NOTES OF A JOURNEY
ACROSS
THE ISTMUS OF KRÁ,
MADE WITH
THE FRENCH GOVERNMENT SURVEY EXPEDITION,
JANUARY—APRIL, 1883.
WITH
EXPLANATORY MAP AND SECTIONS,
AND
Appendix containing Reprint of Report to the Indian Government, by Captains Fraser and Forlong, in 1863.

BY
COMMANDER A. J. LOFTUS, F.R.G.S.

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To

THE ROYAL GEOGRAPHICAL SOCIETY
OF ENGLAND,

These Notes with the accompanying Map and Sections,

are respectfully inscribed

by

Their humble fellow worker,

A. J. LOFTUS.
NOTES OF A JOURNEY ACROSS THE
ISTHMUS OF KRÀ, &c.

In the early part of this year, as Commissioner for His Most
Gracious Majesty The King of Siam, I accompanied the French
Expedition to survey the Isthmus of Krà for the purpose of
ascertaining the practicability of constructing a maritime canal
to connect the Bay of Bengal with the Gulf of Siam. The
Expedition landed at Paknam Chumphon, on the east side of
the Isthmus, on the 16th January, and left Muong Rehnong, on
the west side, (Bay of Bengal), for France, via Penang and
Singapore, about the 4th of April, the whole time occupied
being two months and nineteen days.

I was with the Expedition the whole time, and had ample
time and opportunity to make independent observations.

The following Notes, with the accompanying Map and
Sections, are the result of observations then made, and, while
not pretending to scientific accuracy, they may be relied on as
being sufficiently accurate for all practical purposes.

I do not know, of course, what conclusion the French
engineers came to on the subject, but my own opinion, formed
after careful investigation, is that such a canal as that proposed
is quite impracticable. My reasons for thinking so will appear
in the course of the following paper.

It will be remembered that the idea of cutting through the
Isthmus of Krà has been frequently mooted, and in 1863 a
survey was made on behalf of the Indian Government by
Captain Alexander Fraser and Captain J. G. Forlong of the
Bengal Engineers. Their report was published at the time,
but as it is extremely interesting at present, and is not easily
accessible, I have added it to this pamphlet as an appendix.
It will be observed that these officers pronounced a canal
to be impracticable, but they recommended a railway. It is
evident however that their survey was very hastily and roughly made. Indeed they say so themselves. On one most important point they made a serious miscalculation. They stated the height of the Krà Pass to be 75 feet above the level of the sea, which is clearly a very great underestimate. Lieutenant Bagges, who was sent by the Indian Government in 1868 to survey the boundary between Tenasserim and Siam, stated the height of the Krà Pass to be 250 feet, which agrees exactly with my own observations. The opinion therefore of Captains Fraser and Forlong regarding the practicability of a railway must be received with caution. But whether a railway could be made or not, I think in these days of swift steamers, it could not compete with them, and would not pay. Without further preface I shall proceed with my notes.

On the 15th of January, 1883, the Expedition left Bangkok on board the gunboat Coronation, Commander Trail, generously placed at the disposal of the French party by His Majesty.

The passage down the gulf was fine for the season of the year, and on the afternoon of the 16th the party had the good fortune to land the greater portion of their luggage and instruments, which were safely stored in a comfortable brick-built bungalow (formerly belonging to His Grace the ex-Regent) at Paknam Chumpon.

On the following day, after landing the heavy baggage, the gunboat left for Bangkok, with Dr. Harmand, the French consul, on board, who accompanied the Expedition to this place.

The French Expedition was under the command of Lieutenant Paul Bellion, of the French Navy, and consisted of five gentlemen besides the Commandant, viz.:—Messrs. Bourgery and Delaplanche, Civil Engineers; M. Delport, Secretary; M. Schlüssel, Mathematician; and M. Tournard, Leadsman. Its object was to examine that portion of the Malay Peninsula lying between the parallels of Langsuen and Krà, for the purpose of constructing a maritime canal, with a view of shortening the route between India and China.
To accomplish this with as little delay as possible, it was arranged, first, to make a preliminary examination of the country in the valleys of the Sawe and Langsuen rivers, and subsequently to make a careful study of the route between Muong Krà and Chumpon.

In pursuance of this decision, observations for the longitude of the first station, viz., the entrance of Chumpon river, were taken, and a few other measurements made, instruments examined, &c., and finally on the 17th instant, the survey party embarked in a number of boats, sent by His Excellency the Governor of Chumpon, and took their departure for that city, where they arrived the same day. At the mouth of the river there are generally scores of monkeys searching for food on the mud flats; one of these was shot and cooked French fashion—poor Jacko's flesh made an excellent meal—his bones alone left the table!

At Chumpon we remained the guests of the Governor for a few days, and here I had an opportunity of seeing a fresh joint of beef cooked to perfection, in a few minutes, by a French solar cooking apparatus. This is a simple, effective, and most useful article, and should form part of the kit of every jungle traveller.

Here twenty elephants were hired by Commandant Bellion; guides were supplied by the Governor, baggage, &c. not required on the journey was left behind, to be forwarded to Langsuen by sea, and everything being satisfactorily arranged, the Expedition set out on its maiden jungle trip on Sunday, the 21st of January, for Ooay Sie, the first halting place on the route to Langsuen, six hours' elephant ride from Chumpon.

I followed the Expedition next day, with four elephants and nine men, as a precautionary measure, to arrange any mishap that might occur; which is usually the case on the first day's march when a large and promiscuous party set out together.

It may not be considered out of place here to describe the most convenient order of marching in the jungle for a survey party, which I have found in practice to answer very well.
The guide, and a man carrying a white flag on a tall thin bamboo, take the lead in the procession; behind these, at a distance of 500 or 600 feet, a red flag is carried by another man, and at the same distance behind him, comes the first elephant with the surveyor and his interpreter. Alongside of this elephant walks the man whose duty it is to give the names of places, &c., &c. The chronometers are slung to the middle of a light bamboo, fitted with legs at a short distance from each end, and protected from the sun by mats covered with several thicknesses of white cloth. Each chronometer is carried directly in advance of the leading elephant by two men, so that they are always under the eye of the surveyor, who should never lose sight of them for one moment. On long journeys four men are allowed for each chronometer, so that they can relieve each other when tired.

After the surveyor's elephant comes his assistants' elephant with a few portable instruments, chain, tape line, and large umbrella. Next in turn come the elephants carrying the heavier instruments, baggage, &c., and these are followed by those of the servants and the provision department. The elephants of the government official in charge of the Expedition, with his followers, come up in the rear, and complete the procession.

The female elephants are the best to ride on, and the males for carrying luggage. These jolly old wags—for wags they are in their way—move steadily on at the rate of two and a half statute miles per hour. This is the natural pace of the Siamese elephants, and they will keep it up with wonderful precision, for six or eight hours, if they are in healthy condition and fed before starting.

Beware of baby elephants and those ejecting oil from their ears; the former are intolerable nuisances, and the latter are dangerous.

I will now resume my notes from Ooay Sie which is a small village with a wat or temple, situated on the banks of a narrow stream running into the Bay of Sawe, and distant from it about one and a half miles. The Expedition remained here one night,
and the following day, after a four and a half hours' march, arrived at Ban Naa Po, a village on the right bank of the Sawe river, and about three miles below Ban Kri Sawe. From this point it was intended to branch off across the Peninsula, and follow the route via Kow Kye (a dangerous pass for elephants,) and Chah Hoon to Muong Rehnong, and to make an examination of the valley of the Sawe river on the way, but owing to the unauthorized departure of ten elephants to Chumpon, the course of the Expedition was altered, and it was decided to take the route to Rehnong, via the valley of the Langsuen river, which afterwards, I think, proved to be the best way of economising the already limited time the Expedition had to accomplish its labors in.

We remained four days until complete preparations could be made for the onward march. The time however was judiciously employed in surveying the bends of the river to the sea, taking solar observations, and determining atmospheric curves, &c. Independent of this, a laborious ascent of an adjacent hill (Kow Taakade,) clothed with dense jungle, was made for the purpose of having a good view of the country in the supposed direction of the Sawe valley. On the summit of this hill, about 400 feet high, a ladder and platform were rigged up a tall tree, and from this elevated position almost a perfect view of the country to the west was attained, mountains and hills of every shape and size, covered with the thickest jungle, were massed together in one unbroken, but varied outline, and nothing in the shape of the sought-for valley could be discerned in any direction. The Sawe river is a deeper and better stream than the Chumpon river. It is about 350 feet wide at its entrance in the S.W. part of Sawe bay, and Ban Naa Pa is about seven miles from its mouth.

Having engaged extra men from the head official of the village to carry baggage, and despatched the remainder in a native boat by sea to Langsuen, the Expedition again started on its journey on the 26th inst., and arrived, after five and a half hours' march, at Ban Taa Ko, a small village on the Bank of the Klong Taa Ko.
Ban Taa Ko is a small hamlet on a very narrow snakefied river, about five and a half miles from the sea, surrounded by a small area of paddy land, and a number of isolated hills of fantastic shape.

On the following morning we started from here in our usual order of march, and in four hours reached the left bank of the Langsuen river, nearly opposite New Town, the residence of His Excellency the Governor. Having crossed the river, we took up our quarters in a *tamneap*, or bamboo shanty, prepared for us near the Governor's house.

This day's march was somewhat more eventful than the preceding; more open country, with patches of cultivation, gardens, villages, and peculiar looking hills rising abruptly from the plain were met with. An accident, which nearly terminated fatally, to one of the Chinese cooks of the party, is worthy of mention. One of my elephants, a large powerful beast with long tusks crossed near the middle, like the letter X, was very unruly and savage, owing to oil exuding from his ears. He had been the cause of one or two rumpusses before, so I took the precaution of loading him last, and keeping him a respectable distance from the other elephants on the march.

On this occasion he was apart from the rest walking quietly, when the unfortunate cook came into the track a short distance ahead of him. The *mawchang*, or elephant driver, warned the cook to get out of the way as quickly as possible, but the cook, out of sheer bravado, took no heed of this friendly advice and walked leisurely along. Suddenly the elephant went full speed for him, and with his tusks, tossed the poor Chinee high in the air after the most approved pancake fashion; down he came on the tusks again, when the next effort of the enraged animal dexterously landed the gored, bruised, and unhappy celestial head-foremost into the bushes on the side of the track. The furious beast again made for him, but missing the place of his concealment, rushed madly into the jungle overturning everything completely off his back, and seriously injuring the unlucky rider into the bargain. It was not until the following day he turned up with his elephant and goods in a sorry plight. The
cook, dangerously wounded, was carried on bamboos to Langsuen, and placed in charge of a native doctor.

