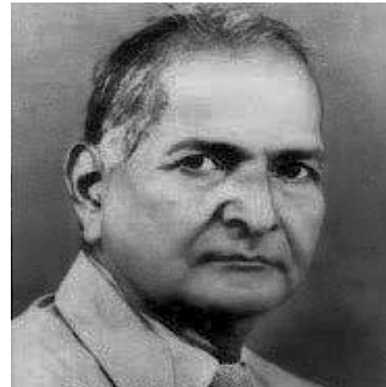
structures in the Late-Palaeozoic and Mesozoic 'Gondwana' successions common in these scattered regions. Du Toit gave cogent arguments in favor of continental drift in his books '*Geological Comparison of South America and South Africa*' (1927), and '*Our Wandering Continents*' (1937). In late 1937, du Toit, accompanied by his wife, arrived in India on their first (and only) visit there. Du Toit's aim was to visit a number of diamond mines (on behalf of his then employer, the De Beers company), and to visit classic areas of Gondwana geology, including the Talchir glacial beds, and coal mines with the *Glossopteris* flora typical of the Gondwana successions. He was also



**Figure 1** Alexander Logie du Toit (1878–1948) (after Gevers, 1950).

there to attend the Silver Jubilee Session of Indian Science Congress in Calcutta in January 1938 (Master 2020 a,b, 2021).

Maharajapuram Sitaram Krishnan (1898–1970) (Figure 2) was the youngest member of a trio of the first generation of Indian geoscientists, who flourished during the last decades of British rule in India, the others being Darashaw N. Wadia (1883–1969), and Birbal Sahni (1891–1949) (Anon 2003; Master 2020 a, 2021). They were all educated initially in Indian institutions, and then obtained their doctorates in British universities, before returning to India, where they had stellar careers. Krishnan was born in the Thanjavur district of Tamil Nadu in 1898. He studied geology at Presidency College, Madras University, obtaining the degrees of BA (Hons.) in 1919 and MA in 1921 (Balasundaram, 1970). In 1921, he received a fellowship to the Royal College of Science (later Imperial College of Science and Technology) in London, UK, where he received the ARCS (1922) and DIC (1923). In 1924 he received a PhD from London University, after which he joined the Geological Survey of India. He had a long and distinguished career with the Geological Survey until 1955, when he was appointed as Mineral Adviser to the Government of India (Balasundaram 1970; Geological Survey of India 1972). He was later to take up important Directorships of the Indian School of Mines and Applied Geology at Dhanbad (1957–58), and of the National Geophysical Research Institute at Hyderabad (1961–1963), after which he retired (Balasundaram 1970; Subramaniam



**Figure 2** Dr M. S. Krishnan (1898–1970) (GSI).

1973; Sankaran 1998). In his early career, Krishnan had worked with Wadia on a report on the soils of India (Wadia et al. 1935). Krishnan's most important and enduring research interests, which gave him a global reputation, were in synthesizing the regional geology, stratigraphy and structure of India and Burma, in various publications (Krishnan 1943 a,b; 1949, 1953, 1965).

Krishnan first met du Toit at the Indian Science Congress in Calcutta (Kolkata) in January 1938. His signature appears in a list of attendees that du Toit had kept in his notebook, together with other famous Indian geoscientists including Birbal Sahni and D.N. Wadia. Both Sahni and Wadia maintained a long correspondence with du Toit, exchanging papers, books and samples (Master 2020 a, 2021). Krishnan appears to have done the same, although the earliest surviving letter of his correspondence with du Toit is from 1946.<sup>1</sup>

In 1943, Krishnan published his most famous work, *Geology of India and Burma* (Krishnan, 1943a), but there is no indication that he sent a copy to du Toit. His book may have appeared after his paper on the structure of India (Krishnan 1943b), but by this time he had left on a study tour of the UK (to study recent developments on radioactive ores). He was not forwarded mail from India, but was informed that papers had been sent by du Toit. So it was only after his return to India in December 1947 that he was able to address some of the questions du Toit had posed to him more than a year before.

<sup>1</sup>The correspondence between du Toit and Krishnan is held in the Jagger Library of the University of Cape Town (Alex L. du Toit Papers BC722, Folder B1, General Correspondence (1930's – 1940's) A\_Z).

