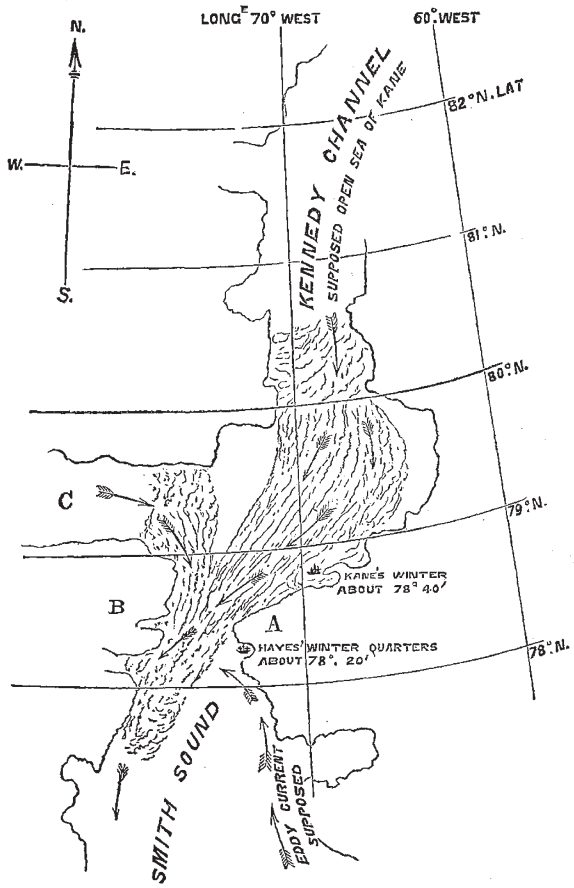
visible at either of these distances, and the haze itself would give the appearance of a distant water horizon.*

The opinion that this open sea was of limited extent is, I think, further confirmed by what Mr. Morton states as a proof (as he thought) of its being "boundless" or very large. Morton says "that he remained for three days watching the open sea rolling in waves at his feet, and, although there was a strong breeze or gale blowing from the north all the time, not a single piece of ice" floated past to the southward.†

My interpretation of the above fact is quite the opposite to that of Morton, for I believe there was a barrier of fixed ice at no great distance to the north, hid from his view by the cause I have named, which prevented any ice driving south at the season of the year when Morton was there, I think in June.



I offer these opinions with much diffidence, for we have been recently told that all great Arctic authorities now agree as to the Smith Sound route being the best. When the subject was brought prominently to notice in 1865, the "great authorities" did not agree, there being about as many opinions on one side as on the other.

At that time, without the slightest pretence to being an "authority" in the matter, I looked rather closely into the figures on which the facts favourable to the Smith Sound route were founded, and finding these figures in several important instances erroneous, the facts themselves lost much of their value. JOHN RAE

* I use the term "water horizon" in opposition to "ice horizon," which exhibits a bright line easily recognisable by those who have once seen it.

† As I quote from memory, I give to the best of my belief Morton's meaning, if not his words.

THE TYPHOON OF 2nd SEPTEMBER, 1871

THE Typhoon in China of the 2nd September last, detailed accounts of which reached England by the last mail, and which included in its area of most active violence the island and vicinity of Hong Kong, affords to those interested in such natural phenomena an opportunity of observing their varied characteristics, that may possibly never occur again. The great centre of its efforts having been in a situation where elaborate observations could be taken regarding it both at sea and land, a vast amount of information has been collected on the subject, which throws more light upon these singular "freaks of nature" than has ever before been arrived at.

In treating on the subject, I shall in the first place point out the course which—after careful investigation—I believe the typhoon to have followed, and afterwards I shall state the evidences that I adduce in support of the theory which I have adopted. Before commencing, however, it may be as well briefly to illustrate the plan engraved. The names *Formosa*, *Siam*, *Onward*, *Mikado*, *Woodbine*, and *Anna Henderson* are those of six vessels which were on their way to and within a short distance of Hong Kong during the typhoon, and extracts from whose shipping reports are now before me. A portion of the continent of China is to the north of the plan. The town of Macao and the islands of Hong Kong, Lantao, and Lema are in their respective positions.