Langsuen New Town is a great improvement on the old one, three and a half miles below it. Roads are being made, lined with native and Chinese shops, and brick built houses, &c. The banks of the river are high, and about 400 feet apart. The bed is sandy, and the stream, though shallow, runs with greater velocity to the sea (about nine miles from New Town) than those crossed on the first part of our journey.

Here the Expedition remained four days. The Governor of the Province was absent at Rehnong, but the Yokabat, or third assistant governor, rigged up a spacious tent for us near the tamneap, and went to work with a good will to prepare boats for our journey up the river to Ban Song. During our stay here, solar observations were taken, and atmospheric tide curves observed as before. Up to this time the weather was foggy and cool in the morning, with fresh easterly sea breezes during the day. The evenings were temperate, pleasant, and enjoyable. Two days before leaving, Commander Bellion and his party ascended Kow Keh Say, a thinly wooded hill of moderate elevation on the left bank of the river, to get a view of the country. A ladder and platform were employed as before, on one of the tallest trees; no more satisfaction, however, was met with here than at Ban Naa Po; the same indefinite landscape of mountains and hills, apparently without break or opening, was observed as at the former station.

On the morning of the 30th January, ten light-built swift canoes, with crews of four, five, and six men each were in readiness. These were not sufficient for our large party, so Messrs. Delaplanch and Delport, with two or three subordinates, were left behind to follow with more luggage by the return boats. At 8 a.m. we pushed off from the Governor's landing place and poled up the river at a good pace by means of light bamboos. Over the falls, or elevated parts of the river's bed, which occur at almost regular distances from each other, these tiny craft bounded right bravely, without a mishap through the whole journey. After seven and a half hours toiling up this
very tortuous but picturesque river, we arrived at a shingle bank near the quiet little village of Ban Taa Ngow, where we secured our boats, lighted the camp fires, and set the cook to work; enjoyed a splendid cool bath in the clear running waters of this beautiful stream, and a pretty fair dinner, flanked with good coffee, brandy, and cigars. At 10 p.m. the whole members of the Expedition were sleeping like infants.

January 31st. The Expedition awoke right early, and after polishing off our regular draught of that never failing remedy against jungle fever, viz: Eno's fruit salt mixed with lime juice, sugar, and water; and partaking of tea and biscuit, we again started to behold the wonders of another day's journey up this highly wooded and interesting river. Aneroid readings were made at regular intervals, and bearings taken of the bends, as we went along; villages, and hills of all shapes and sizes, some sloping to the very verge of the banks, and others rising abruptly a short distance from them, were numerous on both sides along the whole distance. The rapids or falls in this day's travel were stronger and more numerous than those of yesterday, and extra effort on the part of the boatmen was needed to surmount these rocky obstructions, which they accomplished very skilfully.

At 3.50 p.m. after being cramped up for 8h. 40m. we rested for the night on a shingle island in a broad part of the river called Ooay Hok, and the next morning at seven we again resumed our journey.

From this point the river bulged out wider, the rapids became more numerous and difficult to pass, and several small islands, formed of rock, shingle, and sand, were met with in the broad parts of the stream. This state of things continued the remainder of the distance to Ban Song, the highest point attainable by boats. On this day's journey the number and dimensions of the hills increased, as also did the villages on both banks, and finally after eleven hours hard toiling the boats reached Ban Song. Towards the close of evening, at a short distance below the village, a large black snake dashed into the current and with head erect made a savage attack on my
boat. After an exciting and somewhat lengthy scrimmage we vanquished the enemy with paddles and bamboos, but not until we had drifted into the bushes on the opposite side, a considerable distance down the stream.

Ban Song is a moderate-sized village inhabited principally by Chinese engaged at the tin mines, and is under the jurisdiction of the Governor of Langsuen. It is situated on the eastern verge, of the backbone range of mountains which in this part of the Peninsula runs adjacent to the east coast of the Bay of Bengal. It lies in a perfect nest of hills, and is dependent on the villages lower down the river for its supplies.

On the following day, February 2nd, the boats were dispatched to Langsuen for the remainder of the Expedition, observations for latitude and longitude were carefully made by Commander Bellion and myself with similar results, and atmospheric tide curves were also determined.

The approximate distance from Langsuen to this place by the bends of the river is fifty-six geographical miles, and the height above Langsuen by aneroid is 195 feet. February 3rd, Commander Bellion and his party ascended a steep hill in the neighbourhood of the village on those slow but sure footed indispensables, the elephants, to get another view of the country from this important position, but with no better success than before. Hills and mountains in grand confusion, clothed with primeval jungle trees of stately magnificence, were seen in every direction, but alas! no valley gladdened the sight of the beholders. Having completed our investigations, the Expedition left on the 4th February at 7 a.m., the elephants being supplied by order of the Governor of Muong Rehnong. The track followed in the direction of the source of the river, sometimes over hilly ground near its banks, through dense jungle, and at other times up its rocky, tortuous, and uneven bed. At length, after innumerable ups and downs, twistings and turnings, we arrived in a jolted condition at the Kow Deng pass ten minutes before noon.

Kow Deng is the lowest gap of the backbone range in this locality; it is the boundary mark between the Provinces of Rehnong and Langsuen, and is elevated above the sea 630 feet
according to careful aneroid observations. The source of the Langsuen river tapered gradually off to within a short distance from the pass; here we remained three quarters of an hour to refresh both man and beast. At 12.33 we commenced the abrupt and serpentine descent on its western side, and at 1.55 the Expedition emerged into open country.

The source of Raat Koot river was met with shortly after leaving the pass, and we followed the course of that small stream, wending its way along the plain, past the tin mine localities, until we arrived at the insignificant village bearing its name by 2.39 p.m.

Ban Raat Koot is within a couple of miles of the sea coast, and here we found a steam launch, sent by Kaw Sim Kong, the loyal and energetic Governor of Rehnong, to convey the party to that place, instead of following the tedious and dangerous mountain track connecting the two places. In the course of the evening stellar observations were made for latitude; and the following morning, February 5th, solar observations were taken, sketches of mountains and bearing recorded, and aneroid readings noted with considerable care. After this we boarded the steam launch in a fork of the river (Ooay Sie Kow) a few minutes pull from the village, and in a few minutes more we were steaming up the eastern shore of the Bay of Bengal with a smooth sea and enjoyable land breeze.

The weather was cold and pleasant, and revived the spirits of the whole party after our temporary sojourn in the jungle, "and all went merry as a marriage bell," when lo! the eastern landscape presented a grand view to our gaze. There appeared the lofty, interminable, backbone chain of the Malay peninsula standing boldly out in the clear morning sky, with a bluish tint and irregular outline, presenting a gigantic barrier against the puny efforts of human skill and science.

The distance from the mouth of the Raat Koot river to Koh Pee, a small rocky islet off the mouth of the Rehnong river, is fifteen and a half miles. The coast is very shoal between these points. Our little steamer pursued its course close to the eastern shores of a chain of islands lying a short distance off the
coast, and reached Koh Pee in four hours from the time we left the entrance of Raat Koot river. The mouth of the Rehnong river is obstructed by a number of small islands and is very shoal. After considerable delay from repeatedly grounding we arrived with our baggage at the landing place, one and a half miles up. From the landing place a good road, about one and a half miles long, leads to the town. Carriages, sent by His Excellency the Governor, were in attendance, and at 6 p.m. the Expedition met with a warm reception from His Excellency, and took up their quarters in his hospitable residence.

At this place we had a good look round. The latitude and longitude of Government House were carefully determined, and subsequent solar observations were made to verify the same. The Commandant's position of the place and my own agreed very closely. Atmospheric tide curves were carefully observed and recorded both by myself and the chief engineer Mr. Bourgery. The steam launch and elephants were sent to meet the remainder of the expedition on its way from Langsuen.

After completing our observations, it was determined to explore the Chah Hoon river and the track leading theerfrom towards Kow Kye, to discover the Sawe valley if possible, and, in accordance with instructions received from the Siamese Government, His Excellency the Governor of Rehnong supplied a steam launch and elephants for that purpose.

February 13th.—Left the mouth of the river Koh Pee in the launch at 8 h. 30 m. a.m., and arrived at the entrance of the Chah Hoon river at 11 o'clock. Here we remained until ten minutes past noon, repairing the engine, when we again started. The river is wide for three and a half miles inside its mouth, where it gradually narrows and snakes about until the village of Chah Hoon is reached, the highest point navigable for boats.

It is a shallow stream with rocky bed in some places. Hills of high and low altitude terminate near both banks, and are plentiful along its course. At 2 h. 48 m. p.m., arrived at Ban Chah Hoon, a populous village on the left bank of the river, encircled by hills. The river here has shingle banks and a rocky bed, and is nothing more than the beginning of a mountain
stream. The tide reaches a short distance above this point and no further. On the following morning we mounted our elephants at 7 h. 9 m., and followed the course of the river. This leads through open breaks between towering hills, rendered picturesque by numerous neat little villages fenced in, and surrounded by patches of cultivation. The ground and track so far were undulating, and the latter tortuous in a high degree, ascending abruptly as the actual neck, or entrance of the river valley was approached. At 9 h. 10 m., I reached this spot (the other elephants were rearward), and halted. Looking ahead in an E.N.E. direction, I saw a narrow wedge-shaped valley, bounded by mountains several hundred feet in height. The outline of their steep slopes appeared distinct from each other, and blending together at their base in regular succession, resembled the letter W. Continued, more than anything else I can think of. On the right bank of this valley we marched slowly along, twisting and turning, rising and falling, until 10 h. 4 m., when we halted for consultation and breakfast, in a bend of the little stream we had followed so laboriously.

My aneroid gave the elevation of this point 110 feet above sea level, which I believe corresponded with Mr. Bourgery's reckoning. Kow Kye is a high, steep, and dangerous pass, with a narrow track round its southern slope, only wide enough for an elephant's foot. Accidents are not unfrequent in the rainy months, when the edge of the track gives way, precipitating man and beast to the bottom of the chasm never more to be heard of.

Kow Kye was still a long way from our halting place, which was situated on the verge of the backbone range, and here, the gigantic hills towering above our heads, convinced us of the inutility of going further in this direction. At 11 h. 20 m., we remounted and returned to Chah Hoon, where the Expedition arrived at 1.22 p.m. Boarded the steam launch at about 3 o'clock, and started for Rehpong where we arrived at half past eight the same evening. Rehpong is an important tin district, situated at the foot of a range of mountains two miles from the coast. It is inhabited by Chinese, of whom there is a goodly number.
Shops and roads are on the increase. The British India steamers call here regularly to trade, and, under the excellent administration of the Governor, Kaw Sim Kong, who is a just man in his dealings, and has a small but well organized body of soldiers and police, it bids fair to become a thriving province. There are two small hot springs near the town, and this part is entirely submerged by rushing torrents from the neighbouring mountains towards the close of the S.W. monsoon.

