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RORAIMA

REPORT OF THE 1971 BRITISH EXPEDITION

TO MOUNT RORAIMA IN GUYANA, SOUTH AMERICA



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by Adrian Warren

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REPORT OF THE 1971 BRITISH EXPEDITION
TO MT. RORAIMA IN SOUTH AMERICA

by

ADRIAN WARREN, B.Sc., F.R.G.S.

Leader

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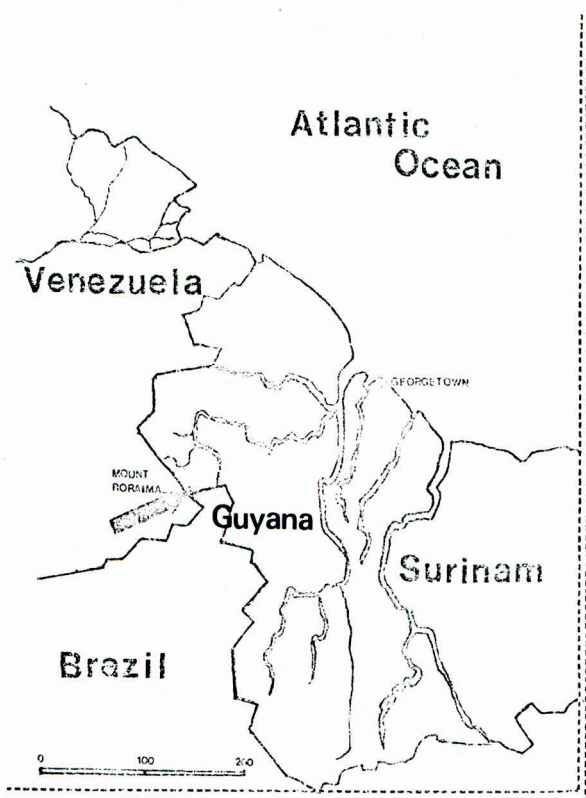
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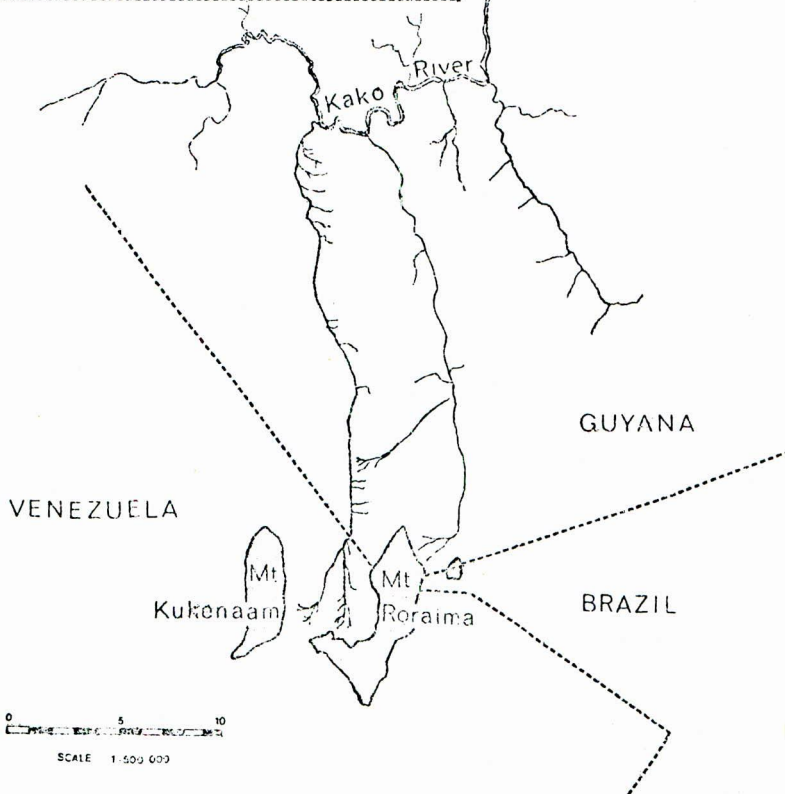
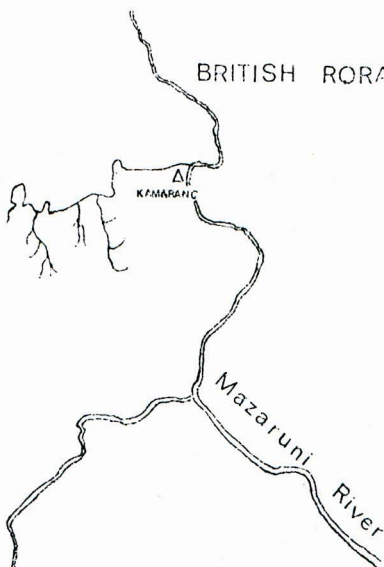


MOUNT RORAIMA

Mazaruni Area, GUYANA

BRITISH RORAIMA EXPEDITION.

Jul - Sep. 1971.



INTRODUCTION

Roraima is an extraordinary, flat-topped sandstone mountain, the most remarkable of a very remarkable group of similar plateau formations which stand in the sandstone region of Guyana and the Gran Sabana of Venezuela. It is situated exactly at the point where three countries, Venezuela, Guyana, and Brazil, meet. Completely encircled by sheer cliffs between 1,200 and 1,500 feet in height the rough but approximately level summit, which is about twenty-five square miles in area, is at an altitude of 8,600 feet and the highest point is 9,094 feet above sea level. The summit is almost entirely devoid of soil, vegetation, and animal life, but those plants and animals which do exist there are of great interest. The remnants of a volcanic sill whose slopes reach outwards and downwards for between five and ten miles support the sandstone beds of the upper precipitous part of the mass. On the southern side of the mountain, the cliffs are at their lowest and the slopes merge with the upland savannahs of Brazil and Venezuela at about 4,500 feet. On the northern side the cliffs are composed of two vertical drops each of an estimated 1,200 feet and the slopes merge with the forests of the Mazaruni drainage system at about 3,500 feet. From the summit of Roraima, leaping down the enormous cliffs, spring various cascades and falls,¹ the sources of rivers which flow apart to swell the Orinoco, Essequibo and Amazon rivers.

But these facts convey very little of the atmosphere of this wonderful place. The majestic cliffs of Roraima are often shrouded by cloud and swirling mists for days on end, particularly in the wet season. Sir Robert Schomburgk, one of the first fortunate enough to have seen Roraima wrote:

Before sunrise and half an hour after, Roraima was beautifully clear, which enabled us to see it in all its grandeur. Those stupendous walls rise to a height of 1,500 feet. They are as perpendicular as if erected with a plumb-line; nevertheless in some parts they are overhung with low shrubs which, seen from a distance give a dark hue to the reddish rock. Baron von Humboldt observed that a rock of 1,600 feet of perpendicular height has been sought for in vain in the Swiss Alps, nor do I think that Guiana offers another example of that description. A much more remarkable feature of this locality, however, lies in the cascades, which fall from this enormous height, and, strange as it may appear, afterwards flow in different directions into three of the mightiest rivers of the northern half of South America, namely the Amazon, the Orinoco, and the Essequibo . . . for these wonderful cascades Roraima is famed among the Indians who in their dances, sing of the wonders of 'Roraima, the red rock, wrapped in clouds, the ever fertile source of streams . . .'. I can imperfectly describe the magnificent appearance of these mountains. They convey the idea of vast buildings and might be called Nature's forum.

The flora of Roraima is of quite unusual beauty and interest; and it would be easy to fill many pages with quotations expressing the delight of the two Schomburgk brothers and of Karl Appun, another early visitor to this district, concerning the vegetation, when

¹ Angel falls, generally attributed to be the highest falls in the world, are to be found in the same group of mountains.

almost every plant they met with was new, or peculiar in nature. However, none of these three had ever seen the Kaieteur savannah, some distance to the east, on the same sandstone tract, otherwise they would have realised that the very peculiar and characteristic flora of the sandstone of Guyana is not necessarily restricted to the neighbourhood of Roraima as they had imagined, although it is true that it is on Roraima itself that the peculiar nature of the flora attains its greatest development. This is, of course, due to the fact that Roraima is the highest point above sea level and is always surrounded by a very moist atmosphere. To this, especially, is due the extraordinary development of the fern flora on Roraima; Appun made a rough estimation that at least 200 species of ferns grow on the mountain and that of these probably fifty per cent are peculiar to it. Tree ferns and filmy ferns, not conspicuously abundant elsewhere in Guyana, seem to form the most prominent vegetation about Roraima. Abundant too are palms and orchids, many of them certainly peculiar to this district. Also worthy of note are the *Befarias* resembling the heather of colder climates and the large pitcher plant, *Heliamphora*, which in places is so abundant as to form a thick carpet over an extensive area.

As with the flora, so with the fauna. Indeed, in the last half of the 19th century, much interest was aroused when it was suggested that life on the summit of Roraima, having been isolated from the rest of the world, may have been suspended in its evolutionary development. It was believed possible that prehistoric forms of life may exist on the mountain. Sir Joseph Hooker in 1884 expected that a careful examination of the top of the plateau would afford some interesting results and considered it probable that the flora would be different from that of the plain and similar to that which existed in 'old time'.

Will no one explore Roraima and bring us back the tidings which it has been waiting these thousands of years to give us? One of the great marvels of the mysteries of the Earth lies on the outskirts of one of our colonies—British Guiana—and we leave the mystery unsolved, the marvel uncared for. . . . (*The Spectator*, April 1877)

The idea of dinosaurs and pterodactyls inhabiting the isolated plateau lived on in peoples' imaginations, giving Mount Roraima an aura of mystery and romance. It was at about this time that Sir Arthur Conan Doyle wrote his famous novel, *The Lost World*. Rumour has it that he would often frequent the Royal Geographical Society building, then in London's Savile Row, and there are certainly many passages in his book which are mirrored in the accounts of the early explorers in the Geographical Journals. The fauna, though scant, consists of a number of interesting and peculiar forms. Of mammals, a small rodent, *Rhipidomys macconnelli*, was described by de Winton in 1900 and named after the collector as a species peculiar to Roraima. Of birds, *Zonotrichia macconnelli* is quite distinct from the ordinary *Z. pileata* which is found over the greater part of Central and South America, being larger and darker. Of amphibians, the genus *Oreophrynella* appears to be endemic to the mountain. Two species have been described: *O. quelchii* from the summit and a distinct form which has recently been questioned as to its status as a different species, *O. macconnelli*, from the talus forest around the base of the mountain. It is also possible that the microhylid *Otophryne robusta* is endemic to these mountains.

The difficulties of reaching Roraima today are great, for although it is the fruitful mother of rivers, the district has no large river to provide an easy approach route, and the many and abrupt mountains of the region, together with the scanty Indian population, offer no easy means of travelling on foot. Before the days of the aeroplane, Roraima must have been even more remote, especially when food has to be carried to support a lengthy journey.

The majority of the early visitors travelled up the Mazaruni on the north side, or the Rupununi on the south side, but these travellers were forced to leave their boats at points far distant from the mountain and to continue on foot. On the northern side the dense forest and the rivers which would rise ten feet overnight after a heavy fall of rain, flooding large areas of the forest, became successful deterrents to any exploration of the area and examination of the northern cliffs for possible access to the summit was limited to distant views. Moreover, no Amerindians, employed as porters or otherwise, would venture near the mountain from the north. The mountain is a magnet to rain and the forest is consequently wet and lush, and the tangle of vegetation makes it very dark. Thunder would reverberate and echo off the cliffs, frightening the Indians, and there is little game to be killed for food. Basically this place is a very inhospitable one even for an Indian.

Even in the south, where the country is savannah, and is thus easy for movement, there were difficulties. The area is sparsely populated by Indians, due to the lack of game, and the distances to be travelled on foot are great, especially when it was necessary to carry the large stores of provisions to last a journey of many days along mountainous and, even to the Indians, little known paths.

Whichever route was chosen, a journey to Roraima by an expedition beginning from the Guyana coast could take three months there and three months back.

HISTORY OF EXPLORATION

Up to the time of the explosion of interest in Roraima in the 1880s, few had ever seen Roraima, and it is not surprising that it became a 'mystery mountain'.

It is possible that Sir Walter Raleigh was the first white man to see Roraima. In his *Discovery of Guiana* he wrote:

I was enformed of the mountain of Christall, to which in trueth for the length of the way, and the evil season of the yeare, I was not able to march, nor abide any longer upon the journey: we saw it a farre off and it appeared like a white church towre of an exceeding height. There falleth over it a mightie river which toucheth no part of the side of the mountaine, but rusheth over the top of it, and falleth to the ground with a terrible noyse and clamor, as if 1,000 great belles were knockt one against another. I think there is not in the world so strange an overfall, not so wonderful to behold. Berreo told me it hath diamondes and other precious stones on it, and that they shined very farre off: but what it hath I knowe not, neither durst he or any of his men ascende to the toppe of the saide mountaine, those people adjoyning beeing his enemies and the way to it is so impassible.

At the end of 1835, Sir Robert Schomburgk, under the auspices of the Royal Geographical Society, was exploring the then almost completely unknown interior of British Guiana. He ascended the Essequibo and Rupununi rivers and spent a considerable time in the neighbourhood of Pirara, an Indian settlement not far from the Rupununi river, where he heard accounts of a remarkable mountain to the north-west. In 1838 he returned to Pirara and set off to the mountain, eventually viewing Roraima from the south and south-east. In 1842 he again visited Roraima, this time with his brother Richard. Richard subsequently wrote an account of the plants found during the trip. The mountain was again viewed only from the south and south-east, and the summit was pronounced 'inaccessible'.

The next visitor to Roraima was Karl Ferdinand Appun, a German botanist, who, in 1864, remained in the vicinity of the mountain for nearly a month. He reached Roraima from the Mazaruni and the Kako with a long journey on foot from the headwaters of the latter river. He examined the mountain from the eastern and southern sides, and, presuming the vertical cliff to completely surround the plateau, also pronounced the summit 'inaccessible'.

In 1869 Charles Barrington Brown, employed by the Government in making a geological survey of the colony, visited Roraima by the same route as the Schomburgks. From Pirara, it took him nine days' walking across the savannahs until he was able to see Roraima and a further eight days before he was able to ascend the mountain almost to the base of the vertical cliff at the south-eastern corner. Then, through want of provisions, the same factor which forced the Schomburgks and Appun to return, he had to make all speed for Pirara. In 1872 Barrington Brown gained a very distant view of Roraima from the north-east, when he ascended the Mazaruni river. He pronounced the summit 'inaccessible, except by means of balloon'.

Messrs. Flint and Edgington were the next visitors to the region, in 1877. They had worked in the interior of the colony for some years, and approached the mountain from

the Rupununi savannahs, a journey which took eighteen days. They too were driven back for want of provisions, and later also pronounced the summit, in all likelihood, to be inaccessible.

In the following year, 1878, Messrs. McTurk and Boddam-Wetham visited the mountain by way of the Mazaruni rivers and the savannahs of the west, finally approaching the southern cliffs. They also examined, though at a distance, the northern face. They pronounced the summit inaccessible from either side and, from the northern face (surrounded as it is by dense forest) to be even unapproachable. Boddam-Wetham wrote:

... it only remained for us to see what we could of the western side. Of this flank we could only get glimpses (from the southern savannahs) by returning towards Kukenaam and from savannah hills, thus obtaining a view up the dividing valley. Owing to the clouds which almost invariably filled the gorge, it was seldom that we could enjoy a satisfactory view; but what we did see only convinced us that the western side was a repetition of the others.

Three years later, an enterprising young orchid collector, Mr. David Burke, visited the mountain by way of the Mazaruni and viewed its north-eastern side. He did not pronounce the mountain either accessible or inaccessible.

Between the years 1879 and 1884, Mr. Henry Whitely, a successful ornithologist, spent some time in the neighbourhood of Roraima. On the subject of reaching the summit of the mountain Mr. Whitely wrote:

It seems impossible to ascend either Kukenaam or Roraima except by balloon and this could only be done from the south side, on account of the strong wind constantly blowing from that direction. It might be possible to ascend by forming scaffolding, making use of the timber of the large forests on the slopes, but in this case it would be a work of great time and expense. A solitary traveller would, perhaps, be able to obtain a sufficient supply of provisions, but a large party would be forced to bring everything for their sustenance with them, besides perhaps encountering opposition from the Indians, naturally jealous of the advent of any large party of strangers.

