CORYNDON MEMORIAL MUSEUM EXPEDITION TO THE CHYULU HILLS, APRIL—JULY, 1938.

PART 1.

General Narrative.

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One frequently reads in the local and overseas Press of Scientific Expeditions to Kenya; what they intend to do, and how they have fared after the "safari" is over. Then, so far as the public is concerned, all is forgotten. Occasionally, as time goes on, the Museum receives papers and Journals containing reports on the results of the expedition. The material and specimens collected are taken out of the country, and Kenya is the poorer by so much. Thousands of pounds are spent on these expeditions, and the public of Kenya gain little. International science may or may not gain. This gradual draining of Kenya's scientific wealth has for many years been regretted by those of us who are interested, and indeed we have chafed against fate that has not brought funds our way, so that the results of scientific work, could in part, remain within the Colony.

There is a saying "that all things come to them that wait"; this may be so, and truly we have been patient, and this patience has in some measure been rewarded. Towards the end of 1937 funds were made available for field work, particularly in connection with botany. This money, a sum of £500, was donated by Mr. W. D. Campbell of New York. At the time the donation was made, we had no Botanist attached to the Museum, but we were making every endeavour to persuade those who "hold the purse strings" that a botanist was a necessary member of the Museum staff. An appointment was made early in 1938.

Our next concern was, how to expend this money to the best advantage? Those of you who have been associated with the Museum for any length of time will have realised that the importance of field work has always been to the forefront, and plans against the day when money would be available had already been formulated.

The Chyulu Hills as a field likely to prove of interest had been marked on the map many years before. They were virtually unexplored, only roughly surveyed, and by reason of the fact that they are situated in the Southern Game Reserve, had remained a more or less unknown quantity. Their situation was suggestive as a possible stepping stone between the Kilimanjaro highlands and those of Kenya.

The last cursory survey of the district was carried out during the war, and this was directed more to the localising of possible water supplies than to general topographical work.

At the outset we were fortunate in enlisting the help of Mr. MacArthur of the Game Department who knew the area better than most, and with his assistance the preliminary arrangements were carried out. Mr. and Mrs. A. B. C. Smith of Kibwezi, together with Mr. Cullen, gave us the hospitality of their comfortable homes before we set out on our safari for the hills, and during our stay on the Range the former very kindly acted as banker and forwarding agent. This assistance was invaluable and greatly appreciated.

The members of this expedition included Mr. Bally (botanist), Mr. Allen Turner (general field assistant), myself, and my youngest son, together with a staff of trained native assistants, and 60 odd porters. Mrs. Bally joined the party toward the end of May.

The Chyulu Hills lie west by south of Kibwezi station at a distance of roughly 25 miles, and the north-west of Kilimanjaro at about 45 miles as the crow flies. The Kibwezi plains with their extensive laval flow lie on the one side, while the Laitokitok plains, lower by several hundred feet, lie on the western side. It was reported that ever-green forest existed on the heights of the range in contrast to the plains vegetation surrounding them. The hills form a compact continuous chain of roughly 30 miles in length, and were said to rise to a height of just over 7,000 feet, the Kibwezi plains being approximately 3,000 feet.

One permanent water spring was known to exist at the northern section of the hills, otherwise there was no surface water, and on this limited supply the party had to exist during the investigation of the entire range. At one time, according to native legend, other springs existed, right up to the time when there was Chagga settlement on the hills, but when these were driven off the hills by the Masai, the retreating Wachagga cast spells on the springs so that they dried up.* The existing spring was the site of their last settlement which they evacuated hurriedly and there was no time to bewitch this last water supply. Be that as it may, there was evidence of some considerable settlement on the northern portion of the range at some time, as distinct from Wakamba settlement at the base of the hills.