February 15th.—The remainder of the gentlemen of the expedition arrived from Langsuen. At 8.30 the same evening I took leave of our hospitable host, and started in an eight-oared boat for Muong Krà. The mornings were very foggy, and the days getting hotter. After a tedious passage, the boat grounding twice on the way up, I reached the British guard station, Naa Ling Chan, at 5.35 p.m., and remained the guest of Mr. R. Leslie (the active Superintendent of Police in these parts) for the night. On the following morning I reached the village of Krà at 9 o'clock, making thirty-seven hours on the passage including stoppage. The French party, with all their luggage and instruments, arrived a few minutes afterwards in the steam launch, having grounded on the way several times, and took up their quarters in tamneaps prepared for them by the head man of the place. In the evening I determined the latitude carefully by circummeridional altitudes of Sirius, and on the following morning solar observations were taken for the longitude by Commandant Bellion and myself, which agreed very closely. Throughout this day I noted with great care the atmospheric fluctuations, as we expected to leave on the morrow to examine the Krà Route, elephants having arrived from Chumphon for that purpose. Mr. Schlüssel also devoted the entire day to the same duty.

Muong Krà is a good sized village in an open place amongst the hills at the head of the Pakchan river. It appears to be of little importance, as the cultivated parts are limited, and produce only sufficient for the wants of the people. Tin also is scarce in this neighbourhood. Krà has, however, greatly improved within the last few years, under the able administration of His
Excellency Tam Kin Ching, his Siamese Majesty’s Consul in Singapore, and has now many more houses and inhabitants than formerly.

The expedition had now arrived at that point from which the engineers had to make their studies and investigations, viz., the survey and levelling of the Krà Route from this locality to Chumpon.

Subsequently a large tamneap was built, at the expense of the expedition, at Taa San (in Siamese means “eye of the jungle”), an oasis on that lonely route, and about one and a half miles east of Krà Pass. Provisions, instruments, &c., were in due time removed from Krà to this place, and here were the head quarters of the engineers, secretary, interpreter, servants, coolies, &c., during the time of Messrs. Bourgery’s and Delaplanche’s very laborious and skilful work.* It was arranged beforehand that Commandant Bellion, Mr. Schlüssel, and myself should leave the Taa San party behind, and go on to Bangkok to re-rate our chronometers and get a further supply of provisions, which was much needed.

Accordingly on February 18th, the whole party left Krà at 8 a.m. At 11.35 a.m. I reached the highest point of elevation, stopped my elephant and made careful readings of my aneroid on Krà Pass, then descended cautiously and arrived at Taa San at 12.11 a.m. I may state here that I took careful readings of my instrument every quarter of an hour, and stopped my elephant each time to do so. This part of the route begins to rise and fall abruptly after leaving Krà, and continues to wind and rise through dense jungles of thornless bamboos, with large trees, to the top of the pass. From thence to Taa San it is steep, serpentine, and undulating, with fewer bamboos. Klorg Hin Song, one of the sources of the Pakchan river, was lost near the west side of the pass, and one of the sources of the Tong Kaa river was first met with close on the east side of it. Stinging flies, called loomps, and leeches were plentiful on the way. The former attack the eyes and nostrils, which they seem

* The jungle was so dense, and the track so undulating and tortuous, that great difficulties were experienced by these gentlemen in levelling this route.
to have a preference for, drawing blood almost immediately. They are a great nuisance when the hands are occupied with books and instruments. The latter spring about in all directions, and finding their way through any small hole in your clothes begin to feed at once. Six or eight of these indulging at one time form a treat not easy to be forgotten. Taa San is the best resting place in the jungle part of this track. It is a ventilated, shady spot, with a clear stream (the Tong Kaa) sparkling close by. Tigers are plentiful about here. On one occasion Mr. Bourgery somewhat incautiously wandered up the bed of the stream, bent on geological discovery, late in the afternoon, and could not find his way back again; night set in rapidly, as it always does in these dense jungles, and the loud roar of a tiger was heard close to him. After covering himself over with anything he found handiest, he remained quietly until day light relieved him from his terrible anxiety.

February 20th. After taking leave of our companions, I, along with Commandant Bellion, Mr. Schlüssel, and interpreter (Nai Soot) started at 6.52 a.m. for Chumpon and Bangkok. From the time of leaving I took careful aneroid readings every quarter of an hour, and compass bearings of each bend in the track; they numbered sixty-six to the Sala at the entrance of the jungle. This part of the track was uneven and tortuous in a high degree, and with the exception of three small openings on the way, was nothing but a compact assembly of various sized trees, through which, judging by their moss covered stems, and the musty atmosphere, I should think the wind never passed. We cleared this hilly jungle district, and reached the Sala at its entrance in the open at 12.43, this made five hours and twenty minutes without counting stoppages. The Tong Kaa was crossed several times on the journey to this point. After leaving the Sala we made rather an indirect course along open country, passing through patches of jungle, gardens, and paddy fields, until at length we arrived on the right bank of the Chumpon river, opposite the house of the Palat, or second Governor, at 3.35 p.m., making in all eight hours and twelve minutes on actual march. Here we left our elephants, and
tides, by a properly constructed gauge conveniently situated near the west end of the base, which duty he performed very carefully. Finally, on the 24th March, the work was completed on a large scale, not however without considerable delay, owing to the obscurcation of objects by smoke. The small steam launch of the Expedition did good service, as also did the Volant. We then took solar observations for our chronometers and started for Chumphon, where we requested the Palat to give us a shake down for the night, which he did, and treated us very hospitably into the bargain. The same day we had an interview with H.E. the Governor, who appeared to be somewhat thick headed, and arrangements were made with him for a supply of elephants to carry out the remaining work of the Expedition. On the following morning Commandant Bellion’s party set out early for Taa San, and the next day I followed them to the same place, where the entire Expedition was assembled. They all seemed in good spirits, and were looking forward to the time when their labours would be completed, especially, I thought, did those excellent engineers, Messrs. Bourgery and Delaplanché, who were having a hard time of it. These gentlemen it appears worked from opposite directions, and meeting at Krà Pass with their levelling instruments, determined its height independently of each other to the nearest millimetre! This they told me was 250 feet, which exactly corresponded with the measurement I made with my aneroid. Mr. Delaplanché congratulated me on the performance of my instrument, and spoke of its great value, and said that in future he would always carry a good one with him. I gave him the name of Negretti and Zambra of London, whom I believe to be the best makers of these very useful instruments. I frequently measured from platforms in trees exceeding a hundred feet in height to the ground with aneroids of this maker’s construction, and have seldom found more than two or three inches of difference between the elevation shewn by the aneroid and the actual height as measured with a tape line. Heavy showers of rain had fallen at Taa San a few days before we arrived. We experienced none at Chumphon, although there were unmistake-
able signs of a coming change in the western sky; the weather was exceedingly hot at this time.

After remaining one night with our friends, we left them to continue their work, while we pushed on to Rehnong, to commence a survey of the entrance to Pakchan river. We met rain on the way, and, of course, the loonps had a good swearing from us before we reached Krà, where we had all arrived before 11 a.m. Here we found a steam launch and boat in waiting for us, belonging to H.S.M.’s gunboat Apollo. The day looked dark and squally. Boats being obtained from Luong Pen, the head man of the place, the Commandant, with his small party and luggage, started off in the evening during a heavy shower of rain for the British police station at Naa Ling Chan, where they remained all night, and continuing their journey the following morning in the steam launch, arrived at Rehnong the same day.

I remained behind, as the accommodation was very limited. On the following day, March 29th, I took solar observations for my chronometer; they were obtained, however, with difficulty, as the weather was dark and cloudy, and according to the reports of the people here, the rainy season had set in.

The following day I started, in a leaky boat, during heavy rain in the afternoon. Called at the police station for an hour to give the boatmen rest and food, and again started pulling down the Pakchan. About 9 p.m. I met the steam launch returning for me, to which I made my boat fast, and grounding once on the way down, reached the Apollo at daylight, where I found my worthy colleagues had been most kindly received by Koon Tuan (a son of His Excellency The Kalahome Prime Minister of Siam), the commander of the gunboat. I may remark here that His Majesty the King generously sent the Apollo (a new paddle yacht of the late ex-Regent) to enable the Expedition to make the survey of the Pakchan river.

In the course of the day we arranged plans for carrying out the survey of the entrance to the Pakchan as expeditiously as possible, and had scarcely commenced our work when an urgent letter was received from the jungle announcing
Mr. Delaplanche to be dangerously ill of fever, and requesting immediate assistance.

The steam launch, with Mr. Schlüssel, was dispatched to Krà at once to render help and bring the sick gentleman back as soon as possible. The gunboat, which had been moored for our operations, was unmoored again, and preparations were made for a start to Penang on the arrival of the remainder of the Expedition from the jungle. Nothing was lost by this act of consideration, the monsoon had evidently commenced, (which was confirmed by the knowledge of H.E. the Governor, many years resident in this place), for every day until we reached Penang heavy squalls, accompanied with thunder, lightning and rain, were experienced. While waiting for the return of the launch, I fixed in front of the Governor's house a large cylinder axis sundial (an invention made in Siam and patronized by His Majesty) from which the true and mean time could be found year after year in the simplest manner. This seemed to gratify His Excellency very much.

About three days after the launch left, the whole of the party from the jungle returned by her to the Apollo. Steam was got up at a convenient time afterwards. His Excellency rowed on board in his fine boat, and after he had taken a friendly farewell of his guests, the Apollo got under weigh at 3 p.m. and steamed through the south channel for Puket, Junksylon, where we arrived the following evening after a stormy passage. Junksylon is an island well known for its richness in tin mines. It belongs to the kingdom of Siam.

April 7th. Provisions having been taken on board, the Apollo again got under weigh, and after twenty-one hours' steaming was anchored, true sailor fashion, in Penang Harbour by her young commander, who seems to have made good use of his time during his studies in the Naval College and subsequent service on board the ironclads of the British Navy.

When the arrival of the Expedition was made known, Mr. Neubronner (the amiable and zealous Siamese Consul at this port) shewed the utmost attention to the members of the Expedition, and saw them comfortably installed in the beach
house of His Excellency the Governor of Rehnong, who had requested us to use it during our stay at Penang. A doctor was immediately sent for by Commandant Bellion, to attend poor Mr. Delaplanche, who was somewhat better than when he arrived on board from the jungle.