The course which was taken by the typhoon was nearly allied to a parabolic curve. I have not attempted to trace its source farther eastward than the position indicated by 22° 30′ N. lat. and 116° 10′ E. long., where it overtook the *Formosa* (see *a* in map), or to follow it beyond the point indicated by 21° 15″ N. lat. and 115° 45′ E. long., where it struck the *Onward* (see *f* in map) on its return from the West. This portion of its course is marked in the plan by a succession of dotted lines. Consequently my observations are confined to the proceedings of the typhoon within these limits. After passing the *Formosa*, it swept over Hong Kong, crossed the mouth of the Canton River, and continued its headlong career to the town of Macao. Approaching this point, however, it was met by a strong northerly gale, and turned towards the south, but again encountering opposition in the shape of a south-west gale, it returned towards the east, upsetting the *Mikado* and driving the *Onward* before it. Throughout its entire course it consisted of a comparatively narrow belt of wind.

So much for the statement of my theorem. Now for its proofs.

I assume that only three conditions are necessary to substantiate my argument:—

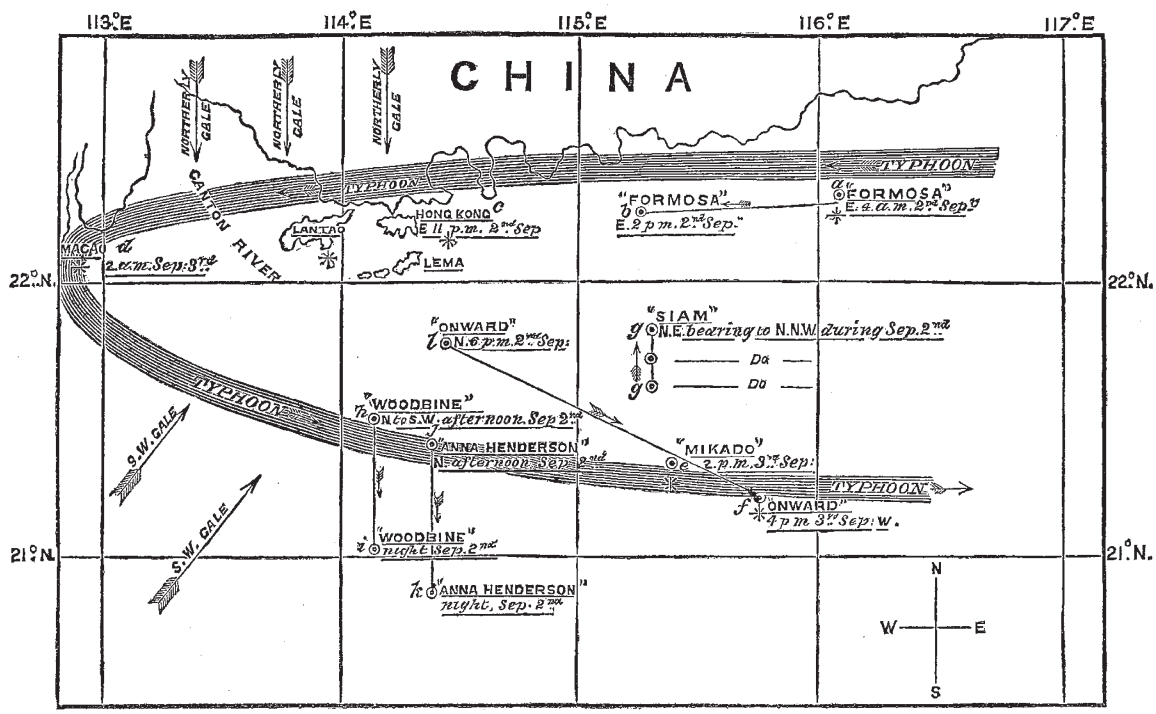
1. I must prove that the typhoon reached the various positions which I have indicated in the order actually laid down.

2. That it reached them at successive intervals of time.

3. That its greatest observed efforts were exerted on or in the vicinity of the line adopted by me, and not at any appreciable distance to the right or left of it.

4. That the two opposing gales, which I have described as occasioning the alteration in the course of the typhoon, did actually exist.