A few remarks must be made regarding the approach to the hills. No road exists; the line of approach lies along native paths of which there are two main ones, passing over the hills to Laitokitok, and a third from both Kibwezi and Masongaleni to Taveta. Our first camp was made at Ithaba Swamp, some 12

* The old Wakamba men stated that the previous occupants of the range were *not* the Wachagga of Kilimanjaro but another tribe which had died out after being driven off. This we could not verify.

miles on our way, at an altitude of just over 3,000 feet. Soon after leaving Kibwezi Station, the path leads over an extensive lava flow on which considerable closed forest exists. This peculiar lava-forest is composed largely of *Acacias, Commiphora, Piptadenia,* and *Euphorbias,* with Fig and stunted Teclea and an almost impenetrable under-bush.

Leaving the laval ridge, the path goes through more open country, the dominant trees being *Acacia spirocarpa, Boababs,* two species of *Sterculea* (from the bark of one excellent fibre is obtained), and *Commiphora.* This I have termed Acacia thornbush. Numerous Gneiss outcrops are visible along the path. This belt gives way to a more orchard-like formation; *Combretums, Cussonia,* and a few *Acacias* are the chief trees. In this portion the Gneiss outcrops are larger, forming hillocks, many of which are more wooded than the surrounding plains. The path rises through this zone and then drops to the Ithaba Swamp which lies in a depression bordered on two sides by a belt of lava. The swamp holds water only during and just after the rains. When we camped at this spot, the only surface water was held in numerous foot prints of elephant and rhino. This spot is evidently a favourite watering place of game in this area. The water, though muddy, was very welcome. Tsetse flies, of two species, together with *Tabanids* and *Haematopota* (both biting flies), were very numerous throughout the day, but fortunately mosquitoes were not numerous by night.

An early start was made next morning soon after daylight; the porters going ahead, and just as well, for during the night there had been a slight shower and the dew was heavy, leaving the tall grass wet and unpleasant until the sun had dried it off. Successive lava flows were traversed as the path gradually ascended. The going was rough and very hard, for lava is an unpleasant substance to walk on. Many of the lava ridges were thickly covered with *Euphorbias, Commiphora,* and *Acacias,* while the intervening zones carried *Combretum, Cussonia,* and *Celastracea.*

Toward the foot-hills an extensive lava ridge is crossed and this is thickly wooded. Here one noted many familiar trees such as *Rawsonia, Teclea, Drypetes, Strychnos,* Olive, *Catha,* and a few Cedars. Flowering herbs and shrubs were numerous, conspicuous amongst them being an exceptionally fine blue *Acantha.*

Butterflies were numerous, including *Papilio dardanus.* I mention this species in particular, because it was entirely absent in the forests at the north end of the Range. Wherever the lava outcrop was large and rugged, there, tree growth was most prolific. In many of the depressions and dongas between these lava terraces, the grass was rank and the atmosphere steamy. In

such situations flowering shrubs and herbs were in full blossom, most noticeable amongst them were pink and purple Hibiscus, masses of several species of Convolvulus, both upright and creepers, numerous *Composites* and *Acanthaceae, Crotalaria,* and a beautiful orange and maroon ground orchid. On the flowering spikes of the *Crotalaria* were hundreds of orange, and black and white *Lycaenids,* feeding on the juices from the plant glands and on the coccid which swarmed on the stems. At about the 3,500 foot level the trees and bush gave way to grass lands interspersed with patches of trees.

In some of the depressions the grass was several feet above one's head and going was rather hard, to say nothing of the cuts one received from the razor-edged grass blades as one forced one's way through. A little further on, a welcome break and interlude presented itself in the form of a derelict plantation where bananas, muhogo, and sugarcane grew in profusion, and large fig trees gave welcome shade. We here halted for an hour to give the porters time to rest and feed. I might mention here that there is no native settlement on the Chyulu hills; the nearest native locations are at Kibwezi. These now abandoned shambas, of which there are four along the base of the hills, were once the site of considerable Wakamba settlement, long since returned to their reserve. Apart from the various crops mentioned, evidence of previous occupation was given in the form of primitive sugar-cane mills, vertical and horizontal, by means of which the cane juice was extracted and subsequently converted into beer with the aid of the fruit of the Kigelia. Judging by the piles of cane fibre and the number of beer pots stored away in derelict huts, a vast quantity of this potent liquid must have been brewed.