He continues:

The scenery round Roraima is very grand; rain was constantly falling on Roraima and Kukenaam during the greater part of my stay in the neighbourhood, and for days together the mountains were enveloped by clouds; at times, when it cleared, waterfalls were observed coming over the edge of the cliff, and when the sun was shining, the deep red colour on parts of the vertical sides, standing out as they did from the sombre coloured forest on the lower slopes, was seen to great advantage.

Mr. Whitely describes in some detail his journey to the foot of the southern cliffs.

The savannah land at the foot of Roraima is covered with immense boulders and smaller pieces of sandstone. These have evidently at some remote time broken away from the face of the rocks and although I made inquiries amongst all the old Indians some of whom had been in the service of Sir Robert Schomburgk 40 years ago, not one of them had ever seen a part of the rock break away, and they told me that they must have fallen away ages ago, for they have no record of any such circumstance from the tales of their ancestors.

Mr. Whitely laboriously cut a trail through 'some of the densest underwood I have ever passed through' on the slope formed by rock breaking away from the mountain. At a height of 6,000 feet he met brambles and prickly bromeliads and eventually reached the

foot of the cliff at just over 7,000 feet.

Mr. Whitely observed, at a different place on the cliffs to that he visited, a spot where the vertical cliff had broken away to form a sloping ledge, and it seemed to him that an attempt could be made to reach the summit at this point, but his efforts to cut a trail through the talus forest to the base of the sloping portion of rock were unsuccessful.

In conclusion to his expedition, Mr. Whitely expressed some optimism in the possibility of reaching the summit by this sloping portion, in spite of the fact that a break exists about half way up. He suggested that the difficulty might be overcome with the use of ropes.

Siedel, who visited the mountain to collect orchids, arrived in February 1884. On his second visit in December he met up with Everard Im Thurn and Harry I. Perkins, assistant Crown Surveyor, who had arrived on an expedition sponsored by the Royal Geographical Society, the Royal Society, and the British Association, to make an all-out effort to gain access to the summit. Their route followed the Essequibo river and the Potaro river, as far as Chinebowie (now known as Chenapow), a large Patamona Amerindian village above Kaieteur falls. From here a long journey on foot took them across the Ireng river near Konkarmo, across the Cotinga river to the southern savannah side of the mountains.

Harry I. Perkins takes up the story:

The view from here is magnificent, as the village of Teruta is placed just in front of Roraima, giving a sight also of Kukenaam; it is situated on a high hill 3,751 feet above sea level, but is dwarfed by the gigantic walls of rock near it, Roraima being about four, and Kukenaam three miles from it. Each mountain seems like a huge impregnable fortress built on a mountain top 7,000 feet high with walls 1,200 to 1,800 feet in height.

The portion of Roraima facing Teruta is about four miles long, and of Kukenaam about the same. In wet weather, their summits are wrapped in dark clouds, and after the rain is over and the clouds have dispersed the water can be seen casting over the cliffs in splendid falls that only by being seen can be at all imagined. At a distance of four to five miles they look like delicate white threads against the dark background of sandstone rock. The two mountains are separated by a wide gorge, and in this clouds of dense white mist accumulate, and gradually creeping up as the day advances, enshroud their summits.

Roraima has not been seen on every side, the northwest at present not having been viewed by anyone, and it would perhaps be quite safe to say that no side but the south-western has been thoroughly scrutinized with a view to finding a means of access to the summit . . . and it is a curious fact that our ledge is on (this) the most easily approached side of the mountain.

Everard Im Thurn wrote:

After due examination, it appeared that there would be especially three points of possible difficulty to be met in making an ascent by the ledge. In the first place, that part of the forest slope which we would have to pass before reaching the foot of the ledge had as we then thought, never been penetrated by man and was of quite unusual density, chiefly on account of the great quantities of rampant bamboo which matted together the trees of which it was composed. A second difficulty, evident from below, was presented in the fact that the lower part of the ledge seemed much broken, and indeed appeared to be not so much of a continuous shelf but rather a shelf which had at some time been broken up into large masses of rock. The third and most doubtful point of all was where, some two-thirds up the length of the ledge, a considerable stream of water fell onto it from the summit of Roraima. This stream, falling on the

ledge, had eaten away, and made a deep gap, impenetrable to the eye from below. It certainly appeared that this might well be impassable; and our only hope was that we might just possibly be able to climb down into it, and up its further side and so on to the upper part of the ledge, which from that point to the summit of the mountain seemed accessible enough.

The path to the foot of the ledge once cleared, and all such observations as could be made from below having been completed, we still had to wait for a tolerably clear day on which we might make our first attempt to ascend with some prospect of success.

On Thursday, the 18th of December, came a bright morning. We found that the path to the foot of the ledge had been cleared only just sufficiently for us to pass, and that not without considerable difficulty. The ground was exceedingly slippery, in consequence of the heavy rains which had recently fallen; and this special difficulty was enhanced by the fact that much of the ground was occupied by a large flag-leaved *Stegilepis* which, trodden or cut down as we advanced, gave us many a fall, on account of the great slipperiness of the whole plant and by the big *Brocchinia cordylinoides*, the latter so densely placed that we had to walk over their tops, plunging and slipping about in the considerable quantity of water which each of these plants holds in its axil. Seldom, if ever, did we step on the real ground, but instead we climbed, hands and feet all fully employed, over masses of vegetation, dense enough to bear our weight, over high piled rocks and tree stumps and not seldom under boulders of vast size, up tree trunks and along tree branches, across the beds of many streams so filled with broken rocks that the water heard trickling below was unseen. Nor did the dense and universal coating of moss, filmy ferns, and lungworts, afford any but the most treacherous foothold and handhold.

It should perhaps before have been explained that what had appeared from below the broken part of the ledge really consists of three rounded spurs, or shoulders, running from a little way up the cliff down on to the ledge; and that these spurs are all wooded, though not so densely as the ground below the ledge, while in parts a few huge boulders stand out over the tree tops. These three spurs occupy about two-thirds of the ledge as seen from below; then comes the part of the ledge on to which the fall dashes from the cliff above. After that the shelf slopes gradually upward to the top of the mountain, its surface, as we saw it through the field-glasses, covered with rocks and low vegetation, its upper part passing behind a sort of false face to the cliff.

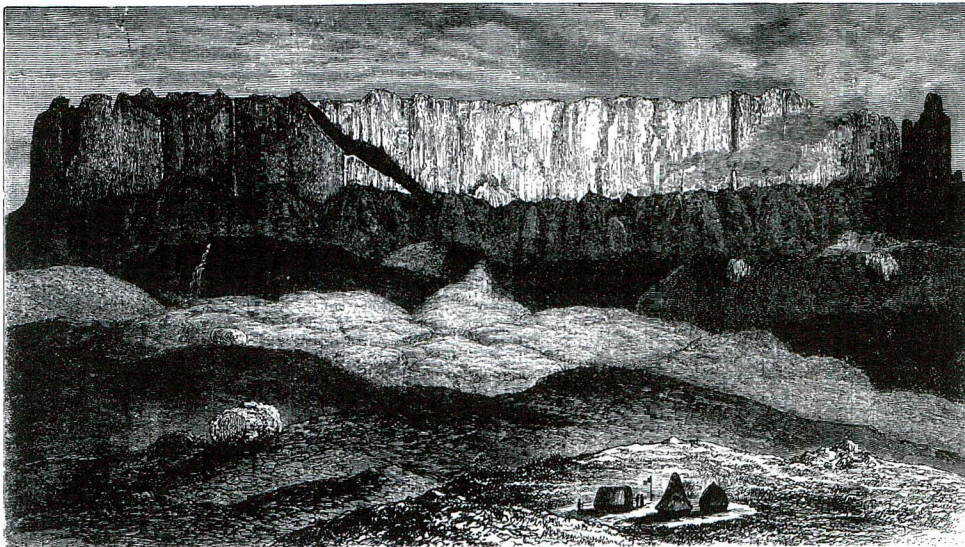
Im Thurn and Perkins made their way without too much difficulty round the three spurs and came to the point where the fall meets the ledge. There was a downward slope covered with tall coarse grasses then a gradual upward slope with no more apparent obstacle than slippery rocks.

On reaching the upper section of the ledge, it was found to be covered in a dense growth of *Brocchinia cordylinoides*, interspersed with a beautiful crimson flowered *Befaria* and the pitcher plant *Heliamphora nutans*.

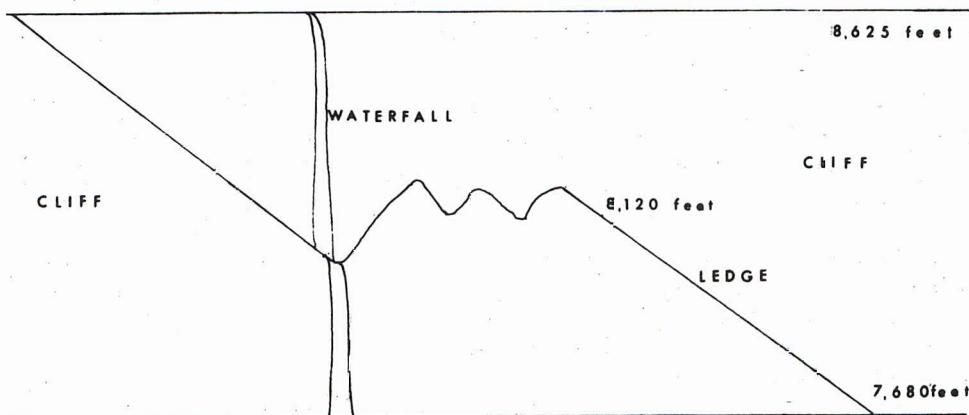
Im Thurn continues in his flamboyant prose:

Up this part of the slope we made our way with comparative ease till we reached a point where one step more would bring our eyes on a level with the top—and we should see what had never been seen since the world began; should see that of which, if it cannot be said all the world has wondered, at least many people have long and earnestly wondered; should see that of which all the few, white men or red, whose eyes have ever rested on the mountain had declared would never be seen while the world lasts—should learn what is on top of Roraima.

All around, on the summit, were rocks and pinnacles of extraordinary shapes; 'seeming to defy every law of gravity'—rocks in groups, rocks standing singly, rocks in



The south-east face of Rcrailma showing ledge of ascent. From a drawing by Henry Whately.



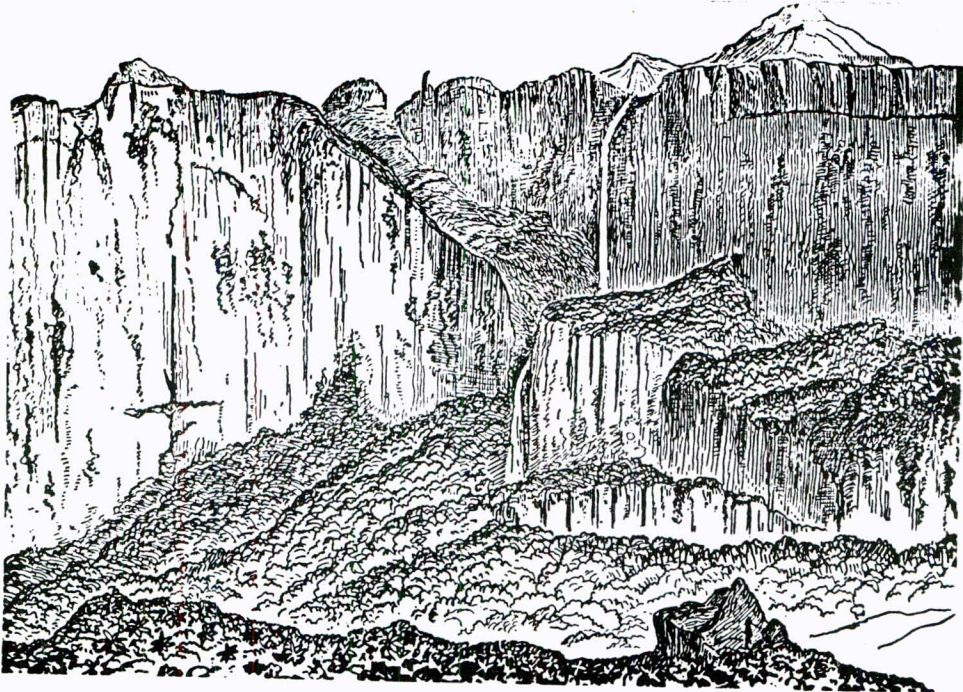
Approximate diagrammatic representation of the ledge. After C. Clementi.

terraces, rocks as columns, rocks as walls and rocks as pyramids, rocks ridiculous at every point with countless apparent caricatures of the faces and forms of men and animals, apparent caricatures of umbrellas, tortoises, churches, cannons and of innumerable other incongruous and unexpected objects.

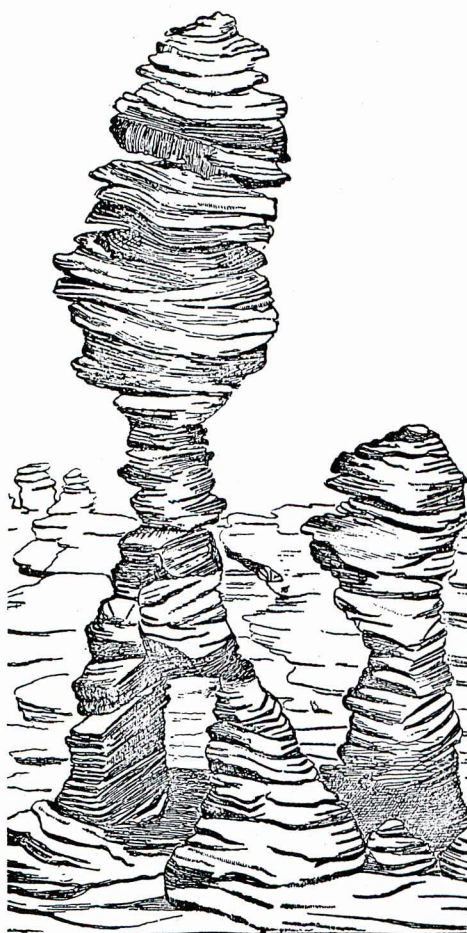
Between the rocks were level spaces of pure yellow sand, with streamlets and little waterfalls and pools and shallow lakelets of pure water; and in some places were little marshes filled with low scanty and bristling vegetation. Not a tree was there; no animal life was visible, or it seemed, so intensely quiet and undisturbed did the place look, ever had been there. Look where one would, on every side it was the same; and climb what high rock one liked, in every direction as far as the eye could see was this same wildly extraordinary scenery.

The result of Im Thurn's expedition was an increased scientific interest in this remote plateau. McConnell and Quelch made interesting zoological and botanical collections during two expeditions in 1894 and 1898. There were three expeditions by the Com. de Limites in 1900, 1905 and 1910; an explorer called Anderson made his way to the mountain via the Ireng river and Amokokopai. Another, one Koch Grunberg, arrived from the south by following the river Kukenaam in 1911. The Clementis, whose journey is quite well documented, came in 1915-16 by a prismatic compass traverse from Holmia, a settlement on the Potaro river above Kaieteur falls started by an old Swedish gentleman called Dr. Bovallius; crossing the Ireng river near Mataruka and from there an approximately direct route to Kamaiwawong, within striking distance of Mount Roraima. It is worth reproducing their account here:

On January 15 1916 we made the ascent of Roraima being most fortunate in having a cool grey morning whilst the mountains were still quite clear. There was a heavy dew on the grass and it was delightful walking up the savannah slopes. The path winds continually uphill over long grass with big boulders lying on all sides much as they do



South-east face of Roraima, showing ledge of ascent.