The first and second of these four conditions appear to be so intimately connected, that I think I cannot do better than consider them together. The earliest observations of the typhoon were made by the *Formosa*, which experienced its full force in the situation indicated in the plan between *a* and *b*. Both positions are accurately determined. The following is an extract from the shipping report: "On September 2, the barometer 29·30, experienced very heavy typhoon; during the typhoon the ship suffered some damage. At 4 A.M. on 2nd inst., barometer 29·25, blowing very heavy from east; at 12 noon, the same day, the wind moderated; at 2 P.M. on same made some



sail." The second series of observations was taken at Hong Kong (*c* in plan). Here I may quote from the register kept at Junk Island, near Hong Kong, during Saturday, September 2, and Sunday, September 3 :—

September 2

Hour	Wind	Force	Barometer
1	N.N.W.	6	29·58
2	,,	,,	29·54
3	,,	,,	29·52
4	,,	,,	29·50
5	,,	,,	29·48
6	,,	,,	29·46
7	,,	,,	29·45
8	,,	,,	29·44
9	N.N.E.	,,	29·42
10	,,	7	29·40
11	N. by W.	7	29·39
Noon	,,	8	29·38
1	,,	9	29·35
2	N.	9	29·30
3	,,	9	29·29
4	N. by E.	10	29·28
5	,,	10	29·27
6	N.N.E.	10	29·22
7	,,	10	29·19
8	N.E. by N.	11	29·16
9	E.N.E.	12	29·16 *
10	,,	12	29·15 *
11	E.	12	29·17 *
Midnight	E. by S. ½S.	12	29·18

September 3

1	E. by S. ½S.	12	29·18
2	E.S.E.	11	29·25
3	,,	10	29·30

—and so on, the barometer rising, as the gale decreased.

It will, of course, be remarked that the *east* wind was the veritable typhoon. This is clear from the fact of the barometer reaching its lowest point, and the force of wind being the highest registered, at or about the hour when the vane pointed to the east. Now, to proceed in the same direction that the typhoon is following as far as the town of Macao (*d* in plan). No register, unfortunately, was preserved—at least, that has transpired—of the direction of the winds at Macao during September 2 and 3, but the barometrical readings were as follows :—

Date	Hour	Reading
September 2	12 Noon	29·705
,,	3 P.M.	29 605
,,	5 ,,	29·555
,,	6 ,,	29·485
,,	7 ,,	29·475
,,	8 ,,	29·425
,,	9 ,,	29·405
,,	10 ,,	29·285
,,	11 ,,	29·185
,,	11·30 ,,	29·135
,,	12 Midnight	29·065
September 3	1 A.M.	28·785
,,	1·30 ,,	28·485
,,	2 ,,	28·385 *
,,	3·30 ,,	28·885
,,	4 ,,	29·035

Still, although no record has been preserved of the direction from which the wind came on this occasion, it is evident, from the nature of the injuries inflicted upon Macao, that it was the turning point or apex of the typhoon. The effects bore a strong analogy to those of a cyclone or whirlwind, as will be seen from the following extract from the *Overland China Mail* of September 15 :

"No less than three vessels, the *Vistula*, French *Edouard et Marie*, and a Dutch barque, have been wrecked in the roads. . . . . Baron de Cercal's house on the point has been unroofed ; the clock tower top has been blown down ; and the façade of the San de Lorenzo Church has been torn off by the force of the wind." Continuing still farther round the course indicated by the

* At this time, between 9 and 11, the typhoon struck the island.

* At this time the typhoon struck the island.

