

northern slope; but it is almost certainly the name of the wooded hills to the north of the route from Laikipia to Rangatan Busi, which Höhnel has called the Marmanett Berge. Ferhagi reported it* as being nine hours north of Settima, which is the right position, if this view be correct. Doenyo Gojito may be only a west spur, unless, as seems most probable, it was based only on an end view of Settima itself. Höhnel certainly marks no mountains west of the main mass.

The next point to be considered is, what place is to be given to Höhnel's Aberdare Kette and Settima Kette, which he places twelve miles to the east of Thomson's Aberdare range. All that occurs there is a flat grass-covered plateau, 6700 feet above the level of the central plain of Laikipia. The plateau is intersected by a series of deep ravines, which have in places a cañon structure, and it bears upon its surface a number of basalt hummocks, which are either the denuded remnants of a lava sheet, or, as is more probable, a number of small volcanic cones. They are very irregular in arrangement, and most of them are separated from Settima by the upper waters of the G. Laschau and the G. Nairotia. The cones are very small and unimportant, and have none of the characteristics of a mountain range. The plateau on which they occur is that division of Laikipia which I have called the Settima plateau (p. 20).

It is clear, therefore, that the name Aberdare mountains must be used either as a synonym for Settima, or else abandoned. As the name has originated in a mistaken view as to the structure of the country, and has been applied by Von Höhnel in a totally different sense to that in which Thomson used it, and as neither Settima itself nor the basalt knolls on the Settima plateau can be spoken of as a mountain range, the latter course seems advisable.

The adoption of the name Settima for the volcanic mass, which is piled up near the western edge of the Laikipia plateau, moreover, helps one to realize its correspondence to Kenya on the eastern side of the same district.

(*To be continued.*)

THE ANGLO-GERMAN BOUNDARY IN EAST EQUATORIAL AFRICA. PROCEEDINGS OF THE BRITISH COMMISSION, 1892.

By Consul C. S. SMITH.

A JOURNEY to Kilimanjaro and back gives little opportunity for the relation of novelties. The mountain and its inhabitants, animate and inanimate, have been well described,† and from a geographical point of

* Denhardt, *loc. cit.*, p. 138.

† A full bibliography of this subject is given in Dr. Meyer's 'Across East African Glaciers.'

view little remained except to accurately map the district. The construction of an accurate map was one of the chief aims of the Commission, and as regards the bolder features I trust that it has been attained. As regards the minor features, it must be understood that time did not allow us to closely examine every part, and that, therefore, much that has been mapped depends on a distant view. Which parts are likely to have been clearly seen may be deduced from the following account of our doings.

During February and March, 1892, at first without skilled assistance, and later with the help of Mr. Imam Sharif, Khan Bahadur, of the Indian Survey, I examined the mouth of the Uмба river. Jungle and mangrove swamp combined to make this work difficult and unpleasant. In July, after the rains, I made a fresh beginning. This time I was accompanied by Lieut. G. E. Smith, R.E., as well as by Mr. Imam Sharif. The good services of these two stand on official record, but I am glad of this opportunity to mention them publicly. It may be of interest to record the duties of each member of the expedition. The observations, astronomical and terrestrial, were, generally speaking, taken and worked out by myself. I also computed the triangulation, and prescribed for the sick. I supervised the making a small collection of plants for Kew, and of course conducted the communications with Dr. Peters, my German colleague. Lieut. G. E. Smith, besides assisting with the observations, took at every station panoramic * outlines, upon which were inserted the true azimuths and vertical angles as soon as ascertained. These sketches were most valuable. He also kept the accounts of the expedition. Mr. Imam Sharif † undertook, as a rule, the plane tabling, a duty which he carried out very efficiently, and, besides, sometimes assisted with the observations. We were escorted by twenty Zanzibar soldiers, who, with their officer, had been lent by H.H. the Sultan of Zanzibar. Our caravan varied in number from about ninety to a hundred and twenty porters. Of these, only the head men were armed. The porters, who were young men enlisted at haphazard in Zanzibar, gave a little trouble at first. But East Coast natives are easily disciplined if rightly managed, and when they once understood my ways, there was little ground for complaint. Their cheerfulness and ready obedience under hard fare and hard work is admirable. After five months we came back in our full numbers with the exception of one porter, who died when on detached service, and of two porters whom we left sick in good hands at Taveta.