Rock pillars on the summit of Roraima

on Dartmoor tors, whilst the depressions are boggy and full of marsh plants. From Kamaiwawong to the brink of the forest was a steady three hours' walk with no halt and we reached the forest edge at 6,510 feet above sea level. Our guide introduced the place to us as 'English pappa banaboo'; and we thought he meant to indicate it as Im Thurn's camp of 1884.

The climb thru' the forest belt is the only disagreeable part of the whole ascent. The ground here is a pell-mell of huge boulders, over which grows a mass of small trees and magnificent tree ferns, rooting on the debris of earlier fallen jungle, which is covered with a carpet of slimy green moss and has a horrid corpse-like smell. The whole place is dank and cold to the last degree; and the moss makes it impossible to know whether one is planting one's foot on a piece that will hold or on a rotten tree branch, or on a mere covering of twigs and leaves over a chasm between boulders. This lasted two hours. After reaching the ledge the path is still in jungle for a little way but with the cliff rising sheer on the right. Gradually the ledge widens and the forest drops away, so that one gets a glorious view of the country spread out below like a great green sea. Lovely flowers abounded at our feet, and the air was like a tonic after the damp oppression in the forest. A troublesome feature of the ledge is that it has three V-shaped descents in it; these are very steep and we had to slide down, clinging on to

every root, bush or stone we could catch hold of. Getting up again was of course more difficult, and in the second place we used a rope. It could be managed without one save for the baggage, which must be pulled up. At the third dip the ledge passes under a waterfall, when after a heavy shower of rain doubtless a great deal of water comes down; but on this occasion it was practically dry. From this point the ascent is direct and steep and in three hours from the foot of the cliff we reached the top, 8,625 feet above sea level.

The summit is covered with enormous black boulders, weathered into the weirdest and most fantastic shapes. We were in the middle of an amphitheatre, encircled by what one might almost call waves of stone. It would be unsafe to explore this rugged plateau without white paint to mark one's way, for one would be very soon lost in the labyrinth of rocks.

Mr. Clementi mentions the cold, the temperature at 6.15 p.m. dropping to 51°F; and the shortage of wood to build a fire.

A fairly extensive expedition was led, in 1927, by G. H. H. Tate, of the American Museum of Natural History, which arrived by following the Cotinga river. A detailed

account of this is to be found in *Ecology*, vol. III, No. 3, pp. 235-257. Other expeditions include Henry Edward Crampton's in 1911, which came via Chenapow; Paul Zahl in 1938; Adrian Cowell, Adrian Thompson and an important expedition by the University College, Bangor, which in 1963 made the first ascent of Kukenaam. An account of their ascent is given here in some detail, partly because the 1971 British expedition would, if it had entered Venezuelan territory, have followed this route to climb Kukenaam; and partly because one of the purposes of this report is to accumulate knowledge of the mountains to aid those following in our footsteps.

Early in 1963, the Bangor expedition commissioned Harry Parsons, who was working in British Guiana, to fly round Kukenaam to make a thorough photographic survey. The photographs were encouraging, showing a broken region of cliff falling into the valley between the mountains.

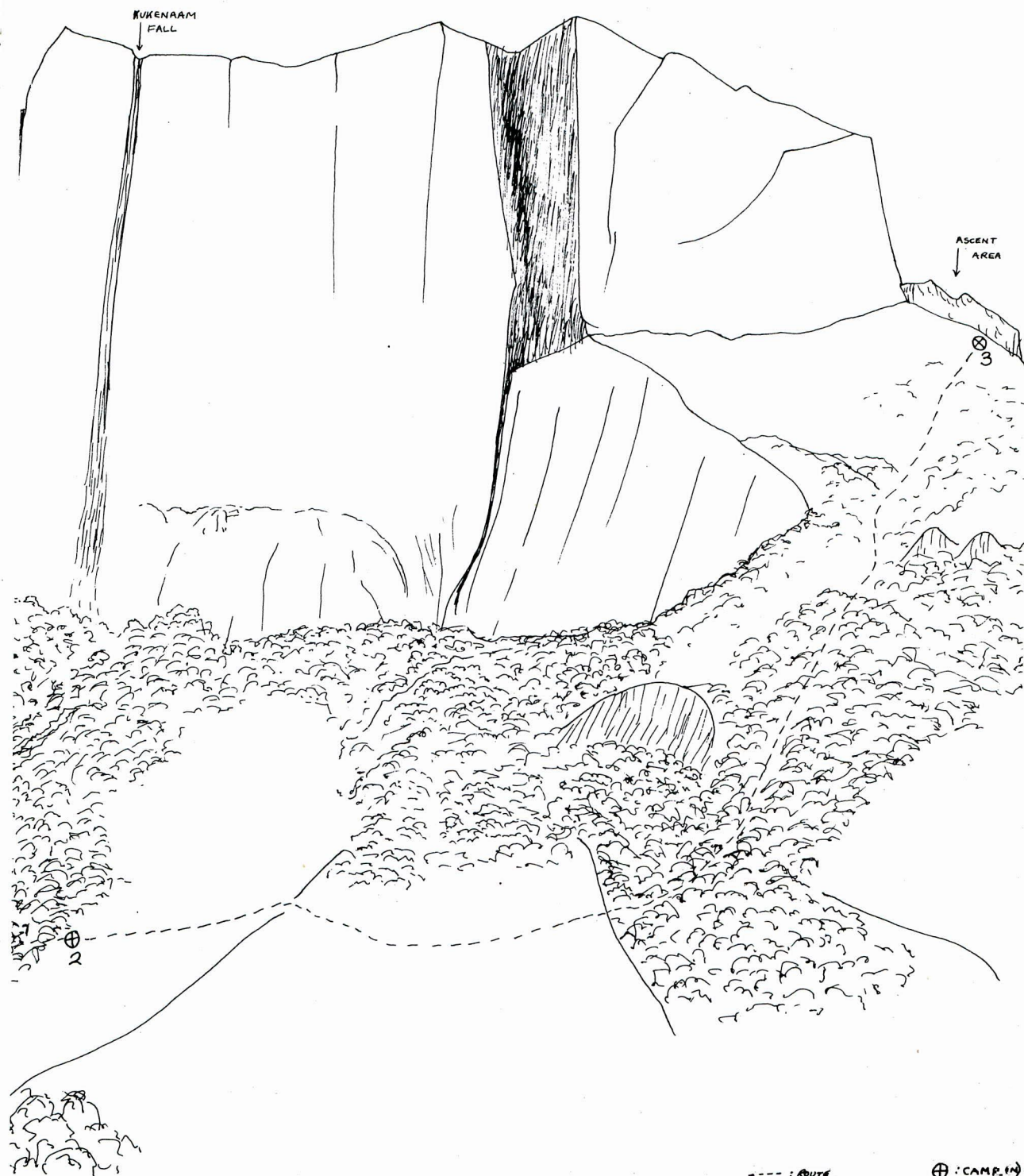
Having reached the gully after considerable difficulties, the steep angle of ascent made their progress more arduous. John Ogden takes up the story:

We managed to reach the terrace area beneath a huge leaning pillar of rock ('the chessman') in 'number two gully' before returning tired to the spur we had left in the morning. Here, in my absence, Harry Parsons and Colin Leighton had established camp three (c. 7,000 feet) and the three of us spent the night here while the Indians continued down to camp two. We spent four cramped and uncomfortable nights at camp three. It was very cold (40-50°F) and there was a howling gale and heavy rain for much of the time. However, when the cloud cleared and the sun beat down onto the rocks about us the site afforded some magnificent vistas of the cliffs of Roraima across the still cloudy valley and the savannah below rolling away southwards to the hazy blue mountains in Brazil.

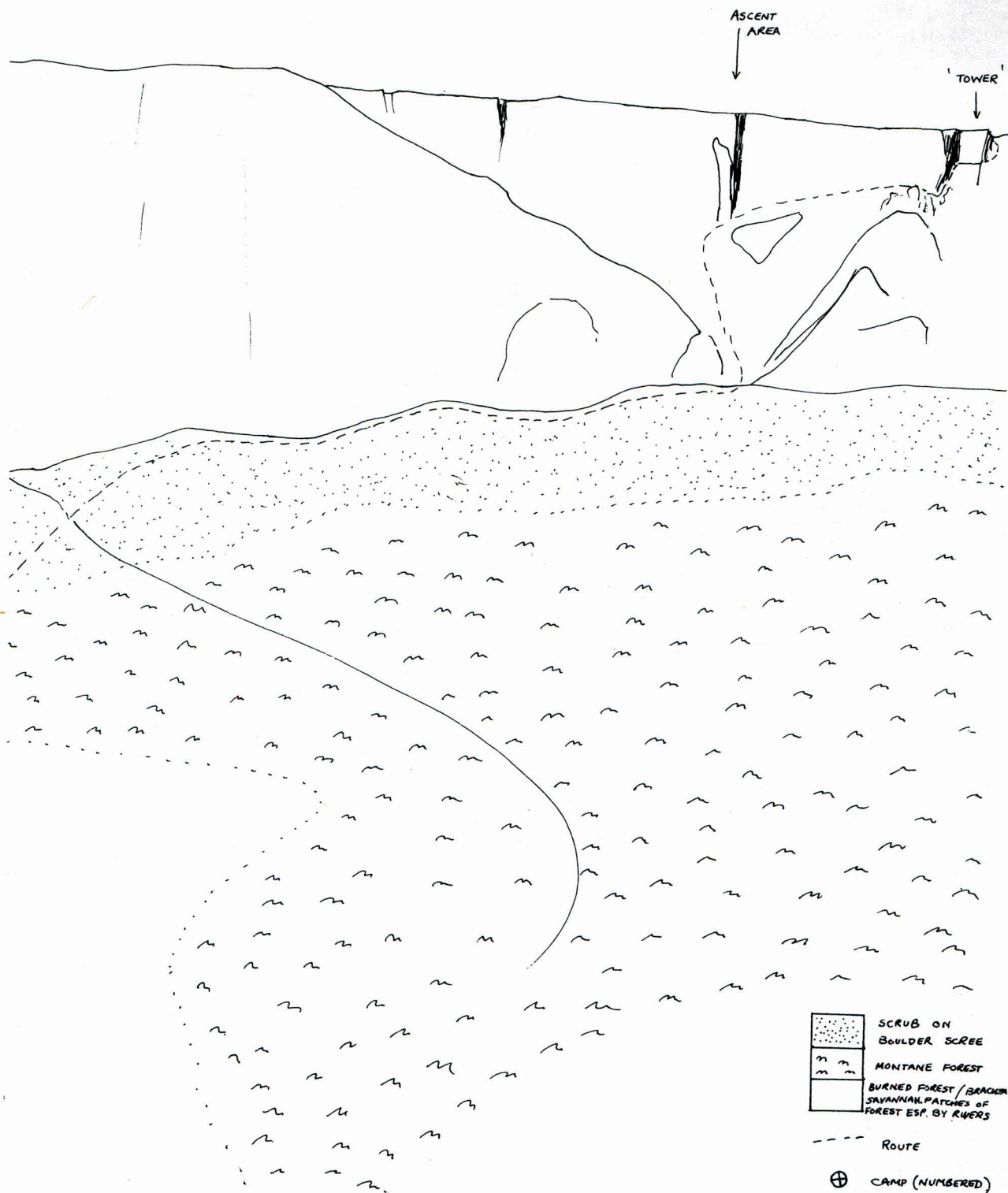
Next morning three Indians came up from camp two and all six of us set off to the terrace. We reached it at about mid-day and hacked our way across it, over a jumble of the fallen logs of trees far larger than any growing on the site at present, until we reached its right hand edge, where it formed a broad ledge (a continuation of the right hand fork of the original gully, see sketch). At this point the cliff arched above us for perhaps 300 feet, and ascent here was obviously out of the question. Leaving the Indians with the packs we gained a large ledge running beneath the overhangs and continuing across the cliff face beyond the termination of the terrace, towards a large square tower leaning against the main cliff. On reaching this tower, we descended slightly down a patch of dense vegetation and traversed the tower by a narrow ledge. The gaining of this ledge was the 'crux' if such it can be called, of the whole climb. On the far side of the tower was a waterfall, and between it and the tower, steep vegetation and large boulders ran up towards the final rounded cliffs, now less than 100 feet in height. We reached these, and traversed back along their base until we were in a small cave formed between the tower and the main cliff. This led to a large mossy and boulder-filled crevasse running parallel to the cliff but behind it, here forming as it were, a false face to the cliff. We scrambled over and under these boulders until one, bridging the crevasse high up, enabled us to step onto a verdant ledge, running up, a few steps onto the summit. The climb, while physically very strenuous, would technically be graded as no more than hard scrambling or 'moderate' in this country.

Their observations on the summit of Kukenaam showed that there were no significant differences from the summit of Roraima. This conclusion was made by Adrian Thompson, who took part in the Bangor expedition and who had seen the summit of Roraima on several occasions.

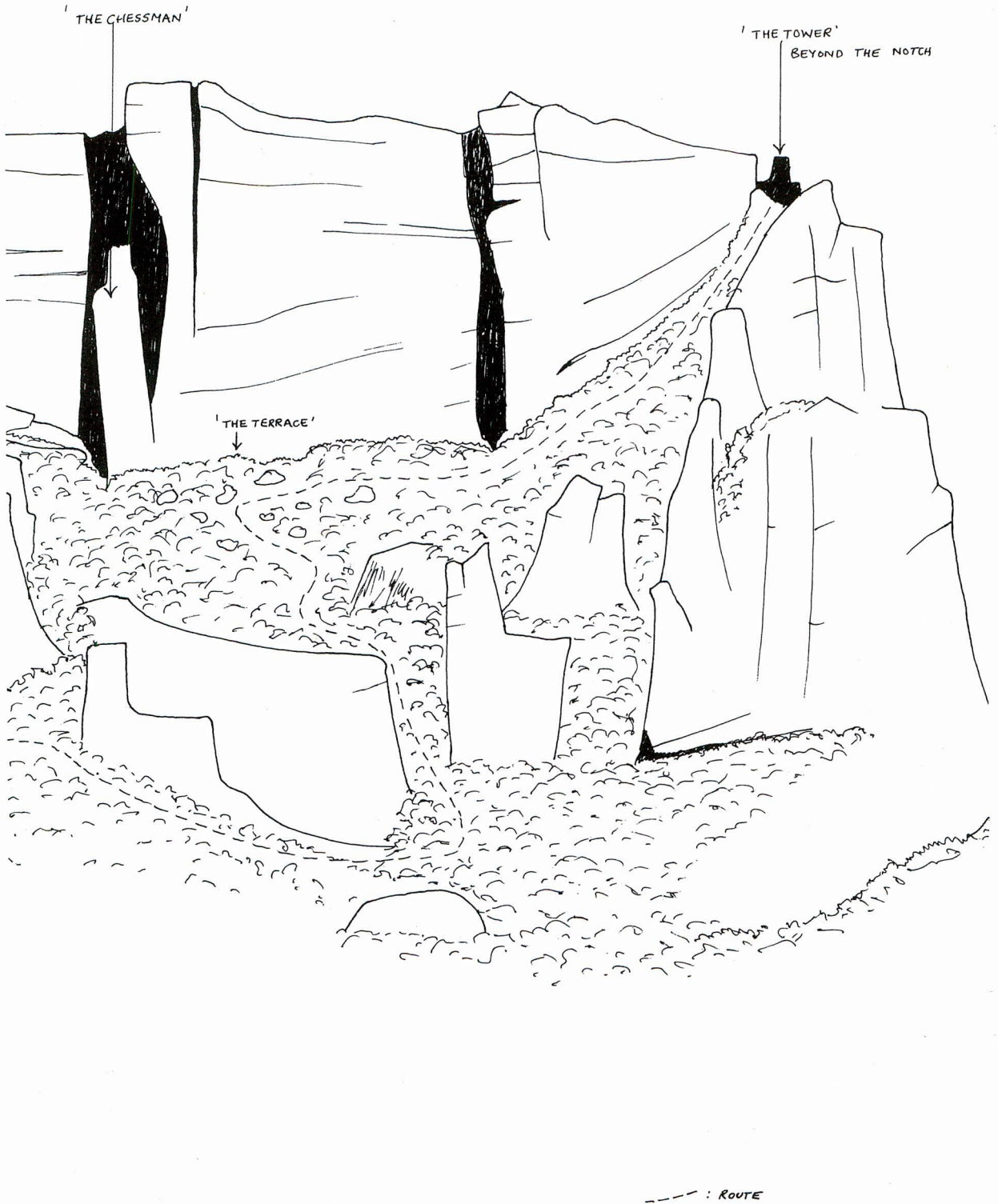
Finally, in March 1971, during the final planning stages for the British expedition to