From these shambas, the path ascends steeply through thickly covered grass land and passing along the sides of the hills emerges on to a wide lava terrace with scattered acacia and other trees, mostly *Cussonia* and *Erythrina* in clumps, and after a further rise another lava flow is reached. This is mostly grass covered and flat. Amongst the flowering herbs here met with, mention should be made of a Blue Lupin, a handsome large yellow *Composite,* masses of pink flowered *Sopubia* (*Scrophulariaceae*) streamers of White Clematis trailing over the grass, orange Gladioli, and patches of white Gentians.

As one ascends from the second lava flow patches of forest become visible, mostly in depressions, and these we afterwards realised were situated in old volcanoes. As one enters a forest patch one descends on a steep bank through undergrowth of varying density and if the crater is deep one may descend perhaps two hundred feet until at the bottom one notes that large

trees have ceased and the floor of the crater is covered only by a dense herbage, mostly *Piper capensis*, and a mass of creepers.

Our first mountain camp was reached at about 4 p.m. and we were, as one of the party described it, " completely dessicated." Tea is always a great stand-by, and I imagine on that occasion we must have drunk gallons. On the way up to the camping site we inspected the only permanent water supply of the entire range. This is a semi-circular shelf of lava in a deep cutting, covered with masses of maidenhair fern, and from this, the water drips steadily, though in no great quantity. MacArthur with wise foresight had installed karais along the line of the drips to supplement the primitive wooden troughs, hollowed out from *Cussonia* logs, which had been left in position by the long departed previous residents of the hills. In addition there were two 60 gallon drums now full to the brim, and by keeping these filled daily our water supply was assured.

Arrived in camp, the tents were erected and stores stacked along the sides of a large thatched " banda " which the advance porters had erected. This was to be our " home " for the next month, and very comfortable we found it, except when the wind blew strongly and the moisture-saturated mist descended on the camp, as it did almost every night, soaking everything, including bedding and clothes. One's clothes, kept in a suitcase, became damp and mildewy.

Still, this was all part of the fun. The night temperature was often round about 45°, and with the damp, it was decidedly chilly; six blankets and a hot-water bottle were often needed.

For these minor discomforts, there were many compensations; the view from the camp on a clear morning was magnificent; on the east one overlooked the Kibwezi plains toward Mutha and the Yatta plateau, on the west, the Laitokitok plains with Kilimanjaro towering in the distance. Very often, just after sunrise with the camp bathed in brilliant sun, the surrounding plains would be shrouded in a thick white blanket of clouds. We knew then that within a very short time these clouds would rise, and be blown in both directions upward on to the Chyulu hills and these in turn would be obscured for perhaps three hours before the sun penetrated through.

The northern and central portions of the Chyulu range present many interesting features. Broadly speaking the range here consists of a central ridge of volcanic cinder cones rising to 6,000 odd feet with subsidiary series on either flank. The slopes of these volcanoes are grass clad on the outer side, and within the craters are patches of forest of varying extent. Very few of the craters were devoid of forest. At intervals between the main craters and the outlying series are considerable lava flows; some

almost flat, others with a gentle slope; others again in terraces. On some of the larger and lower lava flows at 4,000 feet considerable cedar forests were a feature.

On some of the larger cones, where disintegration and erosion had taken place, pure stands of *Catha edulis* occurred and alongside these, previous occupants of the foot-hills had developed their sugarcane and banana shambas. Many of the craters descended to 400 and 500 feet and more, and where these were forest clad, one could look across from one side of the forest to the other.