## 2 Correspondence

### 2.1 A. L. du Toit to M. S. Krishnan, 14 November 1946

2 Bye Way, Pinelands  
Cape Town  
14 Nov, 1946

Dr M. S. Krishnan, M.A., PhD.  
Geological Survey of India  
Calcutta

Dear Dr Krishnan

Very many thanks for the reprint of your paper "The Structure of India" which was so interesting that I have read through it several times. Indeed the only fault is that it is not a great deal longer, for it was obvious that you had much other information as well as valuable ideas on that important subject.

It is naturally gratifying that you would seem favourably disposed towards the Drift Hypothesis, for to my mind India would appear one of the finest examples of immense horizontal crustal movement, the approximate distance having ingeniously been worked out by you. I accordingly trust that you may be able to continue your researches, particularly concerning the old "grain" of the Peninsula. The trend-lines given in Fig. 1 are most useful, & doubtless it should before long [be] possible to elucidate the relative ages of the several orogenies.

In attempting to fit the southern continents together I have always had a difficulty in respect to Ceylon, which comes into conflict with the other groupings. So I wrote to Dr Wadia to know whether there was any evidence that Ceylon could have shifted a little distance to the N.E., as shown by the main lithological trends, etc. He had unfortunately just left Colombo & passed on the inquiry to Mr Fernando<sup>2</sup> & to Dr

B. Rama Rao<sup>3</sup>, but a year has passed & nothing has eventuated. Possibly in the Survey Office there may be something on the older field sheets of a suggestive kind. It seems to me that the problem may be worth pursuing, just as I have found that the former position of Madagascar can be fixed to within quite small limits by the grain coupled with one important & well dated tectonic line in the island & in East Africa.

Pressure of other work, & particularly a revision of my Geology of S. Africa has prevented any time being given to such studies, so I can only forward you in exchange a few short papers under separate post.

Presumably the G. Survey has experienced various changes during the past 8 years. I had a letter from J. A. Dunn<sup>4</sup> written from Australia. Sir Leigh Fermor<sup>5</sup> used to correspond a bit but he has been silent for quite a time. Dr Wadia & Dr Sahni are the only two, save yourself, from whom I obtain reprints & an occasional letter, all of which are indeed exceptionally welcome.

Please remember me to those of the staff who are still with you.

With kindest regards & best wishes for a calmer & more contented environment during the coming year, & with renewed thanks,

I remain, yours sincerely,  
A.L. du Toit

### 2.2 M.S. Krishnan to A.L. du Toit, 3 January 1947<sup>6</sup>

Dr A.L. Du Toit  
2 Bye Way

<sup>3</sup>Dr Bellur Rama Rao (1920-1970) was Director of Geology in the Mysore Geological Department in Bangalore.

<sup>4</sup>Dr John Alexander Dunn (1899-1966), former Director of the Geological Survey of India (1945).

<sup>5</sup>Sir Lewis Leigh Fermor (1880-1954), former Director of the Geological Survey of India (1932-1935).

<sup>6</sup>Although this Airmail letter was dated 3 February 1947, it was actually postmarked 9:15 PM 2 February 1947, and was received by du Toit on 10 February 1947, which date is written at the top of the letter in pencil in du Toit's handwriting, as was his usual habit with received letters.

<sup>2</sup>L. J. D. Fernando took over as Government Mineralogist in Colombo, Ceylon, after the departure of D. N. Wadia in early 1945 (Master, 2020a). He wrote on the geology and mineral resources of Ceylon (Fernando, 1948).

Pinelands  
Cape Town

From: Dr. M.S. Krishnan  
Geological Survey of India  
Bhimasen Gardens  
MADRAS 4  
(India)

17 Hertford Street  
Park Lane,  
London W1  
3.2.1947

Dear Dr du Toit,

I have just heard from my office in Madras that you have very kindly sent me separates of three papers, two of which bear on Continental Drift. Kindly accept my thanks.

I am in London for a short stay studying the recent developments in the investigation of radioactive ores & hope to leave for India by the 1st or 2nd week of March.

The Geological Survey of India has started a program of expansion but it will be 3 or 4 years before we reach a useful strength. Mr Wadia is now Mineral Adviser to the Department of Works & Mines, Govt. of India, at New Delhi. Dr. W. D. West<sup>7</sup> is now our Director.