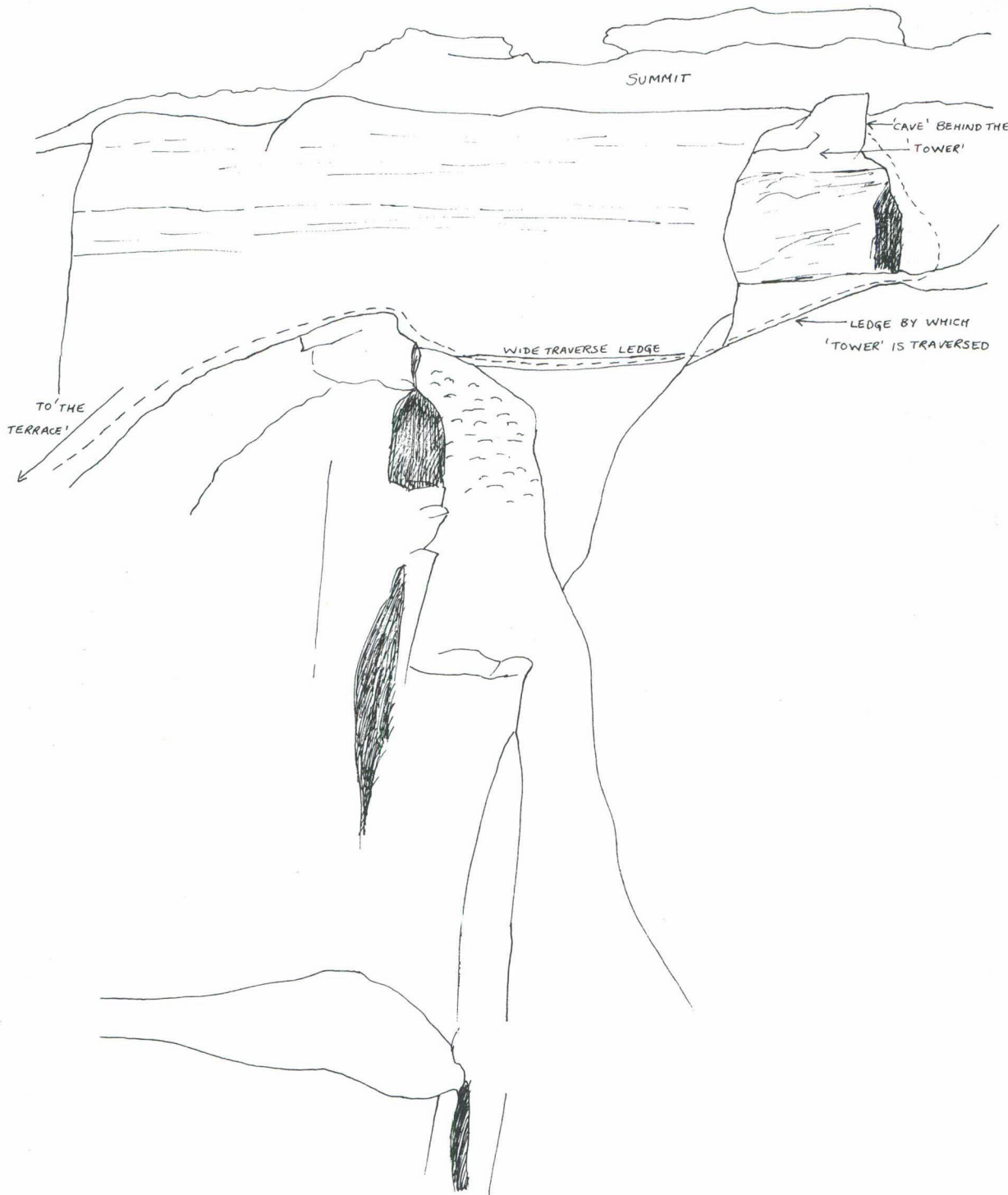
Route of the 1963 Bangor expedition which made the first ascent of Kukenam



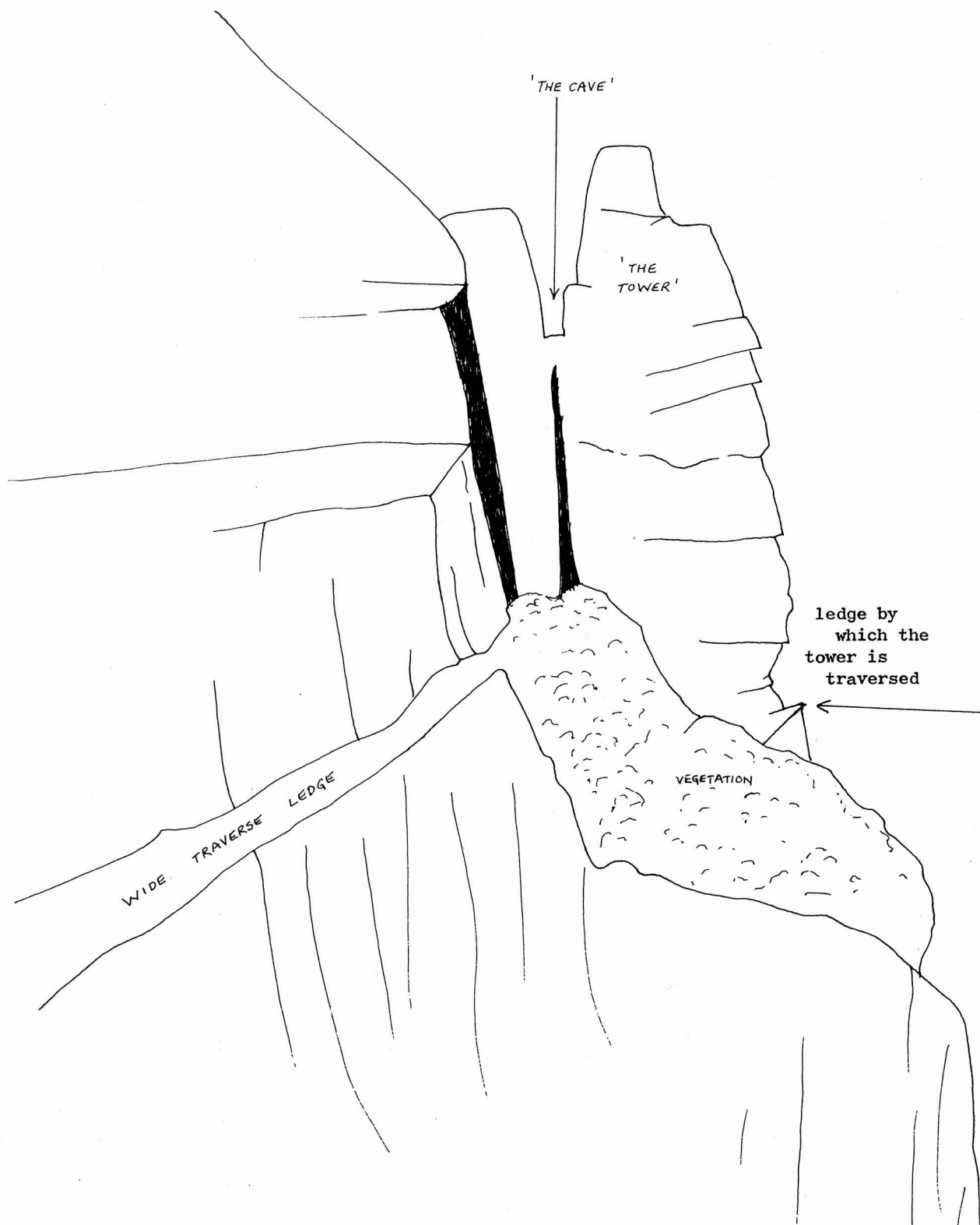
Route of the 1963 Bangor expedition



Kukenaam ascent area—bottom section



Kukenaam ascent area—top section



Kukenaam ascent area—the 'tower' as seen from the 'notch'

take place that summer, Robin Hanbury-Tenison, of the Royal Geographical Society, walked up Roraima and down again in just a few hours, demonstrating how easy it in fact is. Indian women and children have even done it, and the summit of Roraima is no stranger to diamond prospectors from Brazil and Venezuela, who hope to make their fortunes in the jagged crevasses or in the dark shallow pools on the plateau.

That is basically the story of the exploration of Roraima and Kukenaam: from the south, from the rolling savannahs of Venezuela. But what of the impenetrable, unapproachable north, inside Guyana? Until 1971 the only person who had succeeded in approaching the mountains through the tangled forest of the Mazaruni drainage was P. B. H. Bailey, of the British Guiana Government Geological Survey Department, in 1958.

For his route see page 99. Even thirteen years later, in 1971, we found traces of his camps and trails during our exploration of the northern part of the valley between Roraima and Kukenaam prior to our ascent of the north ridge.

DISPUTES

Introduction

Mt. Roraima is straddled across the border of Venezuela and Guyana, unfortunately a border which is delicately situated in the centre of a dispute. The gaining of political clearance for the expedition was one of the biggest problems to be faced during the organization, and is the reason for the planning of alternative approach routes to the mountain. As the border question played such a significant part in the planning of the expedition, a few notes on its history are included here.

The Dispute

When Great Britain came into possession of British Guiana in 1814, Guiana's boundary with Venezuela was the Essequibo river. Gran Colombia, of which Venezuela was still part until 1830, notified Great Britain of her frontier line along the Essequibo, and Great Britain raised no objections to this declaration.

The line of the Essequibo river as far as the present Guyana-Venezuela border is the original Schomburgk line of 1835. Neither the Royal Geographical Society nor the Colonial Office, which sponsored Schomburgk's first expedition, objected to this map.

In 1840 a pseudo-Schomburgk line, which was protested by Venezuela, which was rather further west than the Essequibo river, was published in the Parliamentary papers. This is the origin of the controversy and dispute over the British Guiana, now Guyana, and Venezuelan borders.

However, the British Government commissioned Schomburgk to begin a new expedition (1840-43) in order to draw a fresh map of British Guiana to conform with the pseudo-line. The Prussian naturalist exceeded his instructions, setting up posts, marking trees, and generally carrying out acts of possession which induced formal protests by Venezuela.

The British Government in 1842 disavowed Schomburgk and ordered the withdrawal of posts and frontier marks.

By various official maps Great Britain recognised, from the beginning of the controversy until 1886, all the upper Barima and all the Cuyuni, from their sources to the mouth of the Otomung as undisputed Venezuelan territory.

In 1850 it was mutually agreed that neither Venezuela nor Great Britain would occupy the disputed territory between the pseudo-Schomburgk line of 1840 and the Essequibo line.

Mining interests in British Guiana brought pressure to bear, inducing the metropolitan and colonial Governments to gradually advance the claim which extended, in 1887, almost as far as Upata, a few kilometres from the Orinoco. This was labelled 'line of the extreme British claim'.

Venezuela maintained her claim to the Essequibo line.

The question was finally submitted to Arbitration in 1897, under the impartial intervention of the United States. However, Venezuela was largely left out of the Arbitral proceedings, and the eventual decision was found to be unsatisfactory by the Venezuelan

Government, who made efforts to nullify the decision of the award.

Venezuela's internal and international situation during the first half of the twentieth century influenced her in postponing denunciation of the award. Between 1915 and 1917 Venezuela insisted that the demarcation on some parts of the frontier should be reconsidered; the British Government requested postponement of proceedings due to the First World War in which it was involved. Venezuela did not raise the border question when the United Kingdom was running through the test of world conflicts, and waited.

Since that time the question has been raised again and again, but the extraordinary situation is still, over fifty years later, unsolved.

BRITISH EXPEDITION TO RORAIMA 1971

Whiteoaks,
Harebell Hill,
Cobham,
Surrey.

EXPEDITION PLANS AT 10th JUNE 1971

- References:** A. University of Bangor Expedition to British Guiana 1963 : General Report and 'The First Ascent of Mount Kukenaam'.
- B. Im Thurn : Ascent of Mount Roraima. *Proc. Roy. Geog. Soc.*, Aug. 1885, pp. 497-521, map.
- C. Tate, G. H. H. : 'Through Brazil to the summit of Mount Roraima'. *Nat. Geog. Soc. Mag.*, Nov. 1930, pp. 585-605, 24 illus., map.
- D. Initial proposals for British Roraima Expedition, 15 Oct. 1970; and Planning Instructions Nos. 1 and 2.
- E. Correspondence.
- F. Aerial Photographs (RAF 1952).
- G. Map of Guyana, North-West Sheet, 1:500,000; Dept. Lands & Mines, Georgetown.

1. SITUATION

a. Project Area

- (1) The plateau of Roraima is situated exactly on the point at which Guyana, Venezuela and Brazil meet. Two miles due west of Roraima lies Kukenaam, another plateau, which is not quite as high as Roraima. Both plateaux are each about 25 square miles in area, and both are isolated from the surrounding country by sheer sandstone cliffs up to 2,000 feet in height. Roraima's summit is 9,094 feet above sea level and that of Kukenaam is 8,600 feet. Both plateaux have been proved to be climbable and so further reconnaissance in this direction has not been necessary; there are geological faults in the cliffs and the climbs are classed as 'hard scrambles'. Roraima has been climbed a number of times, but Kukenaam is unexplored; the University of Bangor party in 1963 managed to find an ascent route which this expedition intends to follow. Both known ascent routes lie within Venezuela. The northern slopes of the plateaux are covered with dense forest, not penetrated by any expedition.
- (2) The stories of the early explorers prompted Conan Doyle to write his classic adventure novel *The Lost World*.

- (3) The wildlife of the two plateaux has by no means been thoroughly investigated, and Kukenaam is still virgin to the scientist. In the early part of this century, a number of specimens were collected from Roraima, mainly birds and plants, but the collecting was haphazard. Much of the fauna is endemic, and a study such as is planned may throw some light on the origin of these plateaux, and their evolution.
- (4) Climate. The expedition will, in theory, take place as from the beginning of the dry season, but the rains tend to be a little persistent and it seems likely that the first few weeks in the Roraima area will be wet. Very little data is available on the temperature and rainfall etc. (one of our projects), but it can be expected to fall to 7.7°C (46°F) at night, rising to 21.1°C (70°F) during the day, on the summit of Roraima.

b. Origins of the Expedition

The two plateaux under study have been the subject of intense scientific interest and speculation ever since Im Thurn and Perkins reached the summit of Roraima in 1884. Scientists of the time, for example Sir Joseph Hooker, considered it possible that life forms from ancient times may still survive there, due to the isolation imposed on them by the sheer cliffs 2,000 feet high which surround the plateaux. Although this is not so, a considerable percentage of the life forms that exist on the mountains is endemic to this small area. It is hoped that the surveys run by this expedition will lead to a better understanding of the origins and evolution of the plateaux and the life they support.

c. Reconnaissance

It has not been necessary to send out a reconnaissance party as adequate knowledge of the area has been attained through the patient research of this expedition's members and also through first-hand knowledge from various people who have been to the area. The University of Bangor should be given credit for pioneering a way up the cliffs of Kukenaam, and leaving the summit untouched.

2. MISSION

- a. To carry out the surveys outlined in Annex A, in order to gain a better understanding of the origin and evolution of the Roraima and Kukenaam plateaux, and of the ecosystems they support.
- b. To parachute into this remote region, to demonstrate to future scientific expeditions a convenient and easy way in which to reach remote areas with the minimum of effort.

3. EXECUTION

a. General Outline

The team will meet in Georgetown by 18 July 1971, and it is hoped that the flight into the interior will take place on or about 25 July.