dotted lines in the map, and omitting to take notice of the *Woodbine* and *Anna Henderson*, we arrive at the *Mikado*, whose situation (marked *e* on the plan), although not so clearly specified in the report as might be desirable, must, nevertheless, have approximated to that laid down, if we take into consideration the direction from which it was sailing (from Saigon to Hong Kong) and the time at which it arrived in harbour, viz., about four and twenty hours after the typhoon had passed over it. The shipping report is as follows:—"On midnight the 1st inst. (September) the barometer falling, wind increasing from the northerly, barometer falling rapidly. On midnight of the 2nd instant, the weather *indicating* a typhoon, began to take in sail; the wind continued increasing, the barometer still falling; at 8 A.M. on the (3rd)* instant took in the main topsail; at 11 A.M. till 2 P.M. blowing a very heavy typhoon, the ship lying on her beam end, the barometer 29·34. . . . . At 3 P.M. weather began to moderate, and the ship began to righten. . . . . At 8 P.M. on same day the weather again moderated, and we then commenced to make sail to Hong Kong; the wind *rounded* to E.S.E." (showing that it had been westerly or north-westerly during the gale). But the fullest and most minute account of the typhoon appears in the narrative of the *Onward's* adventures during its occurrence; and here, fortunately, I am able to repose the utmost confidence in the statements adduced, owing to a personal acquaintance of several years with the Captain and officers of that vessel. There is not the remotest difficulty in determining the position of Captain Whyte's vessel during the 2nd and 3rd September, the bearings and distances being quoted on all important occasions. The report runs thus:—"Current setting to S.W. ½ W., 34 miles daily. September 2, at 6 P.M. (barometer 29·83), N.E., head of Lema Islands, bore N. by W. ½ W., 15 miles distant; tacked ship and stood to eastward, wind at N. with a heavy easterly sea coming away, with all appearances of bad weather; midnight (barometer 29·70) wind N. increasing to a gale; reduced the ship to two topsails; 4 A.M. (barometer 29·59), wind still at N., gale still increasing with heavy sea from the eastward; 8 A.M. (barometer 29·39), strong and increasing gale, furled all sails, and secured them with double gaskets, and made every preparation for a hard gale. September 3, at noon (barometer 29·15, still falling), wind N.W., blowing most terrifically with a fearful cross sea, ship pitching heavily, putting bowspit and jibboom under water at times, and filling the decks with water; 4 P.M. (barometer 29·3), wind W., blowing harder than ever with thick rain; at 6 P.M. (barometer 29·10), wind W.S.W. blowing still most terrifically with a most fearful cross sea running; at 8 P.M. (barometer 29·20), wind S.W. inclined to moderate, sea still very heavy; midnight (barometer 29·39), wind at S., both wind and sea greatly down with all appearance of better weather; 6 A.M. (barometer 29·60), wind S.S.E., moderate breeze, made sail and squared away for port." The run of the ship from 6 P.M. September 2 till 4 P.M. September 3, I have represented by the line *l f*, as although the course taken was *supposed* to be easterly, the *strong current* setting in a S.W. direction would certainly bring it down to the point *f*. Thus the ship in endeavouring to escape the typhoon ran right into it! Now what may be gathered from all these facts? That a terrific gale from the east struck the *Formosa* in the position indicated by *a* on the 2nd September at 4 A.M.; that it passed over Hong Kong (at *c* in map) between 10 and 11 the following night; that it reached Macao (*d* in map) at 2 A.M. on the morning of the 3rd, exhibiting such peculiar phases of character as would lead one to believe that it was revolving on its axis; that (after changing its direction) it overtook the *Mikado* in the position indicated by *e*, at 2 P.M. on the 3rd September; and that finally it swept over the *Onward* in the position indicated by *f*, still coming from the west, at 4 P.M. the same day.

Hence I conceive that my *first two conditions* are proven.

The third is as easily disposed of. That the typhoon did not spread itself out to any great extent in a northerly direction is clear from the fact of Canton not having experienced its fury. There was a smart gale blowing on Saturday and Sunday; but the barometer did not descend below 29·40, and the typhoon was described there as being "insignificant." That it was not felt so far south as 21° N. lat. is evident from the shipping reports of the *Woodbine* and *Anna Henderson*, which make no mention of it. They speak of gales blowing hard from the N. and S.W., and culminating upon the *evening* of the 2nd of September; but it is apparent, from the tone of their descriptions, that they did not encounter the veritable typhoon. The *Woodbine's* report is as follows:—"2nd of September, about thirty miles from Lema Island, when encountered a heavy typhoon from N. to S.W., with heavy sea." The *Anna Henderson* says:—"Wind veering to N.; on the 2nd increased to a gale, splitting several sails; at 7 A.M. on same day blew away the main topsail, the gale continued up to 6 P.M., than began to moderate." Their courses after receiving the shock of the northerly gale are represented by *h i* and *j k*, and these cannot be far from the actual ones taken, as the positions *h* and *j* are determined from observations quoted in the shipping reports, and the ships having been small, with wind and current both dead against them, *must* have been *driven* in the directions indicated. Fortunate for them that it was so, for by this accident they escaped the typhoon altogether. With regard to the interior edge of the typhoon, it would be impossible to ascertain how far it extended; but that there was a region of comparative calm within its circumference is easily proved. The *Siam*, from Newchwang, a port in the north of China, when in 21° 30′ N. lat. and 115° 15′ E. long., experienced a gale, which, during the 2nd of September, went right round the compass, clearly showing that the ship was in the centre of the typhoon. But that the *Siam* did not feel the full force of the gale or anything like it is equally clear from the trifling notice taken of its effects. The date of this vessel's arrival in port leads us to believe that it scarcely altered its position during the gale; probably as the wind veered round it drifted northwards, as indicated at *g g* in the map. The shipping report states:—"1st of September, in lat. 21° 30′ N., long. 115° 15′ E., when experienced *another* heavy *typhoon** from N.E. veering to N.N.W., and round to S.S.E., with very heavy cross sea, and much rain; on the 3rd inst. it began to moderate, wind from S. to S.S.E." I think therefore we may fairly gather that the typhoon's influence did not extend in any great degree to the right or left of the course laid down for it in my map.