The forest patches varied in size from an acre to more than sixty in extent. In some cases the trees had overflowed the crater rim, so to speak, and had crept along the outer side of the lip, but in such cases the trees were usually somewhat stunted owing to the very strong and ever-present wind. Also, one might note in passing that periodical grass fires were definitely instrumental in restricting forest growth. There was evidence on many sides that this had been the case, particularly with the northern and central portion with which we are now dealing. The presence of forest growth within the craters appeared to be dependent on the extent of surface weathering and disintegration of volcanic cinder, combined with moisture, resulting in a gradual silting up of the crater sides.

It is a remarkable fact, as yet unexplained, that many of the craters did not have large trees growing in the bottom of the depressions. It has been suggested that this might be accounted for by the presence of a volcanic core or plug of lava on which no depth of soil existed. Actually, an examination of such a base by means of a soil drill, showed greater depth of soil and humus in the base than at the sides or lip. The problem is still one of the unsolved riddles of the hills.

One very large crater, measuring over 400 feet in depth and shown on the map of the northern portions of the range prepared by Messrs. Champion and Hitchens, as the "bare crater," contained no forest; merely a few *Erythrina* trees around which *Leonotis* and *Vernonia* had grown. This lack of forest growth is another unsolved riddle. An adjacent crater, known as "Giant Crater," over 500 feet deep, contained cedar on its western slopes, stunted tree growth on its southern aspect with sheer cliffs and a bare "scree" on its north-west aspect.

Taken as a whole it can be said that each crater was forested. An interesting fact was noted that most of the northern and central craters has a break or depression in the lip or wall toward the south-east. It has been suggested to us that this might be due to the prevailing wind blowing strongly during the process of eruption and thus causing a heaping up on the far side and

a denudation of lava ash on the exposed side. This appeared a feasible explanation until one noted that on the southern portion of the range, these depressions were west, south and east. Did the wind change?

During the first two months of our stay on the hills, the rains were on, and as a result, flowering shrubs and herbs were at their best. With the exception of the *Erythrina* and *Cussonia* which are deciduous, the forest trees were ever-green; mist and rain fed, they had developed in the sheltered craters and proved a most interesting study.

Apart from the actual collecting of natural history specimens attention was given to the general geological formation and topography, for undoubtedly these were important factors in any attempt to work out the ecology or general inter-relationship of the species to soil, vegetation and altitude.

In these respects we were fortunate in interesting Messrs. Champion and Hitchens who between them carried out a topo-survey of the north end of the range and studied its geology. Unfortunately these gentlemen were unable to devote more than ten days to the work and the data collected by them was augmented by additional material and bearings carried out by myself during June and July. We now have a sketch map which shows the general topography of the entire range.

The first month was devoted to a study of the northern portions of the range; and toward the beginning of May, Mr. and Mrs. Bally and Turner moved camp and worked the central portion of the range. This was a useful preliminary to the investigation of southern portion. This last section of the hills presents some pretty problems, for in this we find the greatest development of forest growth, mostly on the western side, and at the same time it is at the bases of these higher volcanoes that one finds the most recent evidence of volcanic activity as indicated by vents, blow-holes, and immense lava flows with terraced and parallel lava extrusions more particularly between the main range and the southern Chyulus. As a whole, the eastern aspect of the south end of the main range is more precipitous than either north or central, and there is a lack of any subsidiary line of cones or hills, thus the main ridge slopes steeply to the plains for more than 4,000 feet. These slopes are deeply scored by raised lava ridges with deep gullies in between; many of them showing considerable erosion. In these erosion trenches there is evidence of wearing by water-flow for the cinder and lapelli covering is slight, in many places entirely washed off, so that the hard lava lies just below a sparse covering of dwarf grass. The storm water must here drain off

rapidly. Between the main ridge and the last of the subsidiary cones on the eastern aspect is a wide lava flow deeply scored in the middle where two adjacent lava beds have made contact. In this drainage channel commencing forest has sprung up, limited almost entirely to *Erythrina* at the upper portions, it widens out into mixed forest which eventually makes contact with a considerable patch of similar forest on a large lava flow at the foot of the hills. It is along this chain of gradually extending forest that such species as *Papilio dardanus,* and *Amauris niavius,* entirely absent on the north and central portions of the hills, have extended upwards. It is also along such natural chains that certain species of plains insects and birds have crept up.