Warren and *Lyes* will leave England on 27 June to arrive in Georgetown by 30 June,

making use of a cheap scheduled flight from Luxembourg to Barbados. *Dr. Forss* and *Heard* will make use of the same flight on 12 July, and it is hoped that *Capt. Chapman* and *Bromhall* will also be on this flight. *Cobb* and *Nott* will travel by boat by courtesy of the Harrison Line on 4 July, and accompany the main bulk of the expedition luggage.

b. Composition (at 10 June 1971)

- (1) Mr. Adrian Warren, age 21, Leader, Zoologist, Parachutist.
- (2) Capt. Roger Chapman, M.B.E., age 32, Deputy Leader, Geographer, Parachutist.
- (3) Mr. Martin Lyes, age 20, Treasurer, Zoologist, Parachutist.
- (4) Dr. John Heard, age 49, Botanist.
- (5) Mr. A. Goudie, M.A., Geomorphologist.
- (6) Dr. Henrik Forss, age 39, Medical Officer to the Expedition.
- (7) Mr. Derek Bromhall, M.A., age 42, Zoologist, Film Cameraman to the Expedition, Parachutist.
- (8) Lt. Stephen Cobb, age 22, Caterer, Parachutist.
- (9) Lt. Harley Nott, age 23, Quartermaster.
- (10) Lt. Don Hughes, age 37, Parachute despatcher.
- (11) Maj. John Blashford-Snell, M.B.E., Rear Party, Representative in Britain.

c. Programme

Proposal for use of Parachute Techniques

In 1971, the team of the British Jostedals Expedition made a parachute descent onto a glacier in Norway. Its team of twelve, most of whom were scientists, were trying to bring to the attention of those involved in organising expeditions, the need for scientists to make use of modern technological means not only in their survey, but also in their initial assault.

The British Roraima Expedition hopes to follow and support the British Jostedals Expedition in its aims. If assaults by parachute have been accomplished in both Norway and South America, perhaps a new era in exploration will be sparked off where the time and effort saved by this method is used for extra scientific work with the better results which must inevitably follow.

If the project is carried out by the proposed method, the Expedition is presented with a wide new range of advantages. The time saved, otherwise occupied in walking to and from the nearest airstrip at Yuruani (a small Indian village), transporting gear, will be used to collect more material while Amerindians can be employed to carry it back to Yuruani.

Expedition members may be interested to read the article 'By Parachute into Peru's Lost World', by G. Brooke Baekeland, *Nat. Geog. Mag.*, August 1964, pp. 269-296.

If permission to enter Venezuelan territory from Guyana is granted:

- (1) Team meet in Georgetown by 18 July 1971.
- (2) Fly into interior by 25 July; some team members will parachute onto the savannah to the south of the plateaux; set up base camp and receive air-dropped stores; remainder of team land at nearby airstrip and walk in with delicate instru-

ments and cameras.

(3) Both Kukenaam and Roraima will be climbed and expedition members, working in pairs, will carry out surveys remaining on the summit plateaux for several days at a time. This part is to be scheduled in detail.

(4) Party walks to airstrip with Indian porters to carry luggage, rendezvous with 'plane to return to Georgetown by 20 September 1971.

If permission to enter Venezuelan territory from Guyana is not granted:

(1) Team meet in Georgetown by 18 July 1971.

(2) Fly to Kamarang, an all-weather airstrip by the Mazaruni river by 25 July.

(3) Proceed up Kako and Waruma rivers by boat towards Roraima.

(4) Carry out modified surveys on northern slopes within Guyana. There is little hope of reaching the summit from within Guyana.

(5) Party returns to Kamarang by 20 September.

d. Scientific Programme

Surveys will be undertaken in close collaboration with the following institutions:

(1) British Museum of Natural History.

(2) The Polytechnic of Central London (Dept. of Life Sciences).

(3) University of Guyana.

(4) Ministry of Agriculture and Natural Resources in Guyana.

e. Preparation

Members' responsibilities are as follows:

(1) Botany: Dr. J. Heard.

(2) Ichthyology and Arachnology: Mr. Lyes.

(3) Mammalogy, Herpetology, and Limnology: Mr. Warren.

(4) Topographical and Climatological aspects: Capt. Chapman.

(5) Photography: Mr. D. Bromhall.

(6) Medical Aspects: Dr. Forss.

(7) Signals equipment: Mr. Cobb.

(8) Base Camp co-ordination: Mr. Nott.

4. ADMINISTRATION

a. Equipment and Stores

Nearly complete at the time of writing; to be moved to Oxford centre for checking and packing; and to be shipped to Georgetown on 4 July with Messrs. Cobb and Nott.

b. Subscription

Members' subscriptions are £100, to be made payable to the Treasurer. Cheques to be made payable to British Roraima Expedition. (Many regrets for the raising of the sub. from £50 to £100.)

c. Copyright

Members are required to agree to and sign the conditions laid down in the Certificate of Agreement.

d. Medical

Members are required to produce a certificate of a recent medical examination to show that they are medically fit, and to make sure they have had all the injections listed in Annex B.

e. Instructions for Personnel

Each member should have already received a list of personal requirements, prepared by the Deputy Leader.

5. POLITICAL CLEARANCE

- a. The Guyanese Government have confirmed their approval of the Expedition in writing.
- b. The Expedition still awaits clearance from Venezuela.

6. SPONSORSHIP

- a. The following bodies have given their support:

The Royal Geographical Society.
The Polytechnic of Central London.
The Scientific Exploration Society.
The British Museum of Natural History.

- b. The following bodies have helped financially:

The Winston Churchill Memorial Trust
The Mount Everest Foundation
The Godman Exploration Fund
The World Universities' Expeditionary Association
The Gilchrist Educational Trust
The Augustine Courtauld Trust
The Bank of London and South America
Pembroke College, Oxford
The Percy Sladen Memorial Fund

- c. The expedition awaits decisions for support from the following:
The Royal Society

7. COMMAND AND SIGNAL

- a. The Leader is Mr. Adrian Warren. Deputy Leader is Capt. Roger Chapman.

- b. A radio link will be maintained between the expedition area and Georgetown. Each member will have a personal radio for contacting other members while in the field.
- c. Maj. John Blashford-Snell, M.B.E., is the Rear Party, and Representative in Britain.
- d. Members' mail may be sent to: c/o. J. A. Sankey, British High Commission, Georgetown, Guyana, South America.

Adrian Warren
Leader

POST-EXPEDITION COMMENTS

- 1. In such a complex plan, changes were inevitable.
- 2. Andrew Goudie, M.A., originally a member of the Expedition as Geomorphologist, dropped out at the last moment, and Dr. John Heard, suffering from a back injury, was replaced by David Philcox, M.Sc., age 45, from the Royal Botanic Gardens, Kew.
- 3. Venezuela finally refused to issue visas to the Expedition so the alternative approach route was put into action.
- 4. An advance party dropped in by parachute onto savannah observed during reconnaissance of the northern approach route.
- 5. Boats had to be abandoned further downstream than was anticipated.
- 6. The expedition objective became the attainment of the north ridge of Roraima.
- 7. Scientific surveys, which had to be modified, assumed a step-by-step study from Camp 1 on the Waruma river, where the boats were abandoned, to Camp 9 on the ridge itself.

ANNEX A

SCIENTIFIC PROGRAMME AT MTS. RORAIMA AND KUKENAAM

1. Topographical and Meteorological Survey

With the limited time and the problems of carrying heavy equipment up onto the plateaux, the map-making will be limited to a plane table traverse. A general map of the outline of the plateaux will be made at 1:100,000. A more detailed map of various sites for any Geomorphological or Botanical Gridding will be made at 1:10,000. A three star fix will be taken to ascertain an exact co-ordinate of the start and finish of both traverses.

It would be extremely valuable to take a dry bulb and wet bulb reading and thus calculate the relative humidity as well as take the wind velocity and direction at 0600 hrs., 1200 hrs., and 1800 hrs. each day on the top of both plateaux. A series of readings could be measured over a period of three weeks on each plateaux. The results would be of interest to meteorologists—as there is little data from this part of South America—as well as contribute to the more exact work of the other scientists on the expedition.

Roger Chapman, M.B.E., F.R.G.S.

2. Geomorphological Survey

The potential interest of the landforms on the plateaux has already been hinted at in the accounts of the early explorers, notably Im Thurn (1885). One of the aims of the survey will be to examine the sandstone weathering features and depressions mentioned in that account, and to discuss the possibility whether one has in this locality an example of sandstone karst. Karst scenery consists of hollows, caves, and solutional features, generally encountered in limestone or dolomite, but also known from sandstone, albeit infrequently. Detailed mapping of the landforms, and the study of their relationship to jointing and lithology of the sandstone could prove to be a most useful study. Water samples from the depressions would be collected to provide some information on chemical weathering processes. Highly saline water would prove very capable of rock disruption.

A second main aim of this survey would be to collect data on the variation of landforms with height, and therefore with vegetation and climate zonation on the plateaux. Some similar studies have been undertaken in the mountains of New Guinea. In particular the role of fog at high altitudes would prove interesting.

A third aim of the project would be to investigate the possibility of installing some simple instruments, like pins and stakes, to measure rates of slope movement under humid tropical rain forest conditions. The instruments would be unlikely to give immediate results, but could be left in the field to be examined at a later date, perhaps after an interval of several years.

A final aim of the survey would be to undertake a general survey of the nature of the erosive process under different microclimatic conditions imposed by vegetation and site differences. Features relevant to this would include canopy gaps, litter quantities on the forest floor, number of fallen trees, number of canopies, frequency of gullies, etc.

It is worth pointing out that the humid tropics are one of the least studied of all the world's geomorphic environments, and that results could be both original and valuable.

Andrew Goudie, M.A.

3. Botanical Survey

My main aim as the Botanist is to make as full a collection as possible of the grasses in the region of Roraima and Kukenaam. These will be dried and pressed in the field and will provide the material for a taxonomic study to be undertaken by myself and the staff at Kew Gardens. I hope to do the same also for the herbage legumes. In this case it will be interesting to characterise the associated nitrogen-fixing bacteria and so I will also collect and preserve the root nodules.

Ripe seed will be collected from any of these plants which are of especial interest, in order that they may be cultivated. Workers at Kew are also interested in the chemical content of the seeds of the legumes.

I will make as full a comparison as time permits of the fungal diseases of the grasses and legumes.

It will be necessary to make notes on the habitat of each of the specimens collected, and as I have an interest in soils, it may be possible to describe the soils of the area in some detail. I also hope to assist the Zoologists in describing the habitats from which their specimens are obtained.

Jack Heard, Ph.D.

4. Zoological Surveys

a. *A survey of the ichthyofauna of the Roraima area*: the fauna and flora of South America are well known for their diversity of structure and form. The Ichthyofauna is no exception. Little work has been accomplished in the expedition area, except for the description of a small number of new species by various authors. The main work is by Eigenmann: *Freshwater fishes of British Guiana*, published in 1912, which covers a great number of species but which shows the great amount of work still to be done.

It is hoped that comprehensive colour charts can be compiled in the field in an attempt to elucidate the classification of such fish groups as the Characins and the Catfish, the Doradids and Ciclids. Such classification is a very arduous job due to the lack of specimens available causing confusion over juvenile stages, sexual dimorphism, mimicry, etc.

The survey to be carried out will not be one of random collecting, although this in itself has its merits, but an attempt to correlate the fish found with work done by other zoologists.

Because of its unique position, water flowing from the tops of the plateaux runs into the Amazon, Orinoco and the Essequibo. Much work has been done on the fish of these three rivers, especially the Amazon, and it may be possible to find valuable ichthyological links between forms in the upper reaches of these three rivers and the main rivers themselves. In any case, this study should yield original and valuable results.

Martin Lyes

b. *Arachnids in the Roraima area*: to attempt random collection of every arachnid encountered would be rather pointless as so little work has been done on South American arachnids to date. The aim of this study will be to observe the behaviour of the animal in response to its environment. Special emphasis will be on the Otenizidae, the Trap-door Spiders, as there are examples of endemic species from the plateaux summits; and also the Salticidae, the Jumping Spiders.

Martin Lyes

c. *The Bat Survey*: so little is known of the bats of the Roraima region, it is only possible to hazard a guess at the species to be encountered. There appears to be evidence of sufficient roosting sites for these animals in the form of caves, both on the summit and in the talus forest on the mountains.

Of as much interest as the actual bat species found will be the stomach contents. These will not only indicate the type of food taken, but in the insectivorous forms, should indicate species of insect perhaps otherwise missed by the diurnal entomologist and which are perhaps endemic to the plateaux region.

Although the bat study will involve systematic collecting and recording of ecological data, examination of the individual will involve the following: stomach contents, collection of ectoparasites, and, if possible, tests will be run for rabid bats in the area. In the case of nectar-feeding forms, the individuals will also be examined for the presence of pollen on the fur of the snout, and the preservation of the carcasses for post-expedition work on the brain and musculature of the head and neck region.

Adrian Warren

d. *Amphibian Survey*: this study will form a basic revue of the species present. There are three general habitats which form altitudinal barriers for these animals: the savannah (up to 6,000 feet), the montane forest (up to 7,200 feet) and the summit (at 8,600 feet). At present only one amphibian species is known from the summit. This small black toad is thought to have some close evolutionary relationship with a species found in the montane forest; this may be clarified. Another species, *Otophryne robusta*, a microhylid frog, is under some controversy at the moment concerning its races in other parts of Venezuela. Many other forms which should be present according to their known distribution will be searched for. So little work has been done on this group in this region, that almost any material collected will be interesting.

Adrian Warren

e. *Limnological Survey*: at the Roraima and Kukenaam plateaux, the limnology of the ponds and streams of the summit will be studied; and a certain amount of work will be carried out in the rivers flowing away from the mountains. This latter part of the work should tie in closely with the ichthyological work to be carried out by Mr. Lyes. Plankton samples will be collected to be studied as a post-expedition task, and physical factors of the streams and rivers such as water temperature, velocity, volume, etc., will be recorded. As far as can be gathered, no previous limnological work has ever been conducted in this region, and thus the results will be original and should be rewarding.

Adrian Warren

ANNEX B

INJECTIONS AND VACCINATIONS

Essential

TABT
Smallpox
Yellow Fever

Optional

Polio
Cholera
Diphtheria
Typhus
Rabies (course of three injections)
250 mgs. Gammaglobulin.

COMPOSITION

- Adrian Warren age 22, Leader, zoologist, parachutist. Educated at Cranleigh School and at present at the Polytechnic of Central London. Has travelled widely in Europe, and has visited Guyana three times on zoological expeditions.
- Capt. Roger Chapman,
M.B.E., F.R.G.S. age 32, Deputy Leader, geographer, parachutist. At present at Oxford University studying for a B.A. degree in Geography. Widely experienced in expeditions, including the Blue Nile expedition in 1968, which made the first successful navigation of that river; and the British Josterdals expedition in 1970 which made a free fall parachute jump onto a glacier in Norway.
- Derek Bromhall,
M.A. (Oxon.) age 42, film cameraman, parachutist. Graduate in zoology. Chief Scientific Officer in University of Hong Kong (1953-60); Director of Fisheries Research, Hong Kong; now Senior Research Officer at Oxford University. Also experienced in field-work in Malaysia, and in West Africa.
- David Philcox,
M.Sc. age 44, botanist. Graduate from Leicester University; Lecturer/Demonstrator in Physiology and Ecology at Technical College, Brighton; Northern Nigerian Department of Agriculture in charge of Herbarium at a Regional Research Station, working on ricefield weed ecology. Now taxonomic botanist at Royal Botanic Gardens at Kew, having worked in Tropical America for nine years and Tropical Asia for three years. Member of Royal Society Expedition to Mato Grosso, Brazil, in 1968; also joint expedition to Amazonas, Brazil, with New York Botanical Gardens.
- Dr. Henrik Forss,
D.P.H. (London) age 40, Finnish Doctor to the Expedition. Expeditions to Congo (1965), to Kenya (Mt. Kilimanjaro), and British Expedition (1970). Academically a specialist in the physically handicapped.
- Martin Lyes age 20, second zoologist to the expedition. Educated at South East Sussex County Technical School, and is at present at the Polytechnic of Central London, studying for a B.Sc. Special Honours Degree (external) with the University of London.
- Lt. Stephen Cobb age 23, caterer to the expedition. Educated at Rugby School, was an undergraduate at Cambridge University reading Engineering, now in the army full-time. Widely travelled to Hong Kong, Cyprus, Libya, and Germany.
- Lt. Harley Nott age 23, quartermaster to the expedition. Educated at Marlborough College; now an undergraduate at Cambridge

University reading Engineering, widely travelled, including a previous visit to Guyana.