* The book of panoramas, together with the other work-books used by the expedition are with me; the field sections from which the maps were prepared, are at the Intelligence Department.

† During the interval Mr. Imam Sharif had performed the valuable service of surveying upon a large scale the town of Zanzibar, and this in spite of its being the rainy season. He has subsequently accompanied Mr. Bent to Arabia.

On beginning work in July, our first care was to astronomically measure the length of the base, Jombo-Kilulu. This done, we passed up the Umba valley for about 40 miles, and then made for Mlalo in the Usambara mountains. The river Umba for the last 15 miles of its course flows in a channel about 60 feet wide, cut deeply into the alluvial soil. Any rainfall in the basin of the Umba makes the lower part of the river overflow all its neighbourhood, a circumstance which the natives well know how to use. They retain the flood water on their fields by means of dams made of earth and weeds. We saw sugar-canes of an unusual size, also good crops of rice and tobacco.

The town of Vanga is the principal place in the Umba district. It is a walled town, with, perhaps, 600 houses. The town is on a creek, which can only be entered near high water even by dhows or boats. It stands on a bank, and is thus raised a few inches above the surrounding ground, which is mostly covered with mangroves, and flooded at spring-tides or in time of rain. The principal commodity exported from the town appears to be wooden rafters, of which any quantity may be cut in the mangrove swamps. The Imperial British East Africa Company is represented in this district by Mr. T. T. Gilkison, a gentleman of whose ready assistance whilst I was in his neighbourhood I would make grateful mention.

Concerning the Digo people, who inhabit the Umba district, I have little to add to the account published in vol. ii. of the Supplementary Papers. Two of their villages, Chole and Kobe, which I visited in 1885, have been destroyed in wars between two sections of the tribe, and certain villages near Jombo have been lately destroyed by a punitive expedition sent by the Imperial British East Africa Company. The Digo villages, except those close to Vanga, are, generally speaking, built in spaces cleared in the thick jungle with but one approach, which is through a narrow path provided with strong low doors, only to be passed in a stooping attitude. The dangers to be guarded against are attacks from neighbours and from raiding Masai, who still occasionally come to the coast to try and steal goats. The Wadigo have now no cattle. All have been taken by pestilence or forays. The village furthest from the coast is Chuini. There was formerly a village near Mwa Kijembe, where Mbaruk-bin-Rashid established himself when at war with Seyyid Barghash. It was, however, abandoned, and now nothing can be seen of the settlement.

The country near the Umba is capable of receiving a population twenty times as numerous as at present; and I do not doubt that it would soon fill up if order were assured. It is difficult, however, to see how that can be unless the power of the Masai is thoroughly broken. The coast jungle belt extends about as far inland as Mwa Kijembe. The district beyond, although believed to be capable of rich yields, looks at present forbidding enough. The country is overgrown with

mimosa and euphorbia in such manner as to make progress very slow, even with pioneers always in front of the caravan. Close by the river there are always fine tall trees and pleasant camping-places. Game is now rare. Zebra and hartebeest and a few small gazelles are all that can be seen, and even these in small numbers. We never saw even the marks of a buffalo. All herbivorous creatures seem to have suffered very heavily from the late cattle disease. The rhinoceros is occasionally encountered, and there are a few elephants, but these are very rare. We saw no live elephants, but we found a dead one near Perani. As regards birds, guinea-fowl and partridges may occasionally be shot.

From the Umba river we went to Mlola, and then up to Mlalo in the Usambara mountains. This departure from our direct route was necessary in order to enable us to shake off attacks of fever, the result of our exposure to malign influences in the hot plain. To reach Mlalo we had to climb the Usambara hills by a steep path, which the weakness of fever made to seem interminable. Arrived at the top, it is seen that the mountain-system is formed of a large elevated area with hill-tops rising from it. Mlalo is a fenced town situated on a small hillock at the upper mouth of the valley down which flows the Umba, making in one place a leap of about 70 feet. Near Mlalo is a Lutheran mission station, under a German pastor, with a gardener as his only companion. They have built themselves a pleasantly situated station, and have opened a school for children. They have no natives actually settled with them, and, as may be expected, the attendance of the children who are unused to school is very fitful. The parts near Mlalo are populous and very fertile. They are well watered with little streams, and the people understand how to irrigate by conducting the water to their fields in artificial channels. Living in the mountains, the people feel safe from marauding Masai, and can build their beehive huts where convenient without needing the protection of a fenced town. The climate is delightful for a European coming up from the hot plains. In the morning the temperature used to go down to 52°, and remained moderate during the whole day* (in September). Sheep, which give excellent mutton, were to be obtained; bananas and sugar-cane and other kinds of native food were plentiful.