So much for the eastern aspect of the southern end of the range. We must now digress and describe the approach to this section, via the plains, carried out by Mr. MacArthur and myself from the old Masongaleni-Noka road. This track is now overgrown and much broken up, except for a narrow path already referred to as going to Taveta. I would certainly not advise anyone to take it unless he has urgent business that way. After the first 15 miles it passes over some of the roughest lava flows I have ever met with. Huge blocks of lava clinker, covered with either lichen or stunted forest growth, ran in parallel lines for miles. Their abrasive qualities had to be experienced to really be known. Nevertheless, through such places one noted recent tracks of elephant and rhino; how they move over such ground is a marvel. Emerging from this rough going one enters portions of rising ground with forest growth of fair proportions, and in the valleys were evidence of previous cultivations. These old shambas were now densely overgrown with every imaginable sort of thorny scrub up to eight or ten feet high, and impassable except by cutting one's way through. I certainly think this portion was far more difficult to traverse than were the lava beds. We had counted on finding water in a rock pool at Noka (a solitary gneiss outcrop), which was our objective for the first day's trek, but on arrival late in the afternoon, we found that the elephant and rhino had been there before us and not more than a gallon of very brackish water remained. That night we went short rationed, cheered by the thought that at our next camp there would be water from two giant fig trees in the forest. The first four miles next morning were hardly less trying and tiring than that of the day previous, but we cut our way through, doing about a mile an hour. This part over, the track began to rise over wide lava terraces on which the dominant trees were a species of *Strychnos,* spaced so regularly that it gave one the impression of an immense planted apple orchard.

The going was certainly better, but the lava worked havoc among the porter's feet. At length we reached the main lava flow which separates the south end of the main Chyulus from the Southern Chyulus. Here were lava ridges running in parallel series in a south-easterly direction, with every degree of extrusion from a mere ridge to cones and blow-holes twenty and thirty feet high and of comparatively recent lava. Some were entirely bare, others were crowned with *Candalabra Euphorbias* and other succulent plants.

Here also were the famous lava domes three to ten or 15 feet in diameter, with thin crusts of lava covering a vent. On opening up some of these one noted that the inner surface of the crust was blued, and many of the holes went sheer down into pitch blackness and if a stone was dropped down one could not hear it touch bottom. Alongside some of these blow-holes were parallel lava pipes, exposed along the top, like badly-laid drain pipes, completely hollow and perforated toward the end. Some of the lava extrusions from these vents were of the twisted rope formation; others in " drop " formation as though the viscid lava had been forced up and through a series of openings and had " set " or solidified on cooling.

It was a most interesting spot but hard going. Arrived at the site for the camp, we next went in search of the water trees in the forest nearby. Again our luck was out; one tree was split as by lightning, and the other had rotted at the base and no longer held any water. We were thus rationed to one cup of water each; our only hope of water was at Campi-ya-Simba, some ten miles off on the Taveta track. This pleasant little tramp we reserved for daylight next morning. All available receptacles that might hold water were collected over-night, and two porters were assigned to each, with orders that at day-break they were to start. It was not until 2 p.m. that afternoon that we had our first real drink since leaving the dam on the Masongoleni track. The tramp to Campi-ya-Simba was not without interest, for one was thus able to study the formation of the Chyulu hills from the south-western aspect.