Here the party rested in pleasure and plenty for a few days, enjoying an agreeable change from wild to civilized life. On the evening of the 10th invitations were accepted for an entertainment given by the hospitable Siamese Consul and his lady in honour of the Expedition, and late the following day we were on our way to Singapore in the fine steamer _M. Meanatchy_, belonging to Katz Bros. After thirty-eight hours' steaming, including a few hours stoppage near the Rabbit and Coney Lighthouse, we arrived at the Borneo Company's wharf in New Harbor. An hour afterwards we were all comfortably settled in that well regulated and respectable institution the Hotel de l'Europe, under the energetic and obliging proprietor, Mr. W. H. Siegfried. Here the Expedition remained a few days, preparing for their homeward journey. Mr. Delaplanche, I am glad to say, was recovering from his malady, and all looked forward with pleasure for a speedy return to their beloved France. Passage tickets for the crowded French mail steamer _Sinâh_ were obtained with difficulty. This, however, was managed through the kind offices of M. E. Meyer, the French Consul, and on the 17th of April we took a parting bumper together on board the steamer in New Harbor. After wishing my friends a hearty good-bye,—they were as good a set of fellows as any one could wish to travel with,—I took the first steamer and returned to dear old Bangkok, the capital of the rising kingdom of the White Elephant.

Having finished my journal, I shall now proceed to explain more particularly those parts examined by the Expedition which are paramount in importance to the subject in hand.

* **Chumphon Bay** is small, and extends three and three quarter miles north of the river of that name, which is situated in its S.W.

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* Chumphon bay and river are called Tsoompeon by Captains Fraser and Forlong, and by Dr. Oldham.
angle. It is quite open, and the strong E.N.E. winds which prevail in the height of the N.E. monsoon blow dead in on its western shore. The bay is shoal, and has silted up very considerably since I surveyed it in 1872. At that time there were about two and a half feet in the narrow channel at the entrance of the river, now it can be waded over at low water, and trading boats have to mark the channel with branches of trees every time they come in and out at high water. At low water spring tides the sand and mud bank dries a good mile from the west side, and the three fathom line is about one and three-quarter miles out. The silting process is gradually going on, owing principally to the freshets from the two rivers in the bay at the end of the rainy season being directly opposed by the constant easterly winds which prevail here during both monsoons. The tides also are too weak to remove the sedimentary matter kept in suspension by these opposing forces, and it appears to me that its being blocked up altogether is only a question of time.

The extreme rise and fall of tide is nearly four feet. A small coral patch lies about a mile from the north shore in a S.E. direction. At the entrance of the river there is a small village, and a wood station for supplying the Government steamers. I may here remark that when I surveyed this locality, I scaled an elevated rocky islet (Koh Teluh) some miles from the coast, and from its summit the distant high land to the westward continued in one unbroken but varied outline as far as the eye could see. Between this range and the coast line, mountains and hills of every form and altitude appeared in grand confusion.

Chumphon River tapers from its mouth upwards, and is about 250 feet wide at the City of Chumphon, where the banks rise twenty-two feet above the bed. The course of the river is very serpentine, one of the bends being nearly a circle. The distance from Paknam to Chumphon by the river is from nine and a half to ten miles. The river is very shoal, full of sand banks and sunken trees from landslips, which are frequent. In the dry season at low water, native boats constantly ground on the sand banks and get capsized on hidden obstructions, of
which there are a goodly number. The mouth is all mangrove, cultivation begins about half-way up. On the left bank, up a small branch of the river, a short distance from Paknam, there is a small town (Chinese) called Taa Yang, where fish, vegetables, and a few odds and ends can be purchased. The course of this river from Chumpon wends to the northward amongst the high land in that direction.

Elephant Track between Chumpon and Langsuen leads mostly through small jungle with villages and cultivated parts between hills scattered in every direction. Several small streams run to the sea across the track. The largest of these are the Tongkaa, Sawe, and Taako rivers, over which elephants can barely pass without taking off their howdahs in the dry season. The track, except where paddy fields are, is serpentine and undulating, and follows the coast line a few miles off. A branch track also extends from Ban Naa Po to Langsuen. On the whole it may be considered a good track.

Langsuen River has already been partly described; I will only add that its bed rises with remarkable regularity along its entire course, from the sea to Ban Song, and that large volumes of water are discharged from it at the close of the rainy season. On one occasion during my survey of the coast, I filled all the tanks on board the gunboat Warlike with fresh water from the sea alongside, nearly two miles off the mouth of the river. Landslips are frequent as they are in all the rivers of this country.

Channels at the entrance of Pakchan River are difficult. The actual mouth of the river is between Victoria Point and the main land opposite, where it is two miles wide. The natural passage to its mouth has, undoubtedly, been in former times between Saddle and Delisle Islands and the coast opposite. This part is now almost choked up, and only fit for the use of trading boats. The deepest water is close to the islands. One mile south of Victoria Point, a chain of islands, rocks, and islets extends in a direct line S.S.W., and exactly parallel with the coast. The chain is eighteen miles in length, beginning and ending at Victoria and Delisle Islands respectively. The
sedimentary waters from the Pakchan river run with great force through the small channels of this barrier chain in the south west monsoon, and being checked by the westerly winds which prevail in this locality during that season, have not only filled the narrow passages with deposit, but raised an extensive bar of sand and mud immediately before their western entrances.

In this locality of sunken rocks and sand banks, are now the existing channels, used by small sized trading steamers visiting Rehnong and Malliwan; there are two of these, viz:—

The North Channel is between Victoria Point and Victoria Island, and the course leads between South Island and a large patch of foul ground composed of sunken rocks and sand banks lying immediately off, but close to its south side. This channel is very narrow and dangerous, and is fit only for the navigation of very small steamers in fine weather by daylight; no sailing vessel would ever attempt it.

The South Channel runs close to the north shore of Saddle Island, and between Harry Head and Spiteful Rock. Sand banks awash, and above water, form the northern boundary of this passage. From Spiteful Rock, three miles in a W.S.W. direction, runs the point of the extensive bank I spoke of as fronting the west side of the islands. The passage between Spiteful Rock and Harry Head, is barely half a mile wide, and has five fathoms in the middle of it. This is the best channel to enter the Pakchan river by, but, however well lighted and marked, it can only be considered fairly safe for small sized steamers in fair weather. Like the North Channel it is intricate, and has a sharp bend in the course between Spiteful Rock and Harry Head. An accident happening to the steering gear of a large steamer at this point in bad weather, would most likely result in the loss of the vessel. Looking at the matter from an impartial point of view, my conviction is that the South Channel is highly dangerous for the navigation of mail, or other large steamers during the thick stormy weather too frequently experienced in the S.W. monsoon.

Pakchan River has been described by Captains Fraser and Forlong in their report which will be found in the appendix,
I will however venture a few more remarks to make the subject in hand understood. The Pakchan, in my opinion, is an arm of the sea as far as the islands off the entrance of Malliwan river. The upper portion with its many affluents, as far as the conflux of its sources at Krà, has more the natural characteristics of a river than anything else, and should, I think, be considered as such. The longest affluents are those of Malliwan, Chah Hoon, and Klong Nam Noi. These streams annually deposit large quantities of sedimentary matter from the neighbouring mountainous country into the main river, blocking it up with obstructions, whilst the residue is swept seaward. The distance from Victoria Point to Krà, is thirty-nine miles; and from Spiteful Rock to Krà, forty-nine and a half miles by the bends. The river is straight from Victoria Point, and carries its width of two miles a short distance from Leslic Well, twenty-three miles from its mouth. From this point the river narrows abruptly, and becomes very serpentine as Krà is approached; there, it is nearly 300 feet wide. One of the bends near Klong Nam Noi is almost a circle. Brackish water in the dry season extends above Krà, and the Attap palm grows profusely on both sides, from Klong Kumaoan Lek to Fresh-water river. Klong Kah Yam is the boundary of Rehnong and Muong Krà.*

Navigation.—The soundings from the entrance to a short distance above the Malliwan river are very irregular, and the narrow channels amongst the cluster of islands off its mouth intricate. Vessels of twenty-two feet draught, with careful pilotage and an efficiently marked channel, could probably reach as far as Klong Kumaonyie, but no further. From this point the river is shoal, full of obstructions, and navigable only for trading boats.

The Kra Route passes through a perfect conglomerate of hills of irregular altitude, and is not only exceedingly serpentine

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* Victoria Island is regarded by the Siamese in Rehnong as their property, by right of its geographical position in relation to the adjacent islands belonging to Siam. The island in question is separated from British Territory by a deep channel one mile wide. On the other hand it is the head of the Siamese chain of islands to the south, and connected with the northernmost by a sandy reef.
and undulating in itself, but makes a deep southerly bend at the pass; from which point it tends in an E.N.E. direction for about five miles as the crow flies. It then runs due east to the end of the hilly district and the beginning of the open country. It must be understood that the elephant track on this route does not pass over the tops of the hills, but through the valleys between them. It is therefore obvious, if a canal were excavated in this direction, it would have a very objectionable kink in it, and a greater bulk of material would have to be removed if the route were aligned. As already mentioned, the top of the pass is 250 feet above the level of the sea.

**Distances.**—From *tamneap* at Krà to end of hilly district, by the elephant route, twenty statute miles. From Krà *tamneap* to observation tree near the Governor’s house at Chumphon, as the crow flies, 20.7 statute miles. The direction S. 87° 03’ E. From Krà *tamneap* to the late Ex-Regent’s house at Paknam Chumphon, as the crow flies, 27.5 statute miles, and direction S. 80° 57’ E. A healthy elephant will travel from Krà to Chumphon at its natural pace in twelve hours.

**Geological Formation.**—The ground through which the projected canal would require to be cut is chiefly of hard rock. Captains Fraser and Forlong state that the rocks across the pass are mostly of a quartzose sandstone. Dr. Oldham, the distinguished geologist, who examined this district in order to report on the Tenasserim coal fields, stated that the rocks through which the proposed canal would require to be cut belong to what he calls the “Mergui series.” These appear to be tolerably simple geologically; indeed, the structure of the whole of Tenasserim appears to be such; notwithstanding, they are anything but easy of being cut through. The “Series” is said to consist of highly metamorphose rocks, resting on granite, and exhibiting every variety from perfect gneiss and mica slate to hard silicious slates occasionally chloritic, and to black and earthy but micaceous and glassy slates. Numerous veins of granite of all sizes penetrate and ramify in every direction through these, which are only seen near to the immediate junction of the granite and the bedded rocks. Where this junc-
tion is not absolutely traceable, the close proximity of similar veins is almost certain. In the southern portion of the Tenasserim division, just where in all likelihood the projected canal will be cut, there occurs, he states, a great accumulation of beds of a pseudo-porphyritic rock, resting on the granite and metamorphosed beds. Imbedded crystalline fragments of felspar, which weather out freely or become whitened on exposure, give the aspect of porphyry, from which their name is derived. In their normal character these beds, though highly indurated, are earthy, with the small irregular bits of felspar disseminated in them. They pass, by insensible gradations, on the one hand, into hard, earthy, slaty masses with their disseminated particles; and, on the other, into grits containing many rounded fragments of quartz, quartzite, and these pseudo-porphyritic rocks themselves. The grits often become very coarse and largely conglomeritic; and the intercalcation and irregular succession of these varied deposits renders the bending of the series traceable. But the rocks have been subjected to very great disturbances, and are found dipping in every direction and at all angles. The higher grounds of the outer ranges in the southern parts of the division, as distinct from the central range of mountains dividing the British territory from Siam, are made up of these rocks, which, however, are feebly represented in the northern portion.