After our visit to Mlalo we descended once more into the plain. At the foot of the hills we found several villages, some inhabited by Kamba people, a half pastoral tribe who possess great numbers of goats. All these lower villages are fenced for protection against the war-parties of Masai, which constantly pass near to them. The names of the villages on the west side of Katulifetha are Mnasi, Mbaramu, Mlalo pa Mdimu, and Ponde. The headman of Ponde is a vassal of Mwasi, the

* Mean temperature of Mlalo, 65° Fahr.; of July, 59.7°; of November, 67.8°; extremes 50° and 79°.

chief of Gonja, who himself is a son of Semboja, a Swahili of Persian descent, who left Pangani many years ago and built a town at Masinde, on the west side of the Usambara hills.

Having made a trigonometrical station at Katulifetha we went to Gonja under the Pare mountains.

Between Ponde and Gonja is a plain about 20 miles across, which, when we passed over it in September and in November, was an arid waste, with the usual growth of thorn trees and high grass. During the rains it becomes a swamp, but it is always passable. The water on it drains partly into the Mkomasi, and perhaps into the Mbaramu. Much sinks into the ground.

Gonja is one of several fenced towns which stand not far from one another. The Pare mountains, at the foot of which it is built, seem to contain a number of villages where bananas and sugar-cane and food of all kinds is grown. But the British Commission had no time to explore them. Just above Gonja is the Thornton fall, where a river flows in broad streams over the face of a precipice about 300 feet high. The precipice is of black, smooth rock. The stream is about 100 feet wide as it falls. Seen from just opposite the fall, from a grassy slope covered with large pink balsams, the water as it descends looks like sheets of silver. It is impossible to express in words the beauty of the shapes assumed by the free masses of water as they shoot down the face of the rock into the round pool at the bottom. The base of the fall is about 1050 feet* above the level of the camp, and the river runs down past it. After leaving the fall, it runs in a rocky bed; and for about a mile of its course it goes underground, so that no water can be perceived.

The next important place at which we stopped is Kiziwani, where the Germans have constructed a strong palisade on the banks of a small tributary to the Kiziwani river. During the rainy season the Kiziwani river flows into the northern part of the plain between Gonja and Ponde, and its water is eventually drained off as explained above. At other times, however, it all flows into the earth; a fact which presented itself to our notice in a striking way. On our return journey we reached Kiziwani during a few days' rain. The river was so swollen that we could not cross it, and I looked forward to a long delay or having to bridge the river. The next morning, however, the river had subsided; it was quite low, and we crossed without difficulty. We crossed the river-bed again about a mile lower down, and to our surprise found that no water had come there. The bed was covered with dry leaves. All the flood water off the hills had flowed underground in the intervening space.

From Kiziwani we went to Lake Jipe by way of Gurungani and Baya camp. Water was obtained at both places. "Gurungani"

* This was measured by aneroid, the height of the fall by clinometer.

signifies "at the water-hole." The holes are in a stream bed in the solid rock; they have presumably been worn * by the friction of boulders constantly rolled round by the action of the current. They contain water long after the bed is dry, and are filled by the smallest shower of rain. The water could be drunk, but was far too dirty to wash in.

During a short halt near Kwa Seguiri we encountered some of the inhabitants. They are of the Pare tribe. The men are armed with bows and arrows. Their hair was in little ringlets richly pomatumed with red clay, or perhaps it would be better said that the men attach masses of red clay to their heads by means of their hair. Each little bunch of hair and clay looks like a bead of dull red coral. The women wear kilts of tanned goat-skin, ornamented with patterns worked in white beads. They wear immense brass bangles with punctured patterns about their necks, and great coils of iron wire round the fore arm. They carry strings of beads round the upper arm, and bands of cloth worked with beads round the knees; also bracelets and armlets of very fine copper and iron chain. It is probable that they carry most of their portable property upon their bodies.