The main lava flow stops short of the narrow neck between the last of the main volcanoes of the Chyulus proper and the semi-circular series of cones forming the Southern Chyulus. A patch of thin forest slopes down out of the crater on the last hill and runs into a steep-sided valley, and this is succeeded by a double lava terrace; the first with a gradual slope and then more abrupty downward to the Masai plains where the lava is turned south-west by gneiss outcrops. Many of the gneiss outcrops stand sheer out of the plains and form a distinctive feature of the area. The Taveta track crosses and recrosses a considerable lava flow, some

of it covered in tree growth, but much entirely bare except for lichens and a few succulent plants. The north-western margin of the flow is abrupt and defined and stands well above the plains and it is on this side that the famous Italweni " blow-hole " exists. This hole is of immense size with precipitous sides descending some thirty to fifty feet with a cavern at one end, and here, natives coming to and from Taveta take shelter for the night. The cavern is capable of accommodating about 80 individuals. Another feature of interest is a volcanic cone with a perfect rim; the interior is sparsely grass grown and its outer slopes are thickly covered with grass which ends abruptly at a wide ring of volcanic clinker varying from twenty to sixty feet in width. Many of the lumps are over a foot through and lie piled on top of each other in a rugged wall; it is entirely devoid of vegetation. Beyond this belt, a tangled mass of creepers and stunted trees and masses of coarse lichen merge on to the plains. The western aspect of the first southern Chyulu hill is covered with a pure stand of *Catha edulis*. This tree is of particular interest for its leaves, bark, and roots contain an invigorating substance which is valued by natives, Somalis, and Indians. The leaves and roots are chewed and report has it that on a long safari no sense of fatigue is felt; furthermore, elderly folk who would otherwise be unable to do a journey are buoyed up by chewing these leaves and suffer no ill effects from the exertion of the safari. While we were in residence at Camp 1, a party of old men and women passed through and each was carrying a bunch of these leaves from which they took a bite as they went along.

We were dead beat when we got back into camp from the Italweni track, but having obtained a supply of water for the next lap toward the hills at 6,500 feet we felt more contented, and we counted on finding water again at our next camping site, water which we knew would have to be brought from Camp 2, somewhere about the centre of the range. Our luck was out, for late that evening two of our old porters turned up from Camp 2 with a note to say that this camp was about two days' march from where we now were, and that the water supply was anything but sufficient. The position was serious and after talking it over we decided to push on and establish a camp on the highest ridge of the south end, yet within reasonable distance of Camp 2 on which we were dependent for water supplies. We agreed to cut down our porters to a minimum, retaining six for future water-relay purposes and the remainder to return to Masongaleni in one lap. The water we had was divided into two portions sufficient for one day for both parties. We shifted camp soon after daybreak next morning taking only such loads as were necessary for future collecting; our food supply was nearly exhausted for we had reckoned on making contact with Camp 2 without difficulty.

There was no known track from the Italweni lava flow up to the hills so we took the most direct line which meant a steady rise of 2,000 feet in little more than two miles over loose volcanic gravel where a false step meant a downward slide of several feet. At the end of three hours, the porters were nearly done in, in spite of changing loads every half hour, and we had as yet covered only half the distance, so a halt of half an hour was called. The going was extremely difficult and we agreed to march for one more hour and pitch our camp wherever we happened to be. We were then about 1,000 feet below the forest edge. Scanning the upper slopes with binoculars we noted what appeared to be a track and made for this point. It turned out to be an old buffalo trail which ran along the hill side and it was surprising how easy the gradient was, and had we known it, this track ran almost the entire length of the southern hills and entered the forest beside which we had pitched our camp the previous day some half a mile higher up. We eventually made the forest edge at the lip of an immense crater and here the porters off-loaded, not without sighs of relief. While the tent was being erected our small supply of water was divided between the porters, leaving about four gallons which had to last at least one more day between eight of us. We had a bite of food, washed down with tea and then MacArthur returned with the balance of the porters and empty water tanks to the Italweni camp and so on to Noka and the Masongoleni road dam, promising to send up posho and water as soon as Kibwezi was again reached. Contact with Camp 2 was made the next day, the porters carrying an S.O.S. for water and posho. The following day Bally turned up, having taken four and a half hours between camps, travelling light, via the lava flows at the base of the hills. We discussed the water problem and figured out that water would have to be carried roughly fifteen miles in two relays each day, from Camp 1 in order to supply just sufficient for cooking purposes. It was thus impossible to close down Camp 2 and transfer all activities to the southern hills, for it had to be maintained as a forwarding centre. A brief reconnaissance of the possibilities of Camp 3 made it amply clear that this southern end must be worked; the miles of the Great Chyulu Forest lay before us, as yet untouched. In the two days I had already spent at this spot, several birds unrecorded from the north and central forests had been obtained; insects and flowers not hitherto met with were here in abundance; and a general survey of the southern end of the range had to be carried out.