PHYSICAL CHARACTERISTICS OF THE COUNTRY.—These have been pretty fully described already, and a general view of them will be afterwards seen in my letter to Commandant Bellion. The description given by Dr. Oldham tallies exactly with my own. The Eastern boundary, he states, which separates the British territory from the dominions of Siam, is but little known, and is, for the greater portion of its extent, formed by an uninterrupted range of mountains which, in parts, rise to peaks of between 7,000 and 8,000 feet elevation, but the average height of which does not exceed 4,000 to 5,000 feet in the northern parts of the division (Tenasserim), diminishing to 3,000 feet and even less in the more southerly districts. The main direction of the range is north and south, and the direction of the coast line corresponds with this for the upper part of the country, but
trends gradually away to the east in passing southwards. The prevailing direction of the main ranges of hills, and consequently of the rivers, is also meridional. Through and across the line of the outer ridge, the general drainage of the country is discharged by a series of gorges or narrow rocky channels, through which the main rivers pass. All these gorges have a common direction, nearly east and west, although the general drainage of the country, and the course of the main streams, is almost invariably north and south. The rivers that will have to be chiefly dealt with are the Pakchan, on the British side, and the Tseompyoon,* on that of the Siamese. The latter rises a little above the village of Tasan, at the foot of a low range of hills; the Pakchan has its sources in the angle formed by the main range and an offshoot of lofty hills which form the water-parting between the Maleewoon and Lengya tracts. For the first fifteen miles of its course, the Pakchan is an ordinary mountain torrent, but as it receives the drainage brought down by numerous affluents from the hills which bound its valley, it gradually broadens, till at Krà it is 250 feet wide. Seven miles lower down, the Namoy stream joins it, and then it widens to nearly 400 feet. From this place it increases in width as it nears the sea, till, at its mouth, it is two and a quarter miles from shore to shore. Its appearance for the last ten miles, from where the Maleewoon river joins it, is more like an inlet of the sea than anything else. From its source to Krà is thirty miles, and the direction followed is south-west. From Krà to its junction with Namoy, its course is tortuous, along the base of hills which descend to its northerly bank in four or five different slopes. But, from where the waters of the Namoy are received, it flows in an almost straight direction to Victoria Point, the cape which has to be rounded by the voyager to the Malliwan tin-mining districts. In the dry season the bed of the stream above Krà is almost dry, and below this, as the tide runs out, flats and sand-banks appear, leaving at last a small channel, thirty feet wide and some three feet deep. Below the mouth of the

* Now called the Chumpon.
Namoy, when the tide falls, a ridge of rocks appears, almost across the river, leaving a narrow channel, through which the river runs with considerable velocity. The Pakchan is, however, navigable by steamers from the junction of the Malliwan to Victoria Point. In the dry season, the tide is felt ten miles above Krà, where its rise and fall is eight feet. From Krà, eastward, the country is covered with forests of bamboos and trees, and is very rugged, till the water shed, a small grassy plain, is reached, some eight miles above Krà. The river Krà runs west from this place, and joins the Pakchan at Krà, while the Bankren, a quarter of a mile farther on, flows eastward, joining the river Tsoompeon at Tasan, and then flows into the Gulf of Siam. At the twenty-second mile from Krà the hills end, and the country becomes a fine open campaign. At the thirtieth mile is the town of Tsoompeon, on the river of that name. The distance from this place to the sea is about twenty-one miles, the rise and fall of the tide being six feet.

Mean Height of Hilly District on the Krà Route.—The highest level of the pass is, as I have stated, 250 feet above the level of the sea. The mean level, however, of the hilly district, which is twenty miles in length, is 130 feet. Increase this by thirty feet for the depth of the canal and we have 160 feet. Now, assuming a transverse section, 191 feet at top, 77 feet at bottom, and 160 feet high, with only an angle of 20° slope from the perpendicular, and we shall have in round numbers eighty-four millions* of cubic yards of mountain land, 75 or 80 per cent. of which is hard stone! When could such an enormous bulk of material be cut through, and where could it be deposited? Certainly not on either side of the excavation. A portion might be deposited at the Krà end, but the greater bulk of it would have to be run out into the paddy land to the eastward. Considering that the dimensions of the section I have given are probably smaller than would be adopted if such an ill advised scheme were attempted. It appears to me from this, and from what I have seen, that there is as much chance of its ever being accomplished as there is of reaching the moon in four days.

* The exact quantity is 83,854,222 cubic yards as mentioned on the Section.
LATITUDES AND LONGITUDES.—The following positions I have determined with care:

Wat Chang, Bangkok.—Lat. 13° 45' 12" N. Lon. 100° 28' 45" E.
Regent’s House, Paknam Chumpon.—Lat. 10° 27' 15" N. Long. 99° 15' 02" E.
Langsuen, New Town.—Lat. 9° 58' 10" N. Long. 99° 4' 56" E.
Ban Song, Province Langsuen.—Lat. 9° 43' 32" N. Long. 98° 39' 15" E.
Raat Koot, Province Rehnong.—Lat. 9° 43' 49" N. Long. 98° 33' 10" E.
Rehnong, Governor’s House.—Lat. 9° 56' 52" N. Long. 98° 36' 40" E.
Krà Tamneap, near Old Fort.—Lat. 10° 31' 01" N. Long. 98° 51' 02" E.

Let us now see what works would most probably have to be performed to carry out the canal scheme in its entirety.

1st.—The prodigious work of cutting the canal, and the removal of the excavations, a question of enormous time and money.

2nd.—The alignment and deepening of the Pakchan river, from Klong Kumaon to Krà, another prodigious undertaking, not to mention the continuous labour and expense of keeping the channel free, as the river would constantly be filling up with deposits from the affluents.

3rd.—The construction of a strong breakwater from Spiteful rock, which in itself would be no trifle.

4th.—The dredging of a channel through the shoal part of the Bay of Chumpon, with breakwaters on each side to prevent silting.

5th.—The erection of lighthouses, landmarks, and beacons, and lastly a pilot vessel at the Bengal entrance, if not another in the Gulf of Siam.

From what has been stated it will readily be perceived that the cost of such an undertaking would inevitably be enormous. We will now see what distance would be saved by the proposed “cut off,”—
1st.—The difference in nautical miles between the proposed Krà route and the present Malacca Straits route, for English mail and other steamers passing through the Suez Canal and bound to China, is 256 miles; this measurement has been carefully made from a point off Dunda head, south coast of Ceylon, to a converging point in the China sea, from which all steamers by either route would have to steer the same course to Hongkong.

2nd.—The difference in distance between the aforesaid routes for the French mail steamers calling in at Saigon and bound to China is 383 miles, measuring from the same position off Dunda head.

3rd.—The difference between the aforementioned routes for steamers bound from Calcutta to Hongkong is 471 miles.

4th.—The difference between the aforesaid routes for steamers from Madras to China is 381 miles. From this it is evident that no saving in time could be effected, as from one to two days' detention would surely be incurred in the canal before a steamer could pass from one sea to the other. Independent of this, there is risky navigation to be encountered, with heavy canal expenses, pilotage, and light dues into the bargain.

In addition to all this, it is more than probable that marine insurance companies would raise their premiums in proportion to the extra risks steamers would run in taking the Krà route. Sailing vessels could never attempt this passage if it was opened, for besides the ordinary heavy expenses, they would have to pay for seventy-three miles of towage—the distance in nautical miles from Spiteful rock to Chumphon bay. This at the present rate of low freights would scarcely leave enough to pay wages. It should not be forgotten also that every year produces new and faster steamers. Indeed, looking at the proposed canal scheme from a mercantile point, I fail to see how it could answer any useful or profitable purpose; on the contrary, my conviction is that it would be ruinous to all who had anything to do with it. A merchant in Singapore remarked, "Why, "instead of steamers paying to go through the canal, the canal "would have to pay steamers for using it." This remark would
appear appropriate at the present time, for since that far-sighted
nobleman, Sir Stamford Raffles, built the first bungalow on
Government Hill in 1823, the Free Port of Singapore has
rapidly grown to the highest commercial importance with the
neighbouring countries, both far and near, and is now the most
active trade emporium on the ocean highway between Europe
and China, with every prospect of increasing its greatness as
the trade of Borneo and the adjacent islands becomes developed.

Here is the nucleus for the produce of the Eastern Archi-
pelago, and vessels of every size and nation which pass through
the Straits of Malacca and Singapore, by dozens daily, load and
unload vast quantities of merchandise, which could not be
obtained at Krà; consequently it would be against the interest
of merchant vessels to take the Krà route.

The navigation of the Straits of Malacca and Singapore,
which in former times was considered somewhat dangerous
for sailing vessels, is now no longer so. Since the Horsburgh
lighthouse was built in 1850, and other marks have been
erected in various prominent situations through both Straits, the
navigation has been perfectly safe.

From the foregoing remarks it will be apparent, that in my
opinion the Isthmus of Krà as a means of transit from one sea
to the other would be utterly useless, either by canal or railway,
even if it were practicable to construct either; as no time would be
saved, and the heavy expenses on the route would be a dead loss.

The calculations of Captains Fraser and Forlong as to the
saving of time to be effected by the railway which they recom-
mend, are inapplicable to the present day, when the speed of
mail and other ocean-going steamers has been so much increased.
Their statements on this head are open to other objections, which
it is needless to specify, as they will readily occur to every
practical seaman, and indeed to all who give the subject their
earnest study.

My views on the whole subject were frankly stated to the
Commandant of the Expedition, immediately on our arrival at
Penang, in a letter, of which—with the exception of one or two
paragraphs relating to extraneous matters—the following is a
copy:—
Pulo Penang, April 8th, 1883.

To Lieut. Bellion,

In Charge of the Krà Expedition, &c., &c., &c.,

My dear Commandant,

As I have, at your request, accompanied the Krà Expedition throughout, and you wish for my private opinion on this subject, I have pleasure in giving the same, as frankly and unreservedly as you ask it.

Here then is my unbiassed conviction which I have formed from my experience and knowledge of the country, extending over a period of twenty-eight years, and from what I have seen during the late Expedition, I may safely state that from Singapore to the parallel of Bangkok Bar there is not any portion of the Malay Peninsula practicable for the excavation of a ship canal that would answer any profitable purpose.

I may say, that such a scheme is impossible, for it is well known that there is only one road and very few jungle tracks across the Peninsula.