From Kwa Seguiri the ground falls gently towards the Jipe lake. Near the lake the slope is so slight that the adjacent land to the south of it no doubt is flooded and swampy in time of rain. The land on the east side of the lake has a slight rise, and the water would probably drain off it quickly, thus making it convenient for living on. The neighbourhood of the lake is the only place where we saw much game in the whole journey. We saw some very large troops of zebra and antelope, chiefly hartebeest, Grant's gazelle, koodoo, also small gazelles with zebra. The numbers have, however, been greatly reduced by the cattle plague, and are not to be compared with what is described by Messrs. Thomson, Johnston, and Meyer. We saw no buffalo, nor the marks of any. A few years ago this animal was very common, especially near the Jipe lake. We only once in the whole journey saw the marks of giraffe. Rhinoceros and ostriches were rarely seen; the marks of elephant we occasionally saw. We found great difficulty even in shooting our food, because the game had been made very shy by several people shooting in the neighbourhood just before our arrival. In Lake Jipe itself are crocodiles and hippopotamus. There are also fish and numbers of birds.

I need not describe the beautiful but unhealthy forest in which the Taveta people have their villages, for this has often been done by more competent persons. I will go on to deal with our proceedings in the neighbourhood, only taking this opportunity to acknowledge our indebtedness to the local knowledge and kind help of Mr. W. Hamilton, a servant of the Imperial British East Africa Company, who, unhappily, has since lost his life at Kismayu.

* This process is fully explained in Dr. Meyer's book.

From Taveta our first expedition was to the crater lake of Chala or Nakurta. We camped on the top of the crater ridge, about half a mile from the highest point. When we had been shown the place where descent could be made to the water, we found no difficulty in scrambling down. On the days we were there the lake showed no effervescence, nor did any currents tend to draw the paddle out of the hand. Lieutenant G. E. Smith went afloat in a pontoon we found there. He sounded, and at a short distance from the south-west end of the lake obtained 28 and 35 fathoms. I imagine that this mysterious lake, which always seems to be about the same level, is fed subterraneously by streams from Kilimanjaro.* A stream which suddenly springs into existence just to the east of the crater, and flows into the Lumi, is no doubt supplied from the lake and prevents its rising above a certain level.

From Chala we went into the Rombo country. We were first hospitably received by a chief named Ngogo, and then by another named Mkinabo. Each village lies hidden in banana groves; that of Ngogo is protected by hedges, but Mkinabo's village is a walled stronghold. A short description of the latter may be of interest, for, I believe, there are many such in the Rombo country. The chiefs' houses are built in an enclosure, of which the rough stone walls are about 11 feet high, and much thicker at the bottom than at the top. The place is entered through a long passage, which is formed by the wall being doubled. The space between the double walls is about 18 inches wide at the bottom, forming a narrow path, but the sloping shape of the walls makes their tops 10 or 12 feet apart. The entrance to the passage is closed by a wall across it, with an aperture about 3 feet high at the lower part, making it necessary to stoop very low in order to enter. At intervals in the passage, which is about 200 yards long, there are walls built across with the same low entrance, so that an attacking party must enter at a great disadvantage. The Rombo country appeared to be in parts very fertile. Bananas are the principal product, but all the East African products, with the exception of coconuts, are grown. The fields are kept exceedingly clean, all the stones being collected in little heaps. The cultivated parts are near to villages, and towards the plain they are bounded by a curiously definite line, along which a path runs.

When we left Mkinabo's village, it was our intention to proceed into Useri, skirting the territory named Rombo wa Kulia. The Rombo country has no supreme ruler; each village has its own chieftain. Being well received at one village is, therefore, no guarantee for being allowed to peacefully pass other villages, and so we discovered. About an hour after leaving Mkinabo's village, we began to skirt the lower edge of

* In these regions streams often run a large part of their course underground. In such cases the watercourse on the surface only has water in times of flood.

Rombo wa Kulia. The men turned out of their villages in numbers and watched us pass. At first they ran along parallel to our route, sometimes dancing and waving spears and shields, and sometimes abusing our guides. We marched past them quietly for six or seven miles, not appearing to notice their threats, though prepared for attack. We then approached their northern boundary. Misunderstanding our forbearance, the natives began to close on our rear, throwing heavy stones. When the more advanced had come within about 30 yards, I saw that there was no help for it, and gave orders to fire. The fire of my people was not accurate, but the Rombo men gave back. They soon fled, although they did not lose more than one or two of their number. On our side ten or a dozen men had been bruised by stones, but no one was much hurt. It was then nearly dark, and, not being sure how we should be received in Useri, we descended into the plain, going the next day to Useri camp, then to the Kimangelya camp and to Laitokitok camp.