Capt. Don Hughes,
M.B.E.

age 37, parachute instructor and despatcher to the expedition. Chief instructor to Army Parachute Association at Netheravon, Wiltshire. Parachute despatcher to British Josterdals Expedition in 1970 which made a free fall jump onto a glacier in Norway.

Maj. John Blashford-Snell
M.B.E., F.R.G.S., R.E.

age 35, Rear Party representative to the expedition, in Britain. Chairman of the Scientific Exploration Society. Has launched over sixty expeditions, leader of Great Abbai Expedition which explored the Blue Nile in 1968.



EXPEDITION MEMBERS

July 1971; photographed at Pipilipai, on the Kukui river.

Left to right:

Top row: Lt. Harley Nott, Lt. Stephen Cobb, Martin Lyes, David Philcox, Capt. Roger Chapman.

Bottom row: Adrian Warren, Derek Bromhall, Dr. Henrik Forss.

Lt. Don Hughes was not present when this picture was taken.

Joining the Expedition in Guyana

Mr. Oliver Hunter Representative of Guyana Government to the expedition,
from the Guyana Ministry of Information.

Lt. Frankie Gibbs Guyana Defence Force.

Two other Guyana Defence Force personnel.

Amerindians

Isaac Jerry Foreman. Ackawaio.

Ackawaio: Irving George
Lincoln George
Philip Steven
Richard Francis
Milton Hunter
Jonathan Chin
Sandy Williams
Wrenton Williams

Arecuna: Robert Clement.

Supporting members

Capt. D. Murphy, Guyana Defence Force, Pilot.

Capt. J. Singh, Guyana Defence Force, Rear link Guyana.

Mr. Adrian Thompson, F.L.S., Scientific Advisor, Guyana.

Sammy Edwards.

'Floyd', otherwise known as 'Rocky'.

RECONNAISSANCE

Reconnaissance was basically carried out in two forms:

- a. from the air
- b. from the ground.

The aim of reconnaissance on any expedition is to familiarise those taking part with the area under observation and to facilitate the execution of the task by recognising any alternatives available.

For the British Roraima Expedition, reconnaissance was particularly important since, even after the party had assembled in Guyana, permission to enter Venezuelan territory by the preferred route had still not been granted.

The possibility of permission from Venezuela being refused had been foreseen, and an alternative route by which the expedition could approach Roraima had been considered in detail before the team left England for South America.

In the beginning, aerial reconnaissance was most important. The original approach route was to run as follows:

- (i) Party assemble in Guyana and rendezvous with the leader on 18 July, who had spent a fortnight in the Kaieteur-Echerak region carrying out part of a herpetological survey.
- (ii) Advance party of four parachutists drop onto savannah area three miles south of Roraima and Kukenaam, on or about 25 July.
- (iii) Air drop of stores and equipment to advance party. Base camp established.
- (iv) Main party fly to Yuruani, on the savannahs, 2-3 days' walk from Roraima.
- (v) Walk from Yuruani to base camp.
- (vi) Expedition members climb both Roraima and Kukenaam by the known ascent routes and carry out surveys, remaining on the summit for several days at a time. Amerindians employed as porters to transport material, as collected, to be stored at Yuruani.
- (vii) Expedition returns to Yuruani to rendezvous with aeroplane to return to Georgetown by 20 September.

This plan involved the use of Guyanese aircraft to land in Venezuela and the presence of the expedition in Venezuelan territory for nearly two months.

The alternative plan was as follows:

- (i) Expedition members rendezvous in Georgetown on 18 July.
- (ii) Expedition moves to Kamarang on or about 25 July. Assemble team of Amerindians as porters and advance up Kako and Waruma rivers by boat.
- (iii) Carry out surveys on the unexplored northern slopes of Roraima, within Guyana.

Venezuelan permission had still not been granted some weeks after the team had assembled in Guyana. It was considered worth waiting for, however, but only for a reasonable length of time; and if permission was still not granted, the alternative plan could be implemented.

This time was spent carrying out three aerial reconnaissance expeditions to study the

summit of Mount Roraima, the country to the east to Pipilipai (a small Amerindian village), and the country to the north.

The first aerial reconnaissance was carried out at dawn, the best time for studying the summit free from cloud. It was very successful and many members of the expedition were able to see Roraima for themselves, and for the first time to see what they had travelled several thousand miles to tackle. A comprehensive photographic record was built up, both in still (35 mm and 2¼ square) and 16 mm Eastmancolour ciné film. The more immediate result of the reconnaissance was the realisation that it would be *impossible* to reach Roraima by the most direct route—to parachute onto the plateau itself—an idea which had been considered in England several months previously. The summit is a comparatively small area, and disturbance of the air by swirling, unpredictable winds, would be a great hazard to the parachutist, threatening to blow him over the side of the cliff. Moreover, in landing the parachutist would have to negotiate bare, jagged rock, with large crevasses over fifty feet deep.

Politically it would not have been feasible to parachute onto the summit unless Venezuela gave permission to the expedition to enter her territory, as the team would have to leave the plateau on foot by the only known access route to the summit, which lies in Venezuela.

Although the first aerial reconnaissance achieved much in observation of the summit, the valleys and low-lying ground were smothered by cloud. The second reconnaissance was carried out in mid-afternoon, when the cloud had lifted sufficiently to expose proposed approach routes.

The objects of this flight were:

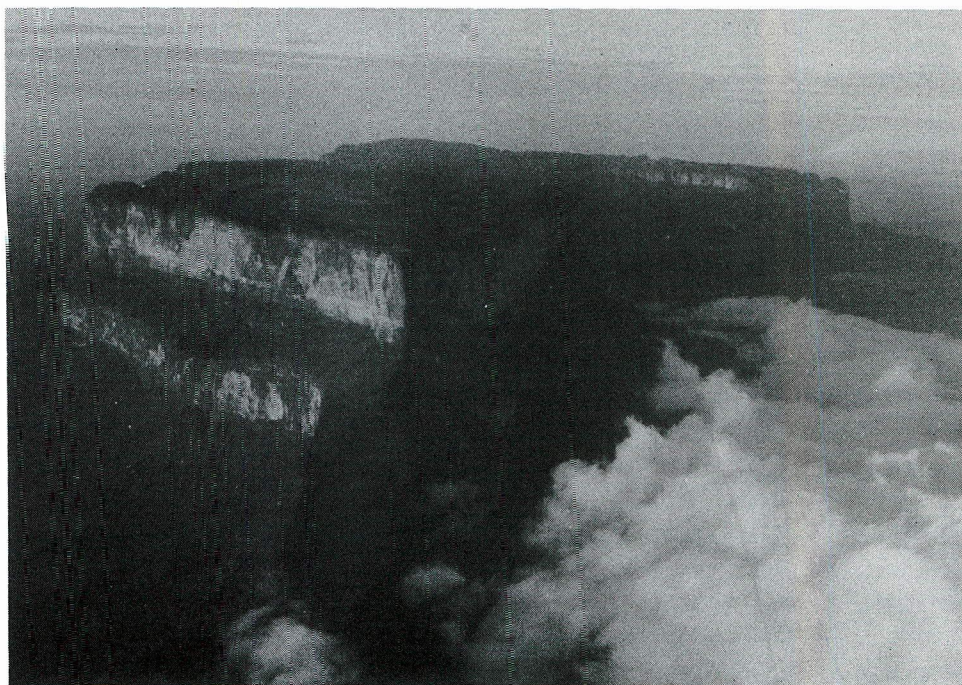
- (i) To examine the forest directly between Pipilipai and the western side of Roraima, north of Mt. Maringma, to estimate the feasibility of cutting a trail on a direct route within Guyana to the north-eastern cliffs.
- (ii) To examine a possible approach route from the north, using the Mazaruni, Kako and either the Paikwa or Waruma rivers from Kamarang, an all-weather airstrip situated at the confluence of the Kamarang and Mazaruni rivers. To examine the Arabaru savannahs for the possibility of parachute jumps and advantages of an advance party; and finally, to examine the north ridge of Roraima and the northern cliffs of Roraima inside Guyanese territory for any remote possibility of a hitherto undiscovered access route to the summit.
- (iii) A photographic record was to be made in 16 mm Eastmancolour ciné and in 35 mm and 2½" square stills.

Adrian Warren writes:

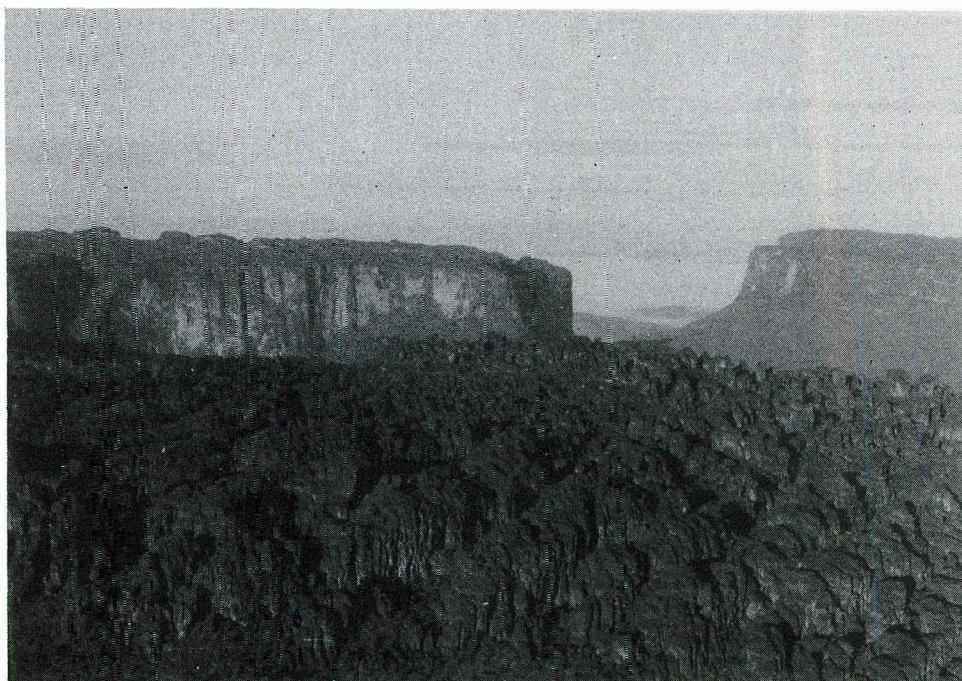
George Grandsoult, pilot, left me at Kamarang while he flew his private 'Islander' with some provisions to Kurupung, a diamond prospecting area. He left me because the airstrip at Kurupung is narrow and rather short, so any unnecessary weight made for a risky landing.

Kamarang was very colourful, bustling with thousands of Amerindians from all over Guyana, who had assembled for a national conference on Amerindian welfare to be held in the presence of the Prime Minister, Mr. Forbes Burnham. I lost no time in contacting some Amerindians from Pipilipai, an Ackawaion village near the Brazilian border, on the Kukui river, from which a known trail runs to the ascent point of Roraima, in Venezuela, via Arabopo. Pipilipai is itself only 30 miles as the crow flies from Roraima.

George Grandsoult returned to Kamarang, and after refuelling we took off and



Mt. Roraima from the north showing the north ridge.



Summit of Mt. Roraima. Mt. Kukenam is on the right in the background.

headed more or less due south towards Roraima and Kukenaam, following the Kako river. The Kako probably originates in Venezuela, but a good distance to the west. However, it is a good wide river, and although it meanders, there are stretches where an amphibian aircraft could be landed easily.

We examined various patches of savannah, known as the Arabaru savannahs, near the Kako river. Some were flooded and long distances from the river, and were therefore unsuitable for parachuting; others seemed usable. There was no time on this occasion to make anything other than a superficial examination.

There was a good deal of cloud on the northern side of the mountains, and it was not possible to fly into the valley in between Roraima and Kukenaam (known as the 'Gateway to Hell'), due to turbulence. Swirling clouds filled the valley. Many fine waterfalls were seen plummeting some 2,000 feet off the cliff faces. A close examination of the north ridge revealed that it would be feasible to climb it, if a trail could be cut on an accurate bearing to a convenient point at the base. The top of the north ridge opens out to a flat area devoid of trees some 1,200 feet below the summit.

We flew eastwards towards Pipilipai across the northern side of Mt. Maringma. The forest here is so thick that the crowns of the trees interlock 'like the head of a cauliflower' (as David Philcox, expedition botanist described it), and there are many escarpments. This would be very difficult country for cutting a trail, especially in the limited time available to the expedition.

The third aerial reconnaissance was carried out once an approach route from within Guyana was necessary and once the expedition main base had been established at Kamarang. Details of this are in the expedition log of Thursday, 5 August.

Reconnaissance from the ground was carried out on Friday, 6 August, by dug-out canoe from base camp at Makuripai on the Kako river, to discover which of two tributaries of the Kako, the Paikwa or Waruma, was the most suitable for the expedition to follow in an approach to Roraima, and for what distance they are safely navigable for small boats. Details of this are in the expedition log for 6 August.

THE EXPEDITION LOG

Introduction

This log, which is here reproduced almost exactly as it was written, is a record of the events of the expedition and was kept by the leader.

The planning of the expedition was complicated by the disputed border area in which the expedition was operating. However, it is hoped that by now this is clear to the reader.

The expedition assembled in Georgetown, Guyana, on 19 July 1971. Martin Lyes and Adrian Warren had flown out at the end of June to carry out a minor expedition in the Echerak-Kaieteur region of Guyana to make zoological collections. The remainder of the party flew out in time for the planned rendezvous in Georgetown on 18 July. Owing to very heavy rains, the 'worst in thirty years', many parts of Guyana became flooded, and Martin Lyes and Adrian Warren were stranded in the interior until the nineteenth.

On arrival, we were immediately hit by all the major red-tape problems of importing a strange assortment of people, and an even stranger assortment of baggage, into a country. We were suddenly presented with a customs duty bill that can only be termed as massive. So massive was it that the expedition very nearly ended before it began. This problem was solved by leaving the 'Racal' radio equipment in bond for the duration of the expedition, its value being almost exactly the duty payable on the remainder of the expedition baggage. So, although the radios were not actually used during the expedition, it can be said that without them it would never have taken place.

The arrival of the party received extensive coverage in the Guyanese newspapers.

At first expedition members stayed at 'Le Grille' guest house, run by Mrs. M. King. David Philcox, botanist, stayed with Adrian Thompson, an eminent botanist and well-known figure in Guyana. We developed a close liaison with the Guyana Defence Force, who very kindly gave us the use of a house at their base at Timehri airport and also a land-rover. They also fed us and we really are deeply indebted to them for making us feel so welcome.

Between the arrival of the party and 27 July, contact was made with all those who could possibly help the expedition, but official problems grew and the strains on each member, rushing around government offices each day in a tropical climate we were not yet used to, promised to exhaust the party before the real work began. Moreover, permission to cross into Venezuelan territory from Guyana had not yet been received, and in view of the delays it was decided to move the expedition to establish a main base at Pipilipai, an Akawaio Indian village on the Kukui river, en route to the Brazilian border, on 30 July. Henrik Forss, expedition doctor, and Lt. Harley Nott, quartermaster, were sent to Pipilipai on 27 July to prepare for the arrival of the rest of the team.

Meanwhile, on 27 and 29 July, two reconnaissance flights were made to examine the mountains of Roraima and Kukenaam and the area in which the expedition would be operating. The various approach routes were studied in detail and photographic records were made of the region. Details of the reconnaissance are to be found in the separate section on page 32.