Kind regards,

Yours sincerely,  
M. S. Krishnan

### 2.3 M.S. Krishnan to A.L. du Toit, 16 December 1947<sup>8</sup>

Dr. M.S. Krishnan  
Geological Survey  
Bhimasen Gardens  
MADRAS 4, INDIA  
16th Dec. 1947

Dear Prof.<sup>9</sup> du Toit,

<sup>7</sup>William Dixon West (1901–1994).

<sup>8</sup>Although the letter was written on 16th December 1947, there is a typing error in the date, which reads 16th Dec. 1942.

<sup>9</sup>This was an honorific title, not one that du Toit actually possessed, since he did not hold any academic position.

I have been away from India practically throughout the year so that your letter of the 14th Nov. 1946 had remained unanswered so far. The short period[s] I spent here during the summer and since my return last month have been taken up with office routine and travelling, so that I have not been able to look up relevant literature on the question you have put.

Since his return from Ceylon, Wadia has been at Government headquarters in Delhi as adviser on mineral production, policy etc. and has therefore been unable to give any time to the academic side of geology. My own attention is being diverted to the training of the large number of young men now being recruited, to the running of an office in Madras, and during the last year to the organization of a new section for the study of radioactive minerals.

As you say, there have been many changes in the Survey here. Sir L. Fermor is in England, retired from the Survey, but does not seem to have done much to continue his writing up of the Archaeans of India. Dunn retired 2 years ago and is now economic geologist to the Australian Govt. West is now Director. Gee (who read a paper on the Salt Range geology in the Science Congress session you attended) went away to Pakistan but I hear is resigning from there. There is a big gap between my generation and the new one and it will be some years before the average work from the Survey attains a good standard.

Coming now to Ceylon, I have felt that its position is not right with reference to the 'grain' of the rock groups. I am now merely writing from memory as I have no access to the relevant literature here at Madras.

The general trend of the rocks of the Eastern Ghats, composed of 'khondalites' (garnetiferous gneisses) is NNE to NE and they would strike into the southernmost parts of Travancore, but typical rocks of this suite are not recognized south of Lat. 16d. But they are well developed in the eastern parts of Ceylon. The regional trend of the southernmost part of In-

dia (including Travancore) is NNW-SSE to NW-SE and this trend is prominent in the southern part and central part of Ceylon. The rocks of this suite are charnockites and associated garnetiferous gneisses (called leptynites by Holland). It is an interesting fact that graphite occurs in association with pegmatites often traversing this suite, both in Travancore and in Ceylon; at the same time graphite is considered an essential constituent of the khondalites and there are numerous small workable pockets of this mineral in the Eastern Ghat region; again khondalites are almost always associated with crystalline limestone. In his recent paper on graphite in Ceylon, Wadia<sup>10</sup> has put forward the theory that it has been derived from crystalline limestone. This leads to the conclusion that the xl limestones are frequently associated with the graphite bearing rocks in Ceylon.

In recent years, after examining the khondalites and the various groups of garnetiferous gneisses in South India I have more or less come to the conclusion that they may all belong to one stratigraphic group and older than the charnockites, though in the field, mainly because of Holland's conclusions, people are inclined to put the charnockites and their associated garnetiferous gneisses (leptynites) together. I have actually written a short paper last year giving the view that the so-called leptynites may be in reality the same as the khondalites. That paper will I hope appear in the Records of the Geological Survey of India some time. If I am correct in my diagnosis, the tectonics of the charnockite region have confused the stratigraphy, and the garnetiferous gneisses (in the charnockite region) will have to be thought of as remnants of the khondalites which have acquired the metamorphic impress characteristic of charnockites, such as coarser grain size.

Coming back to the main point, it appears to me clear that as the khondalites in Ceylon and the Eastern Ghats are identical, they could be definitely related only if Ceylon had been some

distance to the south-west of its present position. In its present position, even the matching of the trends of Travancore and central and SW Ceylon is not too good – it would be better if Ceylon is shifted to the Southwest. We can also assume, with a good deal of confidence, that the western and southern portions of Travancore have broken off and sunk beneath the sea.

I know little about the coasts of Ceylon. Probably the SW coast is faulted, similar to the Travancore coast and there may be a good fit between the two. This would also require that the position of Ceylon should be further southwest. It would also be interesting to know whether the Miocene rocks of the western coast of Ceylon are very closely allied to similar rocks on the Travancore coast (rather than those of the SE coast of Madras). This would of course mean exceedingly detailed work in view of the very young nature of the formation.