At Laitokitok we encountered the Masai in some numbers. Having heard at Taveta that the Masai were nearly exterminated by famine, we had not come provided with the proper presents for them. I had to choose between pushing on against their wishes or going back. Having regard to all the circumstances of the case, that is to say, to the tenor of my instructions, to the small number and poor marksmanship of my armed men, and to the fact that I had obtained the geographical knowledge required for present necessities, I determined to give the Masai other presents, and to return to Taveta.

We went to Taveta along the road, and, having paid a short visit to the hospitable Captain Johannis at the German station of Marangu we explored the western part of Taveta territory. We returned to Taveta, and then made for the coast by the way we had come, except that from Katulifetha Imam Sharif went by way of Bwiti.

After reading the preceding the question will occur to many, What are the real capabilities of these districts? In answer I cannot do better than quote a report on the subject by Mr. Imam Sharif, a gentleman well practised in judging the value of land.

IMAM SHARIF, KHAN BAHADUR, to COMMISSIONER SMITH.

Zanzibar, March 25, 1893.

Sir,

In accordance with your request, I have the honour to submit to you my opinion with regard to the capabilities of the soil in the parts which we have lately visited.

Firstly, with regard to the parts near Wanga, which are flooded by the Umba. Here we have a red soil, over which black mud is carried by the river floods. The soil appears suitable for sugar-cane, Indian corn, millet, cotton, tobacco, rice, etc., many of which products are already grown there. The ground is, however, mostly uncultivated and covered with jungle.

Secondly, the ground between the Uмба and the Usambara hills. In time of rain, this is probably mostly black mud. In the dry season, there is no water. But there is no reason to suppose that it would not be obtained by digging. The ground is at present covered with thorn trees. Except for that, it reminds me of the Punjab between Delhi and Lahore, which is a thickly populated region. The soil in this part is, however, much superior, especially in being stoneless. It would grow millet and kodo, and perhaps rice in parts.

Thirdly, the district extending from Jombo to Ndea. The soil is undoubtedly very rich, and though at present no water can be obtained, it could, I am sure, be got by digging wells. It would grow rice, tobacco, Indian corn, cotton, and vegetables.

Fourthly, the level ground from Ndea to Ndui ya Rombo, near to the Jipe lake. This ground is not much higher than Jipe lake. Part of it is black ground, swampy in rain, and part is red earth. The whole appears very fertile. The elevation above the sea is about 3230 feet. The black earth would grow rice and tobacco; the red soil would grow cotton, wheat, Indian corn, bananas, indigo, water-melon, and all sorts of Indian vegetables. It can easily be watered by canals from the Lumi river and by water-wheels from the Jipe lake.

Fifthly, the Taveta forest. Here the water seems to be everywhere under the surface. The soil is very rich, and will grow all the above products. There is also already a great quantity of timber, though I do not know the quality of the wood which could be cut.

Sixthly, the lower slopes leading up to the Kilimanjaro. In this is included the parts of Taveta which lie to the west of the forest, and the slopes below Rombo and Kimangelya. Here we have an altitude of about 4000 to 5000 feet. The soil is deep and without stones, and much superior to parts near Dehra Doon, where coffee and tea are grown with great success. Water is not at present to hand in many parts, but could, no doubt, be obtained by wells. The soil would have rich harvests of wheat. At present it is covered with grass, which appears very rich.

I have, etc.,
 (Signed) IMAM SHARIF, K.B.,
Survey of India.

It will be seen that much of the country we visited has a very rich soil. Until the questions of water, labour, and transport are satisfactorily solved, it is not likely that the more valuable products, such as tea, coffee, spices, will be grown so as to give great profits to European planters. But short of this, which some think the chief use of a tropical country, a very large proportion of the parts we visited is capable of supporting a numerous population of natives of hot countries. Large areas now unoccupied might be inhabited by farmers from the crowded parts of

India. The land is at present empty, and until it is populated there cannot be a great trade. On the other hand, it seems probable that there would be a considerable trade if the land were fully populated. But the Masai must first be taught not to raid, the petty wars amongst the tribes must be put an end to, and kidnapping must be suppressed. These points attained, the natural increase of the indigenous population would soon overrun the parts now vacant. But the available space is vast, and there is plenty of room for immigrants. If I am right in believing that land for cultivation is the chief want of many districts in India, I would submit that no greater benefit could be conferred on them than to put in the way of emigration those inhabitants who can be induced to do so; and that, looked at from the African point of view, the measures which are calculated to populate the country are also those best suited to create trade.