Food, water, and a redistribution of the porters for relay purposes were the problems to be faced. We ultimately fixed up a working arrangement which would ensure a bare sufficiency

of water amounting to eight gallons every two days for 10 persons; certainly not much, and washing, baths, and even shaving became things of the past. We finally arranged that Turner should remain on in Camp 2 to supervise the water arrangements, while Bally and Mrs. Bally joined me at the southern camp. The distance between the two camps, although only about six miles in a straight line, was nearer 11 by the route Bally had taken, which meant a four and half hours trek, so my first endeavour was to cut as direct a traverse through the great forest as was possible, and by keeping to the higher ground we eventually had a line of communication of two and a half hours' walk. In this work we were assisted to an enormous degree by making use of buffalo trails, for these forest animals, far from being a nuisance, gave us the line with the best gradients and thus fairly easy going. These buffalo tracks are wonderfully graded, and we very soon found that they had regular paths throughout the forest of which we availed ourselves on many occasions. In order to facilitate collecting and to avoid the persistent wind which blew strongly and most unpleasantly, I shifted my camp to a sheltered spot at the edge of the high forest at 6,500 feet.

Here we erected a substantial " banda " as a work room, and having got thoroughly settled in we commenced a thorough survey of the great forest which extended for miles below and above us. From this camp we obtained a wonderful view of the immensity of continuous forest growth, which, measured as one block was roughly five miles by three to four, of splendid timber, with large blocks of outlying forest to the south and west. The highest Chyulu peak, covered in dense forest, rose to 7,200 feet in the centre of the biggest block. In order to obtain a general idea of the contents of the forest, both botanically and faunistically, and to facilitate topographical work, we cut traverses in several directions. From these cuttings we were able to appreciate the fact that this now immense forest had originated, as was the case in the northern section, as crater and valley forests which had, because of its sheltered position, extended and become confluent and gradually merged into one more or less huge block. I personally visited all the high ground within the forest and explored each of the craters which were now densely wooded. It was a noticeable fact that most of the highest points carried a pure stand of a large leafed Croton and in cutting traverses on high ground, the presence of this species indicated that one was nearing the top of the cone. The whole of the forest floor was damp, being drenched almost nightly by heavy mist and dew, and the rotting vegetation and humus formed a carpet in which ferns and ground orchids abounded. The wettest portions of the forest were those on the western aspect of the hills. Here

the trees were laden with mosses and ferns and were dripping wet all day long. In these forests we obtained six species of birds which were not recorded previously, and others which were distinctly scarce in the central forests were here abundant. The beautiful mauve-tinged ground orchid *Calanthe volkensii* grew in perfection and literally carpeted the forest floor in places, whilst giant ferns (not tree ferns) with fronds over ten feet long, relieved the dominant *Piper* undergrowth in large patches. Many of the forest trees grew with straight boles to over 100 feet from a girth of 7-8 feet.