Lt. Don Hughes, our parachute instructor, arrived on 27 July, and on 29 July gave

instruction to the Guyana Defence Force on parachuting both men and supplies into jungle. Don also planned to give the expedition parachutists a practice jump at Pipilipai on 30 July. Adrian Warren made a diversion from the reconnaissance flight on 29 July to Pipilipai to warn the American missionary, Nurse Doris Wall, and the Indians of the intended jump.

Friday 30 July.

Before departure for Pipilipai, Adrian Warren received a cable from London informing of the imminent arrival of a journalist for the *News of the World*. Neither Adrian nor the expedition members were too keen on the idea of the Roraima story being used by a popular newspaper; the atmosphere brightened, however, when the imminent arrival of a cheque for £500, in advance payment for the story, was announced. We needed the money.

The first load for Pipilipai took off from Timehri at 0900 hours in a Britten-Norman 'Islander' owned by the Guyana Defence Force. Flying time was about one hour and forty minutes, and shortly before the approach to Pipilipai we received a good view of the north-east face of Roraima. There were three 'plane loads in all, and the practice parachute jump was executed successfully in between the second and third 'plane loads, since the Guyana Defence Force had been most generous in allowing us to use two 'Islanders'.

A large number of Indians, some of whom had walked from Brazil, had gathered to watch the 'fallers'. Those jumping were Capt. Roger Chapman, Lt. Stephen Cobb, Derek Bromhall, and Adrian Warren. Capt. Roger Chapman was to free fall with a coloured ankle flare as a display for the Indians; the remainder used static line. Much excitement was caused as we soft-landed in bracken beside the airstrip.

Don Hughes returned to Timehri to continue instructing the Defence Force on parachuting techniques.

Saturday 31 July

The idea of establishing base camp at Pipilipai was because:

- a. If permission to cross into Venezuela came through, the main party could walk the trail which begins in Pipilipai, passes through the village of Amokokopai and continues on to the savannahs on the southern side of Roraima, in Venezuela. An advance party would parachute with most of the cargo near to the south face of Roraima and prepare a base camp.
- b. While we were waiting for word from the Venezuelan Embassy, the party was at least in the interior and the scientists could start working and collecting material.

Today the party walked down the trail to Amokokopai, partly to see the trail, and partly to make contact with the Indians. En route, we had a good view of the eastern cliffs of Roraima, approximately thirty miles away to the west.

There were over a hundred Indians at Amokokopai, and we were greeted with a sit-down feast of chillipepper soup and baked fish, which everyone agreed was, as a meal, very different from anything they had previously experienced.

The Indians here belong to a Christian sect called the 'Hallelujah religion', and after eating and introducing ourselves formally we watched dancing and chanting in a special large hut with a beaten earth floor.

We arrived back at Pipilipai to find that the *News of the World* journalist had arrived in the shape of John Lisners, an adventurous Australian. We little realised at this stage the trail of devastation he had left behind him in Georgetown.

Sunday 1 August

The Indian food had not agreed with some of us, and Harley Nott was still recovering from a bout of diarrhoea and vomiting he had last night.

Nurse Doris Wall, the American missionary, invited us to have a meal with her. Pipilipai, she told us, was a well-established mission. The majority of the huts were well built on stilts with planks of wood and with proper roofs. There was a small school and even a hospital. Miss Wall had herself been at Pipilipai for two years.

Henrik Forss made daily visits to the hospital for 'surgery' and by doing so made himself very popular with the Indians.

The scientists began collecting: David Philcox for bromeliads and orchids in the local forest, and the zoologists investigated a cave behind a small waterfall which yielded several bats. Derek Bromhall filmed the work.

Monday 2 August

Radio contact with Georgetown was kept daily, but there was still no word from the Venezuelan Embassy. Tomorrow we will have to start moving on the alternative approach route, from the north.

Another collecting day for the scientists. A barrel was presented to the zoologists by the Indians who announced that there was a snake inside. The snake turned out to be a tree boa, which we demonstrated to be harmless by allowing it to bite us—much to the horror and amazement of the Indian audience.

A small crisis later when, as we were eating dinner, someone saw our hut apparently burning down with much of our equipment and personal belongings inside. In actual fact it was David Philcox's plant-drying equipment which had caught fire, and although the plant presses and his day's collection of plants were destroyed, the hut and all else were still intact. However it was still a crisis for David, who had no spare presses, and from this time on he had to collect living material and a small amount of the smaller, rarer species preserved in spirit.

Tuesday 3 August

Three members of the expedition were hit by a kind of 'flu. David had a bad fever for a few hours.

We heard by radio that permission to enter Venezuela had been refused, so we immediately began planning the alternative approach route in detail.

We decided to move the main base to Kamarang, an all-weather airstrip at the confluence of the Kamarang and Mazaruni rivers, as soon as possible so that an approach could be made up the Kako river, which flows into the Mazaruni a short distance from Kamarang.

The Guyana Defence Force made an 'Islander' available to us, and Derek Bromhall and Lt. Harley Nott flew to Kamarang to prepare for the arrival of the main body. Capt. Roger Chapman and John Lisners flew on to Georgetown to organise the parachute drop

of the advance party with Don Hughes, the transfer to Kamarang with the G.D.F., and the possibility of using a helicopter to land three or four persons on the summit of Roraima in the Guyanese sector.

The helicopter idea, though sound in theory, was impractical. The charter fee, which was 1,000 Guyanese dollars (£200) per hour, was prohibitive for a start. Then the landing would be dangerous due to mists and unpredictable winds, and the pilot would only be willing to make one trip.

Wednesday 4 August

Roger called by radio to say that the main body of the expedition could move to Kamarang today. One 'Islander' arrived piloted by Derek Murphy, a young Irishman attached to the G.D.F. There were two loads, the first carrying cargo, the second personnel.

At Kamarang Derek and Harley had organised for us to stay at the unoccupied guest house. Contact was made by radio to Roger and John at Timehri, and it was decided that the advance party of four would make the parachute drop tomorrow, the fifth of August. The rest of the party would follow with a team of Amerindian porters from the nearby villages. Derek and Harley had already contacted Isaac Jerry, a very close Indian friend of Adrian Thompson's, and who always accompanied him on expeditions. Isaac Jerry was to be our 'foreman'—we would tell him what had to be done and he would organize it with the other Amerindians.

Thursday 5 August

An action-packed day. Derek Murphy arrived at Kamarang in a G.D.F. 'Islander' with Don Hughes, Roger Chapman, and John Lisners aboard, with all the parachuting gear, at 1015 hours.

A reconnaissance flight was made to make a close examination of the Kako, Paikwa, and Waruma rivers, to study the north ridge and face of Roraima, and to choose a parachute dropping zone for the advance party fairly close to the mountain. We also prepared a tent and provisions to be dropped by cargo parachute onto the summit of Roraima in the northern, Guyanese, sector, so that in the unlikely event of finding a new route to the summit from Guyana the climb could be made without back packs.

Henrik Forss, with mountaineering experience, came to study the cliff face for traces of faults and 'chimneys'; Martin Lyes would take still photographs; Don Hughes and Roger Chapman would search for a dropping zone for the advance party and supervise the dropping of the package on to the summit. The leader accompanied the reconnaissance party and Derek Bromhall covered the entire operation with 16 mm ciné film by dangling out of the back hatch of the aeroplane.

North of Roraima there are several patches of savannah across an area commonly known as the Arabarú savannahs. These were all convenient for parachuting, but the majority were flooded; however, we did find one small area of savannah bounded on three sides by forest and on one side by the river Kako, with a small number of Amerindian huts making it easy to identify. This proposed dropping zone was some eighteen miles north of Roraima, as the crow flies.

Henrik could not find any place where a possible ascent could be made, but we still made the cargo parachute drop onto the summit which was carried out successfully, in



Western cliffs of Roraima

spite of patches of mist obscuring much of the area of the summit. If we did ever reach the summit we were counting on the bright colour of the parachute to reveal the position of the package.

Once back at Kamarang, the advance party—consisting of the leader, John Lisners, Capt. Roger Chapman and Lt. Stephen Cobb—prepared for the drop. Derek Bromhall was to continue dangling from the back hatch to film the operation. To save weight we would be jumping without helmets.

Derek Bromhall was placed in charge of the rear party to organize the Amerindian porters, provisions, and boats, and to rendezvous up river at the dropping zone as soon as possible; we would leave a bright flag on the river bank to reveal our position.

The task of the advance party was to set up base camp at the dropping zone, and to make a thorough reconnaissance by dug-out canoe of the rivers by which we may approach the mountain, namely the Paikwa and the Waruma. This would save valuable time and eliminate mistakes which, at this stage, could mean the success or failure of the expedition.

In the aeroplane John Lisners sat uncharacteristically still, watching the forest passing swiftly below. We made the first (dummy) pass over the dropping zone, and Don Hughes hurled out a brightly coloured streamer to 'lay off for the wind'. We climbed to an altitude of 2,300 feet above ground level, and positioned ourselves for the second pass. Roger went first, followed by the leader; Stephen and John were despatched on the third



Parachutist at Makuripai

pass.

Everyone landed safely except for John who, once on the ground, announced the completion of his first parachute jump.

The 'Islander' returned to Kamarang for the first of two loads of cargo drops, some of which were by parachute, and some of which (the supposed unbreakables) were by free drop. Many of the tins and packets which were free dropped burst, and the rest of the day was spent in salvaging as much as possible and sorting it all into some semblance of order.

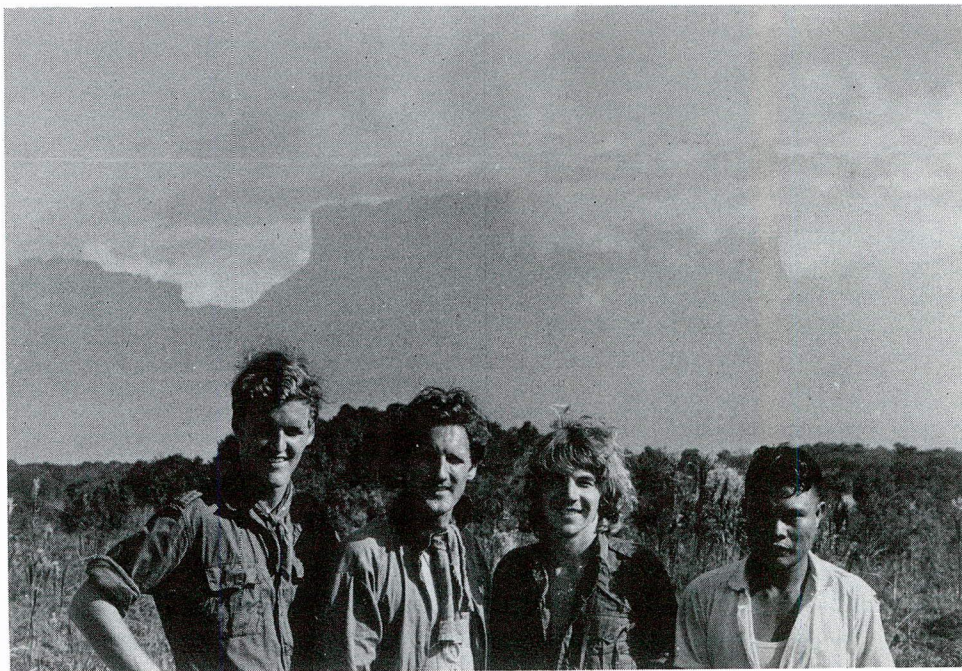
We also made contact with the Indians who had disappeared at the time of the jump, presumably frightened. They spoke a little English, enough to tell us they were Seventh Day Adventists and that their little village was called Makuripai.

Friday 6 August

At first light at Makuripai, cloud hung low over the savannah and the forest, and as the sun rose the north-eastern flank of Roraima, which jutted out above the clouds like a castle in the sky, shone pink in the soft light of dawn.

Capt. Roger Chapman and the leader persuaded 'Irving George', one of the Akawaion Indians living at the small village, to accompany them on a reconnaissance up river in his dug-out canoe. We left at 0800 hours. There is a definite art in travelling in a dug-out canoe. If one sits rather to one side, the canoe proceeds with a permanent list, so one must sit in the centre and try to keep fairly still while at the same time using a small Indian paddle—a strenuous process in itself.

We followed the Kako river with very slow progress at first, much to the amusement of Irving George who, sitting at the front, would every-so-often turn to watch us, collapsing



Parachute party at Makuripai with Irving George. Roraima is in the background



Reconnaissance of the river Waruma by dug-out canoe

with laughter.

At 0915 hours we reached the mouth of the Paikwa river, which was narrow, shallow, and filled with broken branches and logs, making any plan of following it by boat impractical.

We continued up the Kako and reached the mouth of the Waruma river at 1045 hours. Between Makuripai and the mouth of the Waruma the Kako river is wide, slow flowing, and in most parts deep. Bailey (1958) observed that there were many stretches wide enough and straight enough for a small amphibian aircraft to land on. The Waruma is much wider and deeper than the Paikwa, and we paddled up it for two and a quarter hours until 1300 hours. Towards the end of that time we were encountering rapids, finally crossing four sets in all. Progress became very difficult even for a shallow dug-out. About five miles up river from the mouth, the bed becomes stony and typical of upper reaches.

One serious problem we realised was that, after heavy rain, the Waruma and the Kako may rise eight feet in just a few hours, flooding large areas of forest, making it essential to find a camp-site on top of a high bank. Furthermore, under these conditions a slow flowing river becomes a torrent, racing along at some five knots. The rains at the beginning of August are unpredictable, but in September, when we were due to come back, the rains would have ceased, the rivers drying up, forcing us to carry the boats down the river bed—a thought we did not relish.

We estimated that our journey of five hours would take only two using outboard engines, but paddling silently in a dug-out one sees and hears so much more. Giant otters played in the water so close to us we could practically touch them; a giant ant-eater swam slowly across the river in front of us, its snout held above the surface like a snorkel; humming-birds and the bright blue *Morpho* butterflies flashed and flitted past us. We began to feel part of the forest itself.

The journey downstream to base camp at Makuripai took only three and a half hours. A radio message awaited our arrival to say that John Lisners was due to be arrested by the police the next day. Apparently not only had he left a trail of devastation behind him in Georgetown, but he had omitted to obtain the necessary permits for travelling in the interior and entering Amerindian reservations. John wasn't worried, he had been arrested in foreign countries before.

We contacted main base at Kamarang by radio to give results of the reconnaissance and to discover how everything was progressing with the main body of the expedition. We were informed that the police would arrive by boat at Makuripai early next morning with Henrik Forss. Capt. Roger Chapman was to go back to main base with the police boat and John Lisners, and we could make use of it further by sending the bulky parachuting gear with them. Roger was to go to supervise boat preparations to fit conditions we had observed in the upper reaches.

Saturday 7 August

The police boat arrived early to collect John Lisners. The police wore combat helmets and carried rifles, but were good-natured and, like us, saw the funny side of the situation. They posed for photographs with John as prisoner.

Henrik Forss arrived to administer to Stephen who was having problems with his feet. At this time we did not realise the source of the problems, which later turned out to be a plague of jigger fleas at Makuripai.

At main base ten Amerindians, including Isaac Jerry, the foreman, had assembled to act as porters for the duration of the expedition. Derek Bromhall paid them a substantial sum in advance with which they bought the food they would need. The agreement was that they would each be paid five Guyanese dollars (just over £1) per day for their services, which included their food which they preferred to buy and prepare for themselves.

Sunday 8 August

Lt. Stephen Cobb and Henrik Forss set off early by dug-out to see the Paikwa and Waruma rivers for themselves. It had rained heavily during the night and the river Kako had risen dramatically. Stephen and Henrik found the paddling exhausting, and they returned after reaching the mouth of the Paikwa.

The leader fixed Makuripai on the map by taking compass bearings on Mts. Maringma, Weiassipu, Roraima, Kukenam, Iwalkarima, Waikepaibe, Eluwarima, and Ilutipu, which extend in an approximate line from east to west. In addition a number of letters and reports on progress had to be written to be sent out for posting at the first opportunity.