Hence condition *three* is proven.

The fourth condition scarcely requires demonstration. The truth of it is apparent from the report of the wind at Hong Kong up to 3 P.M. on the 2nd of September, and that of the ship *Woodbine*, which occupied the most westerly position of any of the vessels, from whose accounts I have gathered my information.

It seems therefore reasonable to assume that the typhoon of the 2nd of September did take the course indicated by me, which is nearly that of a parabolic curve. Should such be the case, it goes far to prove that these eccentric phenomena have not a circular form, as has hitherto been imagined.

One of the most interesting facts that has been elicited from these investigations is, however, the indication that a space of comparative calm does exist within the circuit

* I have altered this from 2nd to 3rd as the typhoon could not have been "indicated" after it had actually *occurred!* The figure 2 was evidently a misprint.

* This shows in how qualified a sense the word "typhoon" must be taken in reading the *Siam's* report.

of a typhoon, a theory which has always been advanced, but, so far as I know, has never hitherto been substantiated by any actual observations. The case of the *Siam* is a strong argument in favour of the truth of such a theory, for in point of fact it may be said to have scarcely felt the effects of the typhoon at all.

Should any of your readers be disposed to sift the various evidences which I have adduced, the papers are in my possession, and access can be had to them at any time.

FRANK ARMSTRONG

NOTES

WE have received full intelligence of the English Eclipse Expedition from Mr. Lockyer, under date Galle, November 29. At that date the expedition had been detailed into various parties for service at different stations in Ceylon and the mainland; the instructions to these several parties are reprinted in another column. Mr. Lockyer, Dr. Thomson, and Captain Maclear were to observe at Ootacamund, Mr. Davis being detached to photograph at Gunote; Messrs. Abbay and Friswell were to go to Manantawaddy, Signor Respighi and Mr. Holliday to Poodacottah; while Captains Tupman and Fyers and Messrs. Moseley and Lewis were to proceed to Trincomalee. The Indian and Cingalese authorities and the officers of the *Mirzapore* and *Glasgow* had exerted themselves to the utmost to assist the expedition, and the Ceylon party acknowledge great obligation to Captain Fyers, the Surveyor-General. In another column will be found an account of the voyage out.

WE hear with great satisfaction that Mr. Edgar Leopold Layard, C.M.Z.S., has received the appointment of H.B.M. Consul at Para. Mr. Layard has already done good service to science in Ceylon and South Africa, and will now have the pleasure of investigating the fauna and flora of a third and not less interesting region. Before leaving England we understand that Mr. Layard will publish a new and revised edition of his work on "The Birds of the Cape Colony," which is now nearly ready for the press.

WE are informed that Mr. Leighton is preparing for publication a conspectus of all the Lichens hitherto discovered throughout the world, with diagnoses, &c., and also a second edition of the Lichen Flora of Great Britain, Ireland, and the Channel Islands, which will combine an Introduction, Glossary, and Index, and which, it is hoped, will be ready for the press early in 1872. The Glossary, &c., will be printed separately, so as to enable possessors of the first edition to purchase separately.

MR. T. K. SALMON, of Guildford, is making preparations to start on a collecting expedition to the highlands of the Columbian republic. Mr. Salmon's head-quarters will be at Medellin, in the State of Antroquia, whence he will explore the Cordillera of Quindin, and upper valley of the Cauca. Mr. Edwin Gerrard, jun., of College Street, Camden Town, acts as his agent, and will be happy to receive subscriptions in aid of the expedition.