The road I speak of extends from Singora to Quedah, and is very serpentine and undulating amongst the hills in the interior, where it reaches an elevation of 1,100 to 1,300 feet. It is scarcely worth the name of a road, but it is the best across the Peninsula. The jungle tracks are very narrow, and, whilst running in various directions, are exceedingly tortuous and undulating, sometimes in valleys, and by the slopes of hills, and in some parts over their tops, at elevations from 50 to 800 feet.

It is also well known that the whole of the Malay Peninsula is formed of mountain ranges running parallel to each other with detached mountains and hills of high altitude, forming a complete and intricate barrier on both seabords. I have seen and noticed the profile of the Malay Peninsula from elevated positions in the Gulf of Siam and Bay of Bengal, and nothing but an unbroken line of high land was discernable. No signs of a valley or opening in any direction.

The jungle track from Krà to Chumpon is the best, and is of lower elevation than any of the others, but at the same time
it possesses the same characteristics, in outline and natural features, as those in other parts of the Malay Peninsula, viz:—it is exceedingly tortuous and uneven.

My own observations prove this, and doubtless the engineers' plans will confirm it. No direct line or anything approaching to one exists amongst the innumerable and intricate cluster of hills through which the Krà Route wends its course, and although the elevation is but 250 feet, and probably the bed of the adjacent Klong thirty or forty feet lower, it presents such a gigantic mass of stone cutting, extending as it does two thirds of the distance across the Peninsula, that it would require the wealth of a nation and a century to accomplish.

Now for the next point in the proposed canal scheme—

Supposing a canal could be cut from Krà to Chumpon, it would avail nothing, as the upper half of the Pakchan river is both serpentine and narrow and blocked up with sand banks, and is suitable only for the navigation of steam launches and trading boats; even these frequently get aground in passing up and down.

Again, supposing all obstacles could be overcome to this point, and the entrance of the canal could be situated at some navigable position north of Melliwan, even then the scheme would be as insurmountable as before, for the intricate mass of lofty mountain chains in this neighbourhood would preclude all possibility of making a direct or indirect cut obliquely from any part of the left bank of the Pakchan river to any point on the jungle track east of Krà Pass. I think one glance of the country about here would convince the most sanguine of the impossibility of such an undertaking.

Now for the last point and not the least in importance—

We must again suppose the canal and Pakchan river practicable. There is still remaining another item of considerable difficulty to get over, viz:—the intricate channels at the entrance of the Pakchan.

These are two—one north and the other south of Victoria Island. The former channel is narrow and tortuous, studded with sunken rocks and shifting sand banks. The south channel
is better in this respect, and unquestionably the best of the two. The south passage is between two rocky points, half a mile wide, with sand banks on the larboard hand in entering, and a bar of sand and mud on the east side of Victoria Island with depths of two and a half and two and three quarters fathoms upon it. This channel is open and exposed to the full force of the S.W. monsoon, and although it might, if lighted and marked properly, be considered fairly safe for small sized steamers, it is unquestionably the reverse for vessels of large tonnage.

I have had considerable experience in navigating the eastern seas, and looking at this question from a purely seaman's point of view, I declare my opinion without hesitation, that it would be highly imprudent and dangerous for any mail steamer or large vessel to attempt this passage during the thick and heavy weather too frequently experienced on this coast in the S.W. monsoon.

Those who know this channel use it in day-light, and hold similar views to my own respecting its navigation.

In conclusion, I have pleasure in saying that I have never met with more amiable or competent gentlemen in a survey field before, and on my taking leave of you, I give you my best wishes for your future prosperity and happiness.

I remain,

My dear Commandant,

Yours sincerely,

ALFRED. J. LOFTUS.
Breadth 292 feet.

No. 1.
SECTION AT KRÄ PASS.

NOTE. The mean height of the levels by Anecdote, of the Mountlemour District on the Krä Route, is 120 feet above Low Water Level, and 160 feet from the Bed of the supposed Canal excavations. The total length of this portion of the Route is about 20 Statute Miles which is equal to (approximately) 10,000 square yards. Where next would this monstrous bulk of Rock and Soil be removed and deposited?

Scale of 200 Feet

Sketch shows relative size of Mail Steamer (beam 40 ft, draught 25 ft) and approximate section. Area of section 1,999 square yards.

No. 2.
SECTION AT KRÄ.
Landing Place.

No. 3.
SECTION AT EAST ENTRANCE OF JUNGLE
(West of Sala Sahmook)

Scale of 200 Feet
APPENDIX.

Report on a route from the mouth of the Pakchan to Kraw, and hence across the Isthmus of Kraw to the Gulf of Siam.

By Captain Alexander Fraser, Bengal Engineers, and Captain J. G. Forlong, Ex-Engineer, M. and T. Provinces.

From Captain A. Fraser, Bengal Engineers,


Tavoy, 26th April, 1863.

Sir,—I have the honor to forward to you the enclosed Report, with plans, &c., as per margin, of a journey made by Captain Forlong and myself up the Pakchan river, across the Isthmus of Kraw to the Gulf of Siam.

No one can be better aware than yourself of the good which would accrue to the Provinces of Pegu and Tenasserim, by the free importation of Chinese labour by the route recommended, and we therefore submit this Report to you. As, further, the matter involves other and far more important than local interests, we recommend that the Report be forwarded to the Government of India, as one worthy of immediate and attentive consideration, with such remarks as your complete knowledge of the general and local bearing of the subject may deem expedient.

We would beg to bring to your notice the great civility and kindness with which we were received by the Chief Civil Authority, Tacompa, in the Siamese Territory.

I have, &c.,

(Signed) A. FRASER,

Captain, Bengal Engineers.
1.—The steamer Nemesis, with Lieut. Colonel A. Fytche, Commissioner, M. and T. Provinces, on board, anchored about fifteen miles up the River Pakchan in five or six fathoms of water. Banks, steep and densely wooded, with a stream running between them of (here) about a mile in breadth.

2.—Opening into the Mergui Archipelago, opposite the south end of St. Matthew's Island, there are some six fathoms of water, at low water, over the bar at the mouth, though vessels coming from the north, inside the island, have to run some little way southerly to avoid an extensive spit of sand, which runs partly across the entrance to the river.

3.—On the north side, the right or British bank of the stream, are the tin mines of Maleeoon, which are, we believe, workable to any extent, to which money and labour are procurable. On the other side are the tin mines of Rahnong, worked by the Siamese Government.

4.—Collecting, on the evening of the 31st March, all the instruments necessary for a rough survey, a perambulator, compasses, and aneroid, we left the steamer in a native boat with a flood tide, and proceeded up this river which forms the boundary between the British Possessions in these provinces, and the Siamese territories. A fog came on, and we were obliged to anchor for some time. We arrived, however, at Kraw by 4 p.m. of the 1st April.

5.—Kraw is a Shan village of some fifty houses, with a few Chinese inhabitants. The Civil authority was absent attending his superior at Tsoompeon, the chief place of the district, and where a Woontack, a functionary equal in authority to our Deputy Commissioner, resided.

6.—At Kraw we rested the night in a good zayat, which had been prepared for the aforesaid Chief Civil Authority, who visits periodically his district on this (the western) side of His Majesty of Bangkok's southern dominions. We had some difficulty in procuring means of locomotion in consequence of there being no one to give orders upon our wishes, but just as we were starting the next morning (2nd April,) with some four or five coolies we had managed to procure, an elephant made its appearance, and
we were enabled to proceed a little more comfortably than we had anticipated.

7.—We commenced, on the 2nd April, a route survey across a country which we believe is quite unknown to, and has never been traversed by, Europeans. There is a good level cleared road for the first two miles, and to the third mile it rises and passes along the right bank of the Kraw river. The forest on each side contained bamboos and trees, as mentioned in the plan. Up to a little short of the eight miles, the road follows the course of the Kraw river, and is difficult; we had to wade for a mile through the stream, which was not, however, more than ankle deep, but falling every now and then over rocks, with banks about twenty or thirty feet high, and forty feet apart. At this time the rain commenced and fell with little intermission till we returned to Kraw.

8.—At the eighth mile we arrived at the water shed of the country, a small grassy plain. The Kraw river runs hence west to join the Pakchan at Kraw; and a quarter of a mile further on, a river, called the Bankren, joining the Tsoompeon at Tasan (one and a half miles) flows to the Gulf of Siam on the east.

9.—At Tasan is another zayat, similar to that at Kraw, with a few houses and dry cultivation. We continued to cross and re-cross the Tsoompeon river to the tenth mile.

At fifteen and a half miles after crossing tributaries of small breadth, but with steep banks, we got again to the Tsoompeon, where it was some 200 feet wide, but of little depth. The jungle remained of the same character, and the nature of the country, as the path descended to plains passing through low but steep hills, was very similar to that in the ascent from Kraw to Tasan.

10. — At seventeen and a half miles we got to Apay, another zayat, and were glad to rest for the night, for, in addition to the walking over very rough ground and for miles through the rivers, wet through, the rain had brought out the leeches, which attacked us most unmercifully. The first indication of their attacks was finding our trowsers covered with blood; our last resource was to tie the trowsers round the ankles so as to
prevent them getting inside, but even then, unless some one was looking after us while engaged in taking angles or reading the perambulator, if we stood still for any time we found them lodge in our necks. The amount of blood these creatures take from one, before coming aware of it, is really exhausting, and it is therefore desirable to warn others.

11.—The night was fine, the rain was reserved till daylight for our special benefit; crossed a tolerably sized (eighty feet) river just beyond Apay, and another at the twentieth mile, a tributary of the Tsoompeon. We came to the end of the hills at the twenty-second mile, and entered upon a fine open country, with patches of jungle and garden and paddy lands, capable of any amount of cultivation. At the twenty-second mile the hills stretched away to the southward, and seemed to run east, parallel with our course, about a mile and a half to the northward, and, as we fancied, along the left bank of the Tsoompeon river.

At the twenty-third and twenty-fifth miles, crossed another river of 120 feet in breadth, the margin of which was much cultivated, and we continued along (about half a mile from) the left bank of the river, which seems to be the Pahklong joining the Tsoompeon near its mouth, to the twenty-ninth mile, after which at a distance of thirty miles from Kraw, we crossed the Tsoompeon where it is about 200 feet broad, and arrived at the residence of the chief civil authority of this district, who received us most kindly, at about noon of the 3rd April.