The way we went has no very long stretches without water, and but seldom passes over uneven ground. If order were assured, the route by way of the Umba would be one of the most convenient roads to the Kilimanjaro, for there is always water * in the river, and one spot on its banks is as good as another for camping. The long waterless marches which have to be made on the Bwiti road to the south and on the Mombasa road to the north would be avoided. From Mr. Iman Sharif's report, it appears that most of our route passes through cultivable land. If this route ever comes into use, I imagine that the port of Wasin, though smaller than Mombasa, would be found quite convenient for steamers; for dhow traffic it is more accessible than Mombasa.

NOTE TO MR. C. S. SMITH'S MAP. †

A manuscript "Memoir" ‡ on the surveys conducted by Mr. Smith in 1892 as British Commissioner for delimiting the Anglo-German boundary between the mouth of the Umba river and Kilimanjaro, has been deposited in the Society's map-room, where it may be consulted.

During the first season—February 5 to March 28, 1892—the work was confined to the mouth of the Umba river and the immediate vicinity of the coast. Vanga was taken from the Admiralty chart; a small base-line was measured by the late Herr Vogler, of the German Commission; and the latitudes of three camps were determined by meridian altitudes of stars taken with a sextant. During the second campaign—July 7 to December 2, 1892—the whole of the triangulation and the

* At Perani, in August, the flow of water in the Umba was 8000 gallons a minute.

† Consul Smith is a lieutenant on the retired list of the Royal Navy.

‡ The Convention, together with maps and triangulation chart, was laid before Parliament in the Bluebook, marked "Treaty Series, No. 14, 1893." In the maps made by the British members of the Delimitation Commission, nothing has been inserted which was not observed by themselves, except parts of the coast-line.

plane-tabling of the rest of the country mapped was carried out. The instruments used included a six-inch theodolite, a six-inch sextant, two chronometers, two aneroids and heliographs.

The triangulation upon which the survey depends has as a base a line drawn from the summit of Jombo Hill to the Theodolite Station near to Baba Kilulu Village. The length of the base was found from the difference of latitude and reciprocal azimuths of its ends. This value was checked by comparing the triangulated and astronomical latitudes of Vilima Viwili Hill Station, a point where it was thought there would be no local attraction. The base was finally taken as measuring 124,063 feet. The results of a small triangulation connecting Vilima Viwili with the boundary-mark on Lake Jipe show that this value is probably a few feet too small; but as the mean error of the triangulation reduced to sea-level does not appear to exceed about 0.14 per cent., the doubt as to the exact length of the base does not materially affect the final results.

The longitudes throughout depend upon that of Jombo summit, which is assumed, on the authority of the Admiralty Chart No. 1390, to be $39^{\circ} 12' 56''$ E. of Greenwich.

The latitudes of eight points were astronomically determined by sets of circummeridian altitudes of stars north and south of the zenith. The latitudes of the north and south ends of the base depend upon 78 and 120 observations respectively; that of Vilima Viwili upon 56 observations. The average number of observations for latitude taken at each point is 74. Each astronomical Station is linked to the trigonometrical system, but the trigonometrical values have been adopted. At certain Stations the local attraction was calculated.

At each principal Station azimuths were astronomically observed. The general accuracy of the orientation of the survey is tested by theodolite bearings taken from Great Perani Hill Station to Kibo summit, a distance of 136 miles, and to Maji ya Kununua, a distance of 70 miles. In the first instance, the difference between the observed azimuth and that calculated from the computed latitudes and longitudes of the two points amounted to $27''$ of arc; in the second case, to $1' 42''$. The first comparison is thought by Mr. Smith to be more trustworthy than the second.

When surveying, it was impossible to erect marks in front, but quite good results were obtained by observing to the highest points of the hills. The intersection of the vertical and horizontal wires of the theodolite telescope was found a sufficient guide to the exact positions of the summits.