I am sorry that this is a very rambling letter giving more hypotheses than facts. I shall try to study the problem and gather facts.

We are trying to settle down in spite of the problems created by the creation of the Pakistan and the provocations given by the fanatical followers of that new dominion. Unfortunately, in this turmoil, most of the energies of the ministry are absorbed by day to day problems. However we hope that things will soon settle down.

With kindest regards,

Sincerely yours,  
M. S. Krishnan

### 3 Discussion

The problem of the fit of Ceylon with respect to other Gondwana continental fragments such as India, Madagascar and Antarctica had preoccupied du Toit for a very long time. Ever since the publication of his book '*Our Wandering Continents*' (1937), and his visit to India in 1937–1938, he had pursued this problem. He wrote to D. N. Wadia in connection with this in 1944–45, and at Wadia's suggestions, also wrote to B. Rama Rao in Mysore and L. J. B. Fernando in Colombo, without eliciting any replies (Master,

<sup>10</sup>Wadia (1943)

2020a). The geological similarities between the Coromandel Coast of south India and the geology of Ceylon (Sri Lanka) were well known (Adams, 1929; Master 2020a), and their mineralogical affinities were discovered as long ago as 1822 by Lachenault de Latour (de Bournon, 1822, 1823).

In his letter of 14 November 1946, du Toit thanked Krishnan for his paper on the Structure of India (Krishnan, 1943b), which he had read 'several times', indicating his deep interest in the structure and tectonics of India, as it impacted on his own ideas about Gondwana and its breakup. Du Toit mentioned that he had not been able to pursue his tectonic interests (which were of an academic nature) due to 'pressure of other work' (related to finding strategic minerals for the War effort, Master, 2020a), and the revision of his *Geology of South Africa* (du Toit, 1939) and he sent Krishnan three recent papers by separate mail. These papers were sent to the Geological Survey of India in Madras, who then informed Krishnan (who was in London, UK) about their arrival. Du Toit's recent papers were few, and although he did not mention them by name, Krishnan, in his letter of 3 February 1947, states that two were on Continental Drift. The papers du Toit sent to Krishnan would have included one on the formation of the Pacific Ocean (du Toit, 1940), a discussion of a paper on Tertiary Mammals by Simpson (du Toit, 1944), and a paper on amphibole asbestos deposits in South Africa (du Toit, 1945). Du Toit usually wrote on the top of letters received the date of receipt, and the date when any reply was sent- but in the case of Krishnan's letter of 16 December 1947, there is no annotation about receipt, nor about a reply. Du Toit probably received the letter in early January 1948. He certainly read the letter, since he had highlighted in pencil the following sentences with double parallel lines in the margin: "the garnetiferous gneisses (in the charnockite region) will have to be thought of as remnants of the khondalites which have acquired the metamorphic impress characteristic of charnockites, such as coarser grain size" and "as the khondalites in Ceylon and the Eastern Ghats are identical, they could be definitely related only if Ceylon had been some distance to the southwest of its present position". Du Toit was clearly impressed that Krishnan was providing support for his (du Toit's) preferred reconstruction of the Gondwana supercontinent, with Ceylon being in a more westerly position in relation to southern India than it is today.

Despite the discussion with du Toit on the grain of the tectonic fabric of South India and Ceylon, Krishnan did not mention this in the second edition of his book on the *Geology of India and Burma* (Krishnan, 1949). In this edition, though, Krishnan included a general reference to du Toit's *Our Wandering Continents* (du Toit 1937), without discussing anything specific about it.

Krishnan mentioned in his letters to du Toit that the current Director of the Geological Survey of India was W. D. West. William Dixon West had been Secretary-General of the Indian Science Congress that du Toit had attended in January 1938 in Calcutta. West, who was appointed in December 1945, was to remain Director until his retirement in 1951, when he was replaced by Krishnan himself, who became the first Indian-born Director of the Geological Survey of India (1951–1955) (Geological Survey of India 1972; Sankaran 1998).

Du Toit spent the rest of January and early February of 1948 making preparations to attend the International Geological Congress that was to take place in London later that year, he even paid for his registration fees. Without any prior warnings or symptoms, very unexpectedly he died on 25th February 1948 (Gevers 1950), just a few weeks after receiving the last letter from Dr Krishnan, to which he never got a chance to send a reply.

## Acknowledgment

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