12.—Tsoompeon is a large place of some four or five hundred houses, with a water communication of twenty miles with the Gulf of Siam. We thought of continuing our journey down the stream the same day, but the heavy rain that fell was even more persuasive than the kind and polite old governor, who, as soon as we had made up our minds to remain till next morning, placed everything that weary travellers could require at our disposal, and ordered boats to be in readiness for us at 2 a.m., 4th April, when the ebb made. There is a rise and fall of tide here of about six feet.
13.—Started at 2 a.m. of the 4th April, and proceeded down a very winding stream to the mouth of the river opening in the Gulf of Siam, where we arrived at 5.30 a.m., or in about three and a half hours, having the tide with us. Here we landed, and found a fine villa, in some disrepair; this was said to be the King’s residence when he came to this part of his dominions. His steamers were said to come in two days from Bangkok, and fuel (billets of wood) in quantities (about 20,000 pieces) was collected. There was a schooner of about 150 tons lying off the shore, about fifty yards distance, in five fathoms of water, but there is a bar, above where the schooner lay, across the mouth of the river Tsoompeon, with only one and a half fathoms over it at low water. There would be no difficulty in making roads from Tsoompeon to this place. We found storehouses here with a couple of 32-pr. carronades belonging, we supposed, to the King’s steamers, though we asked no questions about them. From the general appearance of the buildings, &c., we think it is a place not open to severe storms or heavy sea. This is confirmed by an extract from Commander Richard’s “Gulf of Siam,” taken from the Bangkok Calendar, stating that “heavy gales are unknown in the gulf.” With a view of establishing a communication across the Isthmus of Kraw, it would be necessary accurately to determine several points which would render such communication practicable with reference to the Gulf of Siam, as we had ascertained in regard to our own side; this, the time and commissariat at our disposal, prevented us doing satisfactorily, and we did not wish to exhibit a curiosity by asking too many questions which might have proved offensive to a friendly power. We made the distance from Tsoompeon to the sea shore twenty-one miles, making the total distance from Kraw to the shore of the gulf about fifty miles.

14.—At 7.30 a.m., 4th April, we returned to Tsoompeon, surveying the river roughly. We passed Tayoung, about four miles from the mouth, a short distance up a creek, which here falls into the Tsoompeon; we were told that two vessels of some 200 tons were loading there. Tayoung is large, said to consist
of some 200 houses; we had not time to land, as we wished to get back to Apay this night.

15.—We arrived at Tsoompeon at 10.30 a.m., and after much civility, which we hereby acknowledge, from Payar Teet, the governor, who provided us with two more elephants, we started on our return through heavy rain. Slept at Apay this night (4th April). Got to Kraw the next day, 5th, at 4 p.m., passing through the streams, which had swollen a little from the heavy rain, the commencement of the monsoon. Went straight on board our boat, tested the correctness of the survey of the Pakchan (hereto annexed) said to have been executed by an officer of the Ganges steamer, which, some fifteen years ago, was employed in conveying Captain Durand on an expedition up this river to settle a boundary question. Anchored for the night; arrived next day at noon on board the Nemesis.

15A.—On the route from Kraw to Tsoompeon we were struck with a remarkable change of geological features. We had observed as we emerged on the plains of Tsoompeon, very marked looking abrupt hills which, being accustomed to such in the limestone islands of the Mergui Archipelago, we concluded were of the same group, but on closer examination they turned out to be sedimentary rocks of either the secondary or primary series—Captain Forlong inclines to think of the latter—and to be closely allied to the old red sandstone group; the dip was N.E. by N. We were unable to collect specimens worthy of being forwarded. All the islands of the gulf that we could see seemed of the same formation, worn into smooth rounded tops, but with perpendicular sides, some of the layers were as fine as thread, although generally half an inch thick, all abounded in pebbles, and what Captain Forlong believes to be minute fossils. The rocks across the pass were mostly a quartzose sandstone.

16.—It seemed, from our survey of the route, so manifest that a communication might be established with little comparative expense across this narrow neck of land, thus connecting the Bay of Bengal with the China sea by a route which would avoid the long, dangerous, and circuitous passage by the Straits of Malacca, that we thought it worth while to enter into a few
calculations by which might be shown in figures the comparative advantages of the two routes. The following is the result, one which, to our minds, makes a further examination of the Isthmus of Kraw worthy of immediate consideration by our government in communication with that of Siam as likely to prove of advantage to each, and of enormous value to commerce and the travelling world in general. It would relieve the commercial world to a great extent of the enormous steam charges which keep up the prices of the goods which form the staples of trade between England, India and China, and which render travelling almost prohibited, and it would open up a new and interesting country to the geologist and botanist, and introduce a hardy and hard working population (the Chinese) into provinces which contain mineral wealth in known and unknown quantities, wealth which merely requires labour to develop to any extent, and in search of which the Chinese even now find their weary way, but who would then come in large numbers, especially as the new treaty allows them to emigrate with their families. Much and valuable information regarding the great mineral wealth of these provinces may be found in some interesting papers by Colonel Tremenhere, Bengal Engineers, and Professors Helfer and Oldham.

17. The tables annexed I. II. and III. show the economy of fuel, establishment, and time, which would be arrived at by establishing easy communication across the Isthmus. A canal we consider out of the question. A railroad is not only quite practicable, but likely to cost less per mile than any other in India.
### Table of Great Sea Routes from Ceylon to China and Calcutta and vice versa.

<table>
<thead>
<tr>
<th>Routes, two steamers starting per month on all lines.</th>
<th>Distance in miles.</th>
<th>Saving.</th>
</tr>
</thead>
<tbody>
<tr>
<td>-----------------------------------------------------</td>
<td>-------------</td>
<td>--------</td>
</tr>
<tr>
<td>I. Ceylon via Singapore to Hongkong.</td>
<td>1570</td>
<td>...</td>
</tr>
<tr>
<td>I. Ceylon via Kraw to Hongkong.</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>I. Calcutta via Singapore to China.</td>
<td>1610</td>
<td>...</td>
</tr>
<tr>
<td>I. Calcutta via Akyab, Rangoon, Maullmein, Tayou, Mergui, and Kraw.</td>
<td>...</td>
<td>280</td>
</tr>
<tr>
<td>I. Calcutta via Akyab and Rangoon to Maullmein.</td>
<td>...</td>
<td>280</td>
</tr>
<tr>
<td>Total saving per month Rs.</td>
<td>41600</td>
<td>...</td>
</tr>
<tr>
<td>Ditto Annnum.</td>
<td>12</td>
<td>...</td>
</tr>
</tbody>
</table>

1st.—Table I. exhibits the cost of the present line of steamer per month, without taking into consideration the expense of idle vessels, or any incidental expenses whatever, merely the cost of fuel and establishment per trip, for running steamers, as kept up by the P. and O. Company from Ceylon via Singapore to Hongkong ... ... ... ... Rs. 39,700,0,0

Table II. the cost of ditto (kept up we believe by Messrs. Apcar & Co.,) direct from Calcutta to Hongkong via Singapore ... ... ... ... 40,200,0,0

Table III. the ditto kept up by C. & B. S. N. Company from Calcutta to Maullmein via Akyab and Rangoon ... ... ... ... 11,900,0,0

Total cost of present arrangement per month 91,800,0,0

2nd.—Table I. shows again the cost of a line running from Ceylon to Kraw and from Gulf of Siam (Tayoung) to Hongkong ... ... ... 32,900,0,0

Table II. the cost of a line from Calcutta via Akyab, Rangoon, Maullmein, Tayouy, Mergui and Siam and thence per China line to Hongkong ... 17,300,0,0

Total cost of two lines which would answer all the purposes of the present three lines ... 50,200,0,8
3rd.—The saving therefore which would be derived by commerce and the travelling world, by establishing a communication across the Isthmus of Kraw, (provided it be quick and efficient) by the mere calculation of saving of fuel and establishment of running steamers, will be represented by the sum of rupees (91,800—50,200=41,600) per mensem, or rupees 499,200 per annum, which sum at 5 per cent. would give a capital of 100 lakhs, or one million sterling.

4th.—The tables do not show, however, the vast further saving which would accrue, by running two lines of steamers instead of three in the Bay of Bengal, and one line instead of two on the China side of the Siamese and Malay Peninsula; the reduction of the number of steamers lying idle while not running, the concentration of coal depots, and many other incidental expenses which of course increase according to the number of lines running.

5th.—The tables again do not show what a vastly more profitable undertaking it would be to run one through line from Calcutta via Akyab and Rangoon to the Pakchan, and thence to China, instead of one with a terminus inland at Maulmein, getting no traffic as compared with that which would open up to the through line, and another line direct from Calcutta to China, only touching at the Straits Settlements.

6th.—The twelve millions trade (if positive, but which is probably only a transit trade) of Singapore, Malacca, and Penang, and fourteen and a half millions of Netherlands-India, could easily command a steamer of its own, to run alternately on either side of the Malayan Peninsula, communicating with Kraw, on the one side of the Bay of Bengal, and Tayong, on the Gulf of Siam, on the other, for China and Europe, as shown by dotted green line on the general sketch map. It may occur to some that the cost of this steamer should be deducted from the saving calculation in the third clause. We think not, but there is much more than sufficient for it; and we may place this cost against that of the other private steamers, between Calcutta and Hongkong via Singapore, not included in our calculations.
7th.—From Point de Galle to the five-fathom anchorage in the Pakchan River, and from Tayoung, in the Gulf of Siam, to Hongkong, Table I. shows to be 281 hours' steam (more or less does not matter for calculation, as the same rate of steaming is taken for all), while the route via Singapore is shown to be 337 hours' steam. We calculate, as hereafter shown, that the passage across the Isthmus of Kraw would not ordinarily occupy more than twelve hours, with a liberal allowance of time.

We have, therefore, a difference of time in favour of the Kraw route \((337 + 12) - (281 + 12) = 56\) hours. This is of much importance when we hold in view the costly nature of the produce and goods conveyed. It has also long been a desideratum to have a weekly communication with England, but the immense cost of putting on four steamers per month from Calcutta to Aden has hitherto, we suppose, deterred the P. & O. Company, as they would thereby obtain no extra trade.

But, supposing the communication through Kraw established, the extra trade that would be brought by the extension of the line of the P. & O. Company's vessels to Kraw would pay for an extra steamer between Point de Galle and Aden, by means of which—by making it meet the Bombay mail at Aden by bi-monthly steamers from Ceylon via Kraw—the communication between England and Calcutta would be weekly: twice per month by the P. & O. Company's line via Point de Galle and Madras, and twice by the vessels via Kraw to Calcutta, thus providing for the whole of the eastern coast of the Bay of Bengal, via Kraw, as the P. & O. Company's does for its western coast via Madras.

The time from Ceylon to Calcutta, via Kraw (by the direct steamer as hereafter mentioned), would be as follows:

- Ceylon to Kraw ... ... ... ... ... 126 hours.
- Kraw to Calcutta ... ... ... ... ... 102 "

Or nine and half days ... ... ... ... 228 hours.