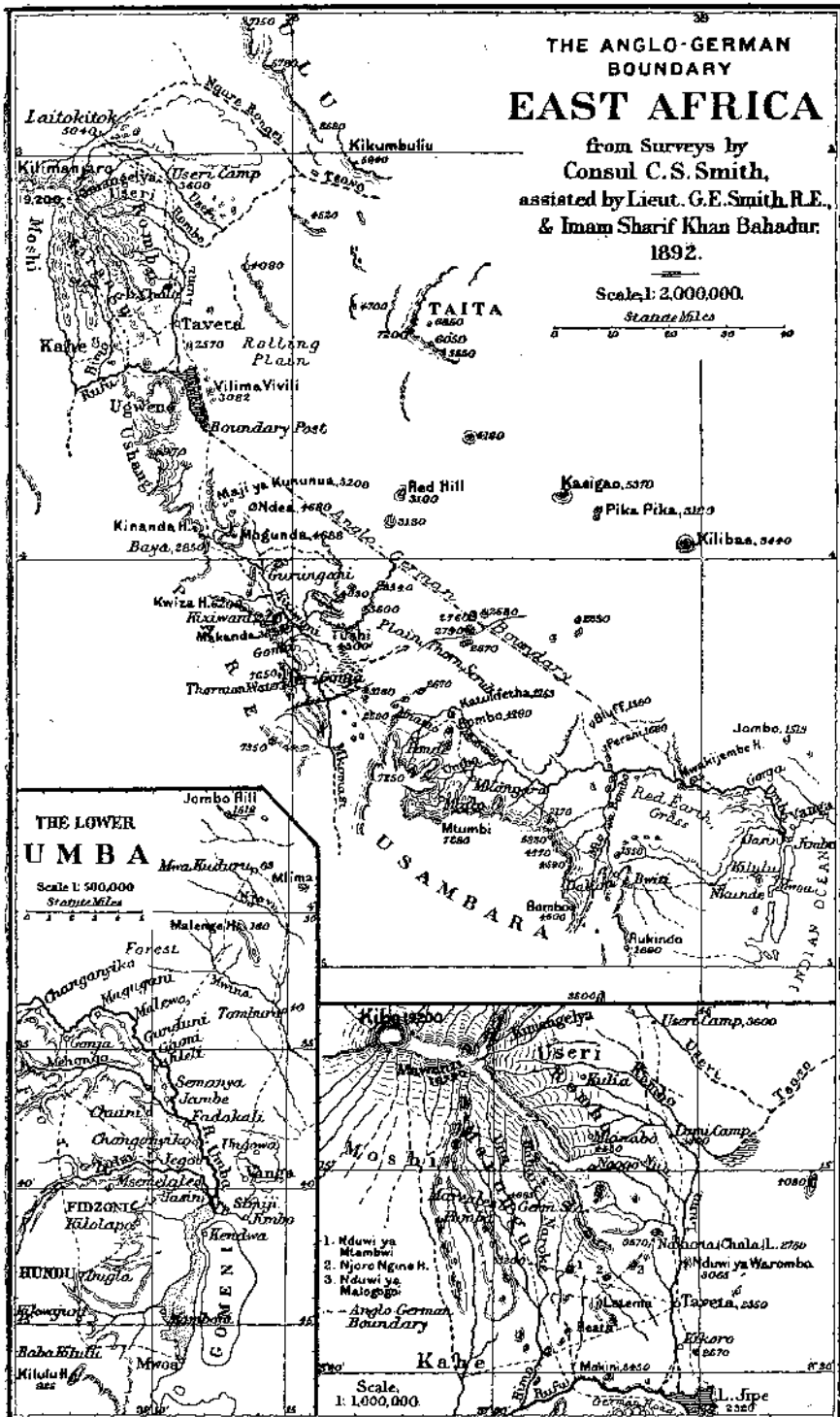
The heights of a few intermediate points are from aneroid observations; but those of all the triangulated points depend upon vertical angles of the theodolite. The datum is high-water mark spring tides at Vanga.

THE ANGLO-GERMAN
BOUNDARY
EAST AFRICA

from Surveys by
Consul C. S. Smith,
assisted by Lieut. G. E. Smith, R.E.,
& Imam Sharif Khan Bahadur,
1892.

Scale: 1:2,000,000
Standard Miles

0 10 20 30 40



To return to the triangulation.

In 10 triangles all the angles were observed; in 76 triangles only two angles were observed. Excluding the principal stations, 11 points are fixed by azimuths taken from more than two points; 45 points depend upon azimuths taken from but two points, and of these 15 points depend on azimuths, of which one or both were read from only one vernier of the theodolite. The geodetic position and height of each computed point are given in the triangulation chart.