This Great Chyulu forest is a good example of an evergreen mist-forest. The main portion, seen from above, gave the impression of being in a huge basin with high sides, with here and there lesser hills entirely forest clad within the basin. The eastern rim, devoid of forest on its outer aspect, sloped steeply to the Kibwezi-Masongaleni plains, while the western rim, which was forest clad, sloped more gradually to the Masai plains. These high forests were intensely cold even at mid-day with the sun shining brightly.

Within the forests buffalo were numerous; two herds 20 and 25 strong roamed the forest below our camp and emerged on an mbuga or open grass-covered flat at the edge of the forest, morning and evening. Solitary bulls were not infrequently encountered during our tramps through the heavy forest undergrowth. Leopards and forest pigs were seen and heard; Sykes monkeys were in large troops, whilst at night galagoes cried until the early morning. Tree hyrax were present but seldom seen. More than once, serval cats were put up in the long grass on the eastern slopes. Reedbuck were noted in twos and threes on the higher exposed grassy slopes on the eastern face; Eland, Greater Kudu, Kongoni, and an occasional Duiker were seen in the grass lands between the main ridge and the outlying cones of the central portions, on the eastern side. An occasional Lion was heard and twice animals killed by them, a Buffalo and a Reedbuck, were found. At the northern end a solitary Giraffe visited Camp 1. The forest Pigs were of an enormous size, but we were unable to ascertain the species. At many places along the edges of the higher forests at 6,800 feet we noted areas where they had been routing amongst the herbage.

For purposes of taking bearings and observations, every high point in the southern portion of the range was visited by means of forest traverses, every foot of which we had to cut through thick and soaking undergrowth. Hardly any rain fell during the last six weeks on the hills, yet the forests were kept saturated by mist and heavy dew. Bearings were taken right through to the second camp just north of which Hitchens and Champion had

carried out their final observations and established beacons. Working back from these and other fixed points we were able to produce a sketch map which shows the general topography of the entire range. These bearings, supplemented by panorama photographs, give one a good idea of the general formation of the hills.

Two special visits were paid to the highest ridge of the range, 7,200 feet, which, as I have already mentioned, was densely forest clad. On the first occasion we checked up this point with observations and bearings taken at various northern and southern beacons; subsequently it was worked botanically and faunistically. One particular feature, from a botanical and faunal point of view, was of great interest. The top of the ridge consisted of a narrow gently rising plateau not more than forty to fifty feet wide, on the sides of which giant trees, *Cornus volkensii*, grew in the form of a great natural avenue, with their branches almost meeting overhead. Along this avenue were Buffalo paths leading to the highest point and here the beasts had trampled down the vegetation into two large " bomas " in which obviously they spent a considerable portion of the day. On both visits Buffalo had been in recent occupation as fresh dung was present on all sides. From this ridge, the ground slopes steeply east and west and on the south-western aspect is a very deep crater now densely forested, which had formerly supplied much of the lava now lying below the floor of the Great Chyulu Forest.

It can be safely assumed that the forest growth at the southern end is the result of greater moisture and shelter as a result of the general conformation of the range, though with the limited time at our disposal we were unable to obtain evidence that it was any older than that of the north end. It would appear from such evidence as we obtained that the main ridge of volcanoes of the south were subjected to less general tectonic activity than those of the north and that subsequent to the throwing up of the main ridge, subsidiary activity was limited to the bases of these main cones. In the meantime the weathering and disintegration of the lava, assisted by the heavy deposition of moisture in this area, produced a soil on which tree growth was more readily established than was the case in the north.

Throughout our residence on the south end heavy banks of mist were continually carried on to the hills from a south-westerly direction, in fact, it often happened that the higher points of the forest were entirely mist covered up to noon. No cloud or mist was driven up from the east, and as already mentioned, this aspect of the range was more or less clear of forest growth except in the sheltered craters.

During the last month or six months on the hills we were short rationed for food and water and tobacco, but the abundance of material and data collected amply repaid us for any hardships.