Nearly as quick as the route via Madras.
8th.—By Table II., including three hours’ stoppage at Akyab, twelve at Rangoon, twelve at Maulmein, three at Tavoy (Mamogan), without going up the river, and three at Mergui (the trade of the two latter places being about five lakhs). The number of hours between Calcutta and Kraw by those places is shown to be \((143 + 33) = 176\), while the further progress to China from Tayoung would be about 153 hours, or with twelve hours across the Isthmus of Kraw, a total distance of \((143 + 33 + 12 + 153) = 341\) hours. The direct line of China steamers touching at Singapore would probably delay ordinarily six hours at Pinang and twelve hours at Singapore—this added to the distance gives 360 hours, making a difference in point of time in favour of the Kraw route, via Akyab, of nineteen hours, while the latter picks up all the trade.

The valuable goods (opium especially) and the mail from England might be sent by a single steamer, running twice a month to and from Calcutta to Kraw. The cost of this steamer is shown in Table IV., and the capital for construction of rail-road would be reduced to £700,000, much more than sufficient however. This arrangement of running a steamer direct to Kraw from Calcutta would beat the direct line to China, via Singapore, by ninety-three hours, as follows:

<table>
<thead>
<tr>
<th>Route</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>From Calcutta to Kraw</td>
<td>102</td>
</tr>
<tr>
<td>From Kraw to Tayoung</td>
<td>12</td>
</tr>
<tr>
<td>From Tayoung to Hongkong</td>
<td>153</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>267</strong></td>
</tr>
<tr>
<td>From Calcutta to Singapore</td>
<td>179</td>
</tr>
<tr>
<td>Stoppages</td>
<td>18</td>
</tr>
<tr>
<td>Hongkong</td>
<td>163</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>360</strong></td>
</tr>
</tbody>
</table>

and would give a regular weekly communication with Calcutta, as shown in last para., while the line running via Akyab gives to the eastern coast of the Bay of Bengal all the advantages of early communication with home, which its western
coast enjoys, via Madras. But the steamers via Akyab should not have to go up the Rangoon and Maulmein rivers, by which means another twelve hours would be saved, making a total saving, even after touching at all the four ports (for Mergui would probably be moved to the Pakchan), of \((19 + 3 + 12)\) 34 hours over the Singapore line. Elephant point and Amherst point should be the respective points of call for Rangoon and Maulmein, with telegraphic communication between those places and the capitals of Pegu, and the Martaban and Tenasserim provinces.

9th.—All the trade between Maulmein and the Straits, for which there is no better mode of carriage than junks and Kattoos, and all the tin found on both sides of the Pakchan, in the Linga river, and indeed all along the coast up to Yeb, and which only requires capital and labour to develop to any extent, would be picked up at Kraw; while the labour for the tin mines of the Pakchan, and possibly for the coal mines of Mergui, could be imported direct from China. All the one and a quarter millions of the Bangkok trade, and that of the Malayan Peninsula, on the eastern and western side, would be intercepted at Tayoung and Kraw, also all adjuncts, which none of the present lines of steamers obtain, but which would go far to make them pay.

Between Maulmein and Kraw, where the coast is profusely wooded, wood fuel might be used to increase profits, or decrease expenses, should it take any time to develop the trade carried on between Maulmein and Singapore. The cost of burning wood on this coast, as compared with that of coal, is as one to ten, taking the wood at ten rupees per 1,000 billets, and coal at twenty-five rupees four annas per ton, and assuming that 250 billets, four feet long by four inches diameter, equal one hour's steam or one ton of coal.

18.—It would answer no useful purpose, to go into all the figures necessary to establish even an approximate idea of the greater profit that would be assured to commerce and to Steam Companies, by adopting the new lines herein proposed instead of the present lines. It was only necessary to take three items, fuel, establishment, and time of actual running steamers, to
prove our position; and if we can show, that by the saving of the two first of these items, we can establish communication across the Isthmus of Kraw, which shall also beat all present lines in point of the third, and most valuable item, time, we think it unnecessary to examine into the contingent saving which, to any one who will give intelligent consideration to them, will manifestly appear enormous.

19.—In the third clause of the seventeenth para. we have shown the saving in fuel and establishment of running steamers to be five lakhs per annum, representing a capital of one million sterling.

Can the communication by Kraw be established within this sum? If so, all the contingent savings and gain in time go to the profit of trade, as well as any difference between the cost of the said communication and the keeping of it up.

Our consideration of the subject of the communication across the Isthmus of Kraw has brought us to the following conclusions:—

1st.—That there should be two or three tug steamers with long flat bottom boats, to carry goods and passengers from the five fathom anchorage of the large steamers twenty-six miles up the river Pakchan, as shown in the sketch map of the Isthmus by the dotted green line, in which distance the river is nowhere less than one fathom at dead low water spring tides. There is a rise and fall of eight feet. Time three hours towing.

2nd.—At this point (see plan), opposite Namoy river, a railway terminus and hotel, whence a railway will proceed (leaving Kraw to the north) by Tasan to Tsoompeon, on the shore of the Gulf of Siam, distance fifty miles, time three hours.

3rd.—Allow another six hours for discharging in the Pakchan, and loading at Tayoung on the Siam side (where there should be another railway terminus and hotel,) total time twelve hours, which is more than that required by the P. & Co. at Suez, on whose arrangements we will suggest further improvements.

4th.—There need be only a station in the centre of the line, where the rails should be double on either side, for the distance
of about one mile, to allow of trains passing, the remainder of
the line may be single as the Suez line.

5th.—The boats of eight or ten tons for the river service
should form the bodies of the carriages for the railroad service,
patent slips being formed at the Kraw terminus, and, if necessary,
also on the Gulf of Siam shore, up which the loaded boats may
be dragged on their own wheels, which could form the slip
cradles, and the boats could be tacked on to the engine, and
proceed to the other side without any delay. The arrangement
of the boats for goods and passengers is a matter of detail
easily managed. There is no reason why a carriage should not
be in the form of a boat, especially when time is saved in
loading, and expense in rolling stock. These boats would be at
the anchorage, ready for the steamers as they come in from the
mouth; when loaded, would be towed up to the railway
terminus, dragged up the slips, and taken off at once per rail to
Tayoung, where there should be a wharf for the China steamers
to lie alongside, if there be water enough; if not, the carriage
should be launched at once on to the sea, and sent to the
steamers.

Here it must be observed that provision is only made for the
boats to make one trip, so that twelve boats, which are said to
suffice in Clause 8 of this para., of eight to ten tons each, or a
little more than 100 tons inclusive, are to convey the passengers
and cargo of the mail steamer from Ceylon; ditto of the
Burmah line, from Calcutta; and of the direct steamer from
Calcutta, whose opium alone would exceed 200 tons, in one trip
from the steamer on one side of the Isthmus to the steamer on
the other. This will appear at once to be a most inefficient
arrangement; however, it serves to keep the expenses low,
which is all that is necessary to accomplish the object in view.

6th.—We would here observe again that our survey was
rough; that we merely passed along the native line (which is
well defined, but in many places in the beds of rivers), with
perambulator, compass, and aneroid; that our aneroid showed
no height above the sea of more than seventy-five feet; and that
our route presented no obstacle of engineering difficulty beyond
dips to nullahs, ordinarily twenty or thirty feet wide. A careful survey would be necessary.

7th.—We would, however, recommend very little masonry, though lime and fuel for bricks are in abundance; but the vast and inexhaustible forests, through which the line passes, are full of timber suitable for sleepers, for bridges, for stations and wharfs, and for fuel for the locomotives. All that would be required from England would be plant, permanent way, and rolling stock, the labour for the work being procurable from China, to any amount.

8th.—We will double what, in our own somewhat experienced minds, would be the cost of such a railroad across the Isthmus, and put down the amount at £5,000 per mile, including stations, wharfs, hotels, coal sheds, &c., &c., and rolling stock, for fifty miles of rail, £250,000. For the river service, three tug steamers, with all the advantages of disconnecting engines, towing with a single hawser, &c., which the Thames tugs possess, at £15,000 each, equal to ... ... £45,000

Twelve coal barges at £800 ... ... ... 9,600
Cost of railway, rolling stock, &c., fifty miles 250,000
Contingencies at 10 per cent., including
buoying river ... ... ... ... 27,000

£331,600

or say half of a million sterling. But there is the interest on a capital of one million of money, saved every year in fuel, and establishment of running steamers only: surely it must be worth while the expending such a capital in establishing this communication.

20.—We therefore think that, without reference to the dangerous navigation, the Straits line should be abandoned as a communication between India and Europe, and China; as the old Cape of Good Hope line was abandoned for the Suez line. Considering, however, the difficulties of the Straits navigation, and peculiarity of the China Sea, the steamers would probably do all the work, and beat sailing vessels off the field, which they
cannot do now, because the present charges upon steamers are so heavy: this will be modified by adopting the Kraw route.

21.—The extra service required to give a weekly mail to Calcutta by a single extra steamer running twice a month between Aden and Point de Galle, might be well undertaken by the P. and O. Company, as well as the whole service (by a lower class of steamer, however, on the China side, than is at present employed) between Ceylon and Kraw, and the Gulf of Siam and Hongkong. The Companies running the direct lines of steamers between Calcutta and Hongkong via Singapore and the line between Calcutta via Akyab, &c., and Moulmein might, advantageously to themselves and to the public, amalgamate and run one steamer twice a month direct to Kraw, to meet the China and Europe steamers returning direct to Calcutta; two from Calcutta via Akyab, Rangoon, and Moulmein, to Kraw, returning via those ports.

The railway should be a separate Company, and there should be a condition in their contract which would scarcely require a guarantee to that effect.

22.—With these arrangements carried out, we may incidentally mention that the telegraph, instead of being submarine from Rangoon, should be carried along the coast from Moulmein, with a junction with the railway telegraph at Kraw, and also a junction with the Rangoon and Touggo telegraph at Sittang, thus giving another line of telegraph communication with Calcutta, by which English news, and China news, may be transmitted from Kraw.

23.—The arrangement which might be made with the government of Siam for the grant of land, &c., has not formed a subject for our discussion, as, with the present liberal-minded and far-seeing monarch on the throne of Bangkok, to whom the advantages which must result to himself and his people, by carrying out this project, will be at once obvious, we see no difficulty on this point.

24.—We have thus laboured to prove, and we think have done so satisfactorily, that, as a mere speculation, the construction of a railway across the Isthmus of Kraw will be
profitable; that the communication may be established for a third of the capital, the interest of which is now being expended yearly on mere fuel and establishment of running steamers, and that a vast amount of time will be saved over present routes. Of the political bearing of the subject we have said nothing; but, holding in view that the line from Ceylon to Cochin China is nearly straight, we are convinced that if Great Britain does not take it in hand, France must, with every chance of a profitable opposition to the P. & O. Company, in their line with Europe to Calcutta via Madras.

ALEXANDER FRASER,
Captain, Bengal Engineers.

J. G. FORLONG,
Captain, F.R.S.E., Ex-Engineer, Tenasserim Provinces.