It should be observed here that since the signature of the Convention in Berlin the triangulation has been recomputed, and that therefore the results which appear in the triangulation chart laid before Parliament have been slightly modified.

The variation of the compass was determined at six places. In the neighbourhood of Kilimanjaro it was found to be very uncertain. The results were as follows:—

Baba Kilulu	8° 34' W.
Mwa Kuduru	8° 46' "
Perani Camp	15° 52' "
Small Perani	8° 12' "
Kiziwani	8° 52' "
Chala	10° 29' "

The following are the final results of the triangulation for 16 points:—

	Lat. S.	Long. E.	Altitude.
<i>Principal Points.</i>	° ' "	° ' "	Feet.
Jombo, summit	4 26 21.3	39 12 56.0	1,519
Baba Kilulu	4 46 12.6	39 7 46.6	511
Great Perani	4 28 10.9	38 45 31.8	1,680
Katulifetha	4 23 24.8	38 22 32.1	2,153
Makanda, summit	4 9 24.0	37 59 20.9	3,829
Mogunda	3 55 33.3	37 51 12.7	4,688
Vilima Vivili	3 34 49.3	37 48 11.3	3,082
Chala, summit	3 19 29.9	37 41 21.3	3,672
Small Perani	4 29 24.3	38 45 40.0	1,365
Mwa Kijembe	4 33 6.2	38 57 24.6	613
<i>Other Points.</i>			
Kasigao	3 49 47.5	38 39 56	5,370
Bombo	4 25 9	38 22 30	4,190
Taita ya Bura	3 25 2	38 17 42	7,200
Kibo (Kilimanjaro)*	3 4 52	37 21 33	19,230†
Mawenzi (ditto)	3 5 52	37 27 41	16,790
Kilibas	3 57 52	39 57 1	3,440

* According to Dr. H. Meyer ('Mitteilungen,' 1893, p. 97) Kibo lies in lat. 3° 3' S., long. 37° 14' E., and rises to an altitude of 19,680 feet. This mountain has consequently been shifted 7' 30" to the east. This correction is borne out not only by the Victoria Nyanza Railway Survey, but also by Lieut. von Höhnel's recent observations for longitude on the upper Tana.

† Since writing the memoir reviewed above, I have recomputed the heights of the three principal landmarks, and give the results on next page—

The Maps which accompany this paper have been reduced from the Official Map issued by the Intelligence Department of the War Office, on a scale of 4 miles to the inch, except that of the coast district, which is on the scale of 1 mile to the inch.

**AN EXPEDITION THROUGH THE BARREN LANDS OF
NORTHERN CANADA.***

By J. BURR TYRRELL, M.A., B.Sc., F.G.S.

In the spring of 1892 the Geological Survey of Canada placed me in charge of an expedition sent to explore the unknown area, embracing about 60,000 square miles, lying north of the Churchill River and south-east of Lake Athabasca. We started from Prince Albert on the Saskatchewan River, and, travelling overland, crossed the height of land, and reached Green Lake, where the canoes were put in the water. The Beaver River was descended to Isle à la Crosse Lake, on the Churchill river. At the trading-post of the Hudson's Bay Company, at the south end of this lake, a half-breed and two Chippewyan Indians were taken on the party as canoe-men.

After descending Churchill River for 90 miles, we began the ascent of the Mudjatic River. We toiled at our paddles against its rapid current for ten days, until we reached its source in the middle of a flat sandy country. Crossing the height of land, here a sandy plain, we reached a small stream, which in a few miles flowed into Cree Lake. Standing on the summit of a rocky hill, on a beautiful bright evening in July, I enjoyed the rapture of being the first civilized man to look down into the clear depths of this large lake, and to gaze into the distance over its shining waters. Three days were occupied in crossing

Station.	Kibo.		Mawenzi.		Taita ya Bura.	
	Dist. in miles.	Height in feet.	Dist. in miles.	Height in feet.	Dist. in miles.	Height in feet.
Great Perani.....	136	19,220	—	—	79	7172
Makanda.....	—	—	—	—	55	7187
Mogunda.....	—	—	—	—	46	7199
Vilimi Vivili.....	45	19,270	40	16,785	35	7229
Chala.....	—	—	21	16,798	42	7215
				16,790		7200

As regards Kibo, the observation from Vilims Vivili is clearly the most reliable, but further observations are desirable. Of the other results the mean may be taken.—C.S.S.

* Published with the permission of the Director of the Geological Survey of Canada. Map, p. 480.