WE are glad to hear that the well-known naturalist, Mr. W. T. Blanford, of the Indian Geological Survey, is appointed a member of the British expedition for the survey of the boundary between Persia and Beloochistan. Commencing on the coast of Mekran the party will pass northward to Seistan and Herat. In Seistan they will enter a most interesting region, of which the geology and zoology are quite unknown. The river Helmund, and Lake of Seistan, in which it loses itself, will certainly present many features eminently worthy of scientific investigation, of which no one is more qualified to take advantage of than the ex-geologist of the Abyssinian Expedition.

THE recent death of Dr. Seemann, who for nine years has conducted the *Journal of Botany*, has caused a change of editorship. A new (2nd) series will be commenced in 1872, under the management of Dr. Trimen, of the British Museum, for the last two years a sub-editor, with Mr. Baker, of Kew, who will continue to be associated with Dr. Trimen in the conduct of the new series. We are also requested to state that unavoidable circumstances will delay for a few days the publication of the January number.

THE Edinburgh papers record the death of Mr. J. B. Davies, assistant-keeper of the natural history section of the Museum of Science and Art in that city. Mr. Davies was appointed to his position in the museum, while it was in its old place in the College, by Edward Forbes during the brief period that gifted naturalist occupied the Chair of Natural History; and in the discharge of his duties he was as much distinguished by the extent and accuracy of his knowledge as by his readiness to assist all students of his science, and by his courteous bearing. In addition to his appointment in the museum, Mr. Davies held the lectureship on zoology in the Royal High School, was assistant-secretary to the Royal Physical Society, and an Associate of the Botanical Society. He was the author of a little manual of practical natural history termed "The Naturalist's Guide."

THE following have been elected office-bearers of the Edinburgh Botanical Society for the ensuing year:—President, Prof. Wyville Thomson, LL.D.; Vice-Presidents, Dr. M'Bain, R.N., Prof. Dickson, Mr. Buchanan, Dr. T. A. G. Balfour; Secretary, Prof. Balfour; Foreign Secretary, Prof. Douglas Maclagan; Treasurer, Mr. P. N. Fraser; Auditor, Mr. Tod; Artist, Mr. Neil Stewart; Assist. Sec. and Curator, Mr. John Sadler.

IN connection with the Gilchrist Education Trust, arrangements have, we understand, been made for the delivery at the Lambeth Baths of a series of lectures, chiefly of a scientific character. The names of Prof. Huxley and Dr. Carpenter are mentioned among the probable lecturers.

MM. DELAUNAY and Ch. St. Claire-Deville have presented to the French Academy of Sciences some further interesting notes of the cold of November and the early part of December. M. Delaunay remarks that the cold advanced, as is usually the case, from north-east to south-west. The minimum temperatures were recorded at Gröningen, in Holland, on Dec. 7 (− 10° C. = 14° F.); at Brussels (− 12°·6 C. = 9·5° F.) on the 8th; and at Paris (− 21°·3 = − 6° F.) on the 9th. This extremely low temperature appears to have been limited to a very small tract of country between Paris and Charleville. On the same day the temperature was above the freezing-point in Scotland as far north as Nairn, and in the greater part of England, falling only at Greenwich as low as − 2°·3 C. (=28° F.). The severity of the frost was considerably mitigated at Paris on the 10th and 11th; but on the latter date it was again as low as − 22°·6 C. (= − 8°·5 F.) at Haparanda, on the Gulf of Bothnia, − 15° C. (= 5° F.) at Stockholm, and − 14°·1 C. (= 6°·5 F.) at St. Petersburg.

SOME of our readers will recollect the controversy which took place in the "Proceedings of the Zoological Society" and the *Athenæum*, some six months ago, respecting a tortoise's skull in the British Museum, upon which Dr. Gray had established a new genus and species, *Scapia falconeri*. Mr. Theobald maintained that this skull (received by the British Museum from the executors of the late Dr. Falconer) had originally belonged to one of the two typical specimens of Mr. Blyth's *Testudo Phayrei*, in the Indian Museum, Calcutta, and that consequently *Scapia falconeri*, Gray = *Testudo phayrei*, Blyth. Dr. Blyth maintained the contrary. We understand that the director of the Indian Museum has recently claimed the skull in question, and that it is now on its way back to Calcutta, so that the authorities of the British Museum must have given up their view of the question.