Monday 9 August

The main body of the expedition left main base at Kamarang early, in two long-boats each powered by a 20 h.p. outboard engine. Capt. Roger Chapman was to travel in a third long-boat later in the day after two Guyanese representatives, who were to accompany the expedition, had arrived.

At base camp at Makuripai Lt. Stephen Cobb, Henrik Forss, and the leader were plagued by jigger fleas. Jigger fleas live in dry, sandy areas, often near human habitations.

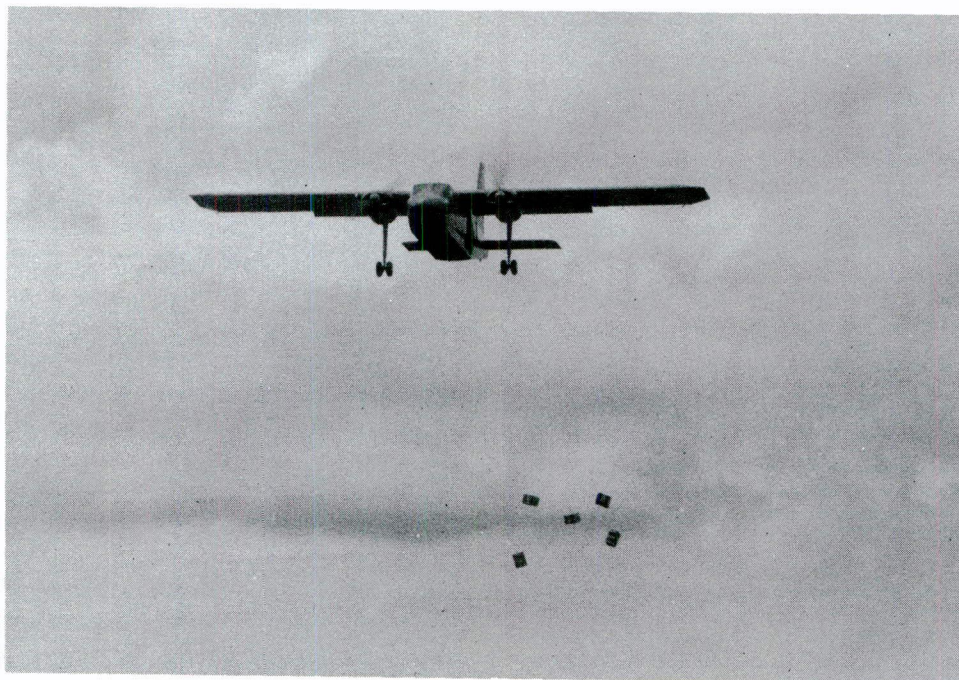
The flea burrows into the skin of the foot or lower leg where it eats away a sizeable cavity in which it remains and lays a large number of eggs. This causes considerable irritation until the infected place 'ripens', when the flea and egg sac can be popped out neatly and easily by an experienced person working with a needle (or in our case, fish hooks). By the time we were finished we were experienced in this art. Stephen excavated over 150 jiggers out of one foot and suffered from very sore feet for days afterwards. Henrik had about 50 in all, and the leader about 100. Some of the jiggers dug themselves in under the toenails, and were very difficult to excavate.

The jiggers were so bad at Makuripai that even wearing high boots with trousers tucked in 24 hours a day did not deter them. David Philcox demonstrated this by excavating several from his arms and chest.

At 1400 hours we heard the sound of engines down river, and 25 minutes later the first two boats arrived carrying Derek Bromhall, David Philcox, Lt. Harley Nott, Martin Lyes, and the team of Amerindians. In addition the long-boats were loaded to the very limit with equipment and stores.

We decided to move on to find a suitable site for Camp 1 as soon as possible. Camp 1 would be situated as far up the Waruma river as we could comfortably use boats. Derek, Harley, and Henrik went with Isaac Jerry and two Amerindians in one boat to look for a suitable site. The remainder of the party would rendezvous with them the next day.

Capt. Roger Chapman arrived at 2100 hours in the third and last boat from main base. With him were Oliver Hunter of the Guyana Ministry of Information, Lt. Frankie Gibbs of the Guyana Defence Force, and two other individuals from the Defence Force who were to remain at base camp at Makuripai to maintain a radio link between us and Kamarang.



Supplies being 'free dropped' at Makuripai from an 'Islander' aircraft



On the river Kaxc

Tuesday 10 August

The team and baggage moved to Camp 1, set up yesterday by Derek Bromhall and party, in two long-boats and a dug-out belonging to Irving George, one of our Amerindians from Makuripai. Two Guyana Defence Force men remained at Makuripai.

Heavy rain had fallen during the night causing the river to rise three feet. However this was a point in our favour, reducing difficulties we had in traversing four sets of rapids on the Waruma. Only on one occasion did one of the long-boats go out of control. On rounding a bend it entered a set of rapids slightly sideways on. The fast current whipped it round and the boat hit a submerged log. The leader was thrown out but his reactions were quick enough for him to twist around and grab the side of the boat with both hands.

Derek and party had discovered a most convenient site for Camp 1, on top of a high bank on a bend in the river. The Amerindians had built a framework of saplings from which we could sling our hammocks. This was to be our first night out in the open, and a great deal of amusement was caused in setting up the 'bashas'. For the uninitiated, once the hammock is slung, a piece of cord is stretched between the same two uprights to which the hammock is secured but above it and tied tightly at both ends. A groundsheet, or some other waterproof sheet, is then draped over this and fastened to the ground each side by a system of guy ropes so as to form an efficient roof. The inmate should, in theory, keep dry, and after the first night, in which one or two members of the party were drenched, any inefficiencies in 'basha' construction were very quickly rectified.

Radio contact was established with base camp at Makuripai, and with main base at Kamarang.

The botanist did a quick reconnaissance of the area and the zoologists set up mist nets for catching bats. Isaac Jerry, our Amerindian foreman, discovered an old trail some 150 yards from our camp, which was much overgrown and which he thought was Bailey's

trail of thirteen years ago. The forest here is typically riverain—very few large trees, mostly tall saplings growing closely together.

Wednesday 11 August

Heavy rain in the night had caused the river to rise yet again, and we had to get up in the early hours of the morning to save the boats and two drums of petrol which were in danger of being swept away.

The Amerindians set aside today for making their warishis, large, open-sided, basket-work equivalents of rucksacks, for carrying our gear. They are beautifully made from strips of a palm and certain kinds of bark found in the forest.

Sammy Edwards and 'Floyd' left with the boats to return to Kamarang where we could contact them by radio in case of urgent need. We were left with two dug-outs at Camp 1.

Thursday 12 August

A slight panic during the night when Oliver Hunter woke up to find a large bird-eating spider, *Theraphosa*, walking over him. He managed to capture it, however, and presented it to the zoologists for the expedition collections.

Isaac Jerry managed to clear the old trail for some six miles, and, at a convenient position by the river, set up Camp 2, and the Amerindians carried the first load of equipment from Camp 1.

Roger, Derek, and Henrik, moved to Camp 2 with the Indians, leaving the remainder to move on tomorrow.

The plan was, throughout the approach phase, that the trail cutting and reconnaissance groups should be ahead of the scientists, who would be able to carry out their work much more satisfactorily with peace and quiet.

Friday 13 August

Rear party move to Camp 2 at 2,230 feet altitude. Because it was Friday the thirteenth, Harley decided to slip when crossing over a fallen tree, sliding his fingers down the blade of a machete, badly lacerating two fingers. At Camp 2 Henrik put in twelve stitches.

Isaac Jerry had been busy trail-cutting and had already found a convenient site for Camp 3.

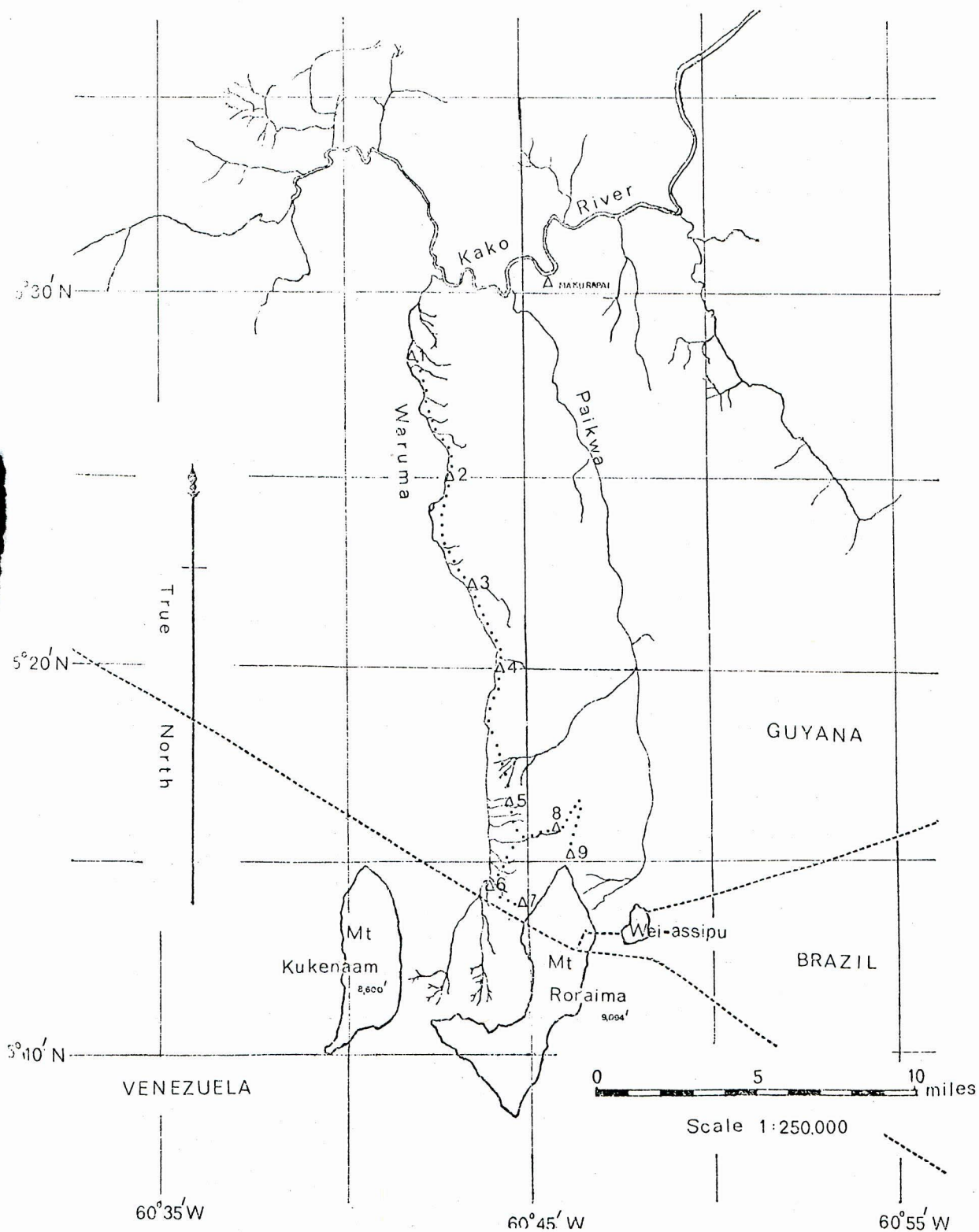
Everyone in good spirits, including Harley, who must have been in considerable pain earlier.

The Indians had caught a fer-de-lance (*Bothrops*) on the trail between Camps 1 and 2.

Saturday 14 August

A thunder-storm occurred during the night, the thunder echoing off the cliffs of Roraima and Kukenaam. Heavy rain caused the Waruma to rise three feet, but by 1100 hours the water level had fallen again. The scientists planned to stay at Camp 2 until Tuesday (17 August) as it promised to be a productive area.

The trail to Camp 3 was now clear, and it was decided that an advance party would move there tomorrow.



Part of the Kako, Mazaruni Area

Camp 3 lies on the banks of a shallow tributary of the Waruma, at 2,250 feet altitude.

Sunday 15 August

Advance party of Roger, Henrik, Derek, and Stephen, moved to Camp 3. The remainder planned to move tomorrow instead of Tuesday, and meanwhile Isaac Jerry and the Amerindians moved the equipment up the trail to Camp 3.



Camp in the forest

Monday 16 August

Camp 2 was not situated on a high bank as was Camp 1. After a night of incessant rain the river at Camp 2 rose six feet, to be almost level with the camp, the current racing along at some twelve knots. The zoologists' first task at Camp 2 was to retrieve the mist nets, which had been set out for bats, before the water rose any higher. They observed many areas of the forest which were flooded, but it was most amusing to find in the mist nets, instead of bats, two fish. During the short time the zoologists were away from camp the river rose a further two feet, and they were almost cut off from the camp which was now on a little island of its own, completely surrounded by the torrent. Everyone at Camp 2 was working feverishly building a high framework of cut saplings on which we put equipment, stores, and specimens. Only a small area in the centre of camp was left dry when the river began to subside at about 1130 hours.

At Camp 3 there were also problems. Although the river did not rise to the same extent as at Camp 2, the bank on which the camp was situated was not as high. The whole area quickly became ankle-deep in water, the equipment and stores having to be placed on a trestle for safety.

There was no question of the rear party moving forward to Camp 3 under these conditions.

Tuesday 17 August

Rear party move to Camp 3. The forest was still very wet but the water had subsided to normal level. No rain had fallen during the night.

Isaac Jerry was pressing forward with the trail to a site for Camp 4, and returned with a 'powis' or black curassow (*Crax alector*) which he had shot and which we made into an excellent curry.

Wednesday 18 August

Advance party of Roger, Henrik, Derek, and Harley, moved to Camp 4, the rear party following tomorrow. Zoological and botanical work at Camp 3 very productive. Isaac Jerry was busy cutting a trail to a convenient site for Camp 5.

Thursday 19 August

Rear party moved to Camp 4, a short walk through the forest of only 70 minutes, much of it along the banks of the Waruma. About half way along the trail the Indians had cleared an area by the river from where we had a good view of the cliffs of Roraima.

The forest here is still riverain in nature, but Camp 4 was situated on the edge of forest of rather different character with bamboo and small palms, and the tree branches were rather more mossy than we had previously noticed. The river at Camp 4 was shallow and swiftly flowing over a bed of large round pebbles. By swimming out to the middle we could see the north-western face of Roraima very clearly, still some seven miles distant.

Philip George had shot a tapir on the trail to Camp 5, and the carcass, weighing over 200 lbs., was butchered and smoked over a fire to preserve it. Jerry had also found some coatimundi (*Nasua sp.*) in the forest and had captured a young one which he presented to the leader. It was christened 'Quashi', the Amerindian word for coatimundi, and became the centre of attention in camp from that moment forward.



Isaac Jerry with a freshly killed Curassow

Friday 20 August

Advance party of Roger, Henrik, Derek, and Harley, moved to Camp 5, a distance of about five miles. Jerry described the trail as more difficult, and apparently, it crosses no streams for four miles. Camp 5 is not situated on the banks of the Waruma but about half a mile from it.

At Camp 4 we discovered that from a point about half a mile up the trail towards Camp 5, on a bend in the Waruma river, an excellent view was obtained of Iwalkarima, one of the other mesas in the Roraima-Eukenaam chain.

Saturday 21 August

The rear party moved to Camp 5, the five-mile journey taking nearly three hours of solid walking. The trail was difficult—over roots, fallen logs, under rocks, and over holes. When one slipped on the muddy forest floor and grabbed for a branch to save a fall, the hand only clenched a fistful of saturated moss, sending streams of water over our clothing. Everything was wet. Photographic equipment was a special problem under these conditions; it had to be kept in polythene bags with desiccant, and as soon as the lenses were exposed to the saturated atmosphere they steamed up, making photography an extremely frustrating process.

Camp 5 was situated in montane forest, the trees with high buttress roots and covered in thick dangling layers of moss. Ferns, too, were abundant. The transition zone of bamboos had been left far behind along the trail towards Camp 4.

Roger, Henrik, and Derek, carried out a reconnaissance of a trail for two miles towards the north-western cliff, which was visible from Camp 5, towering 6,000 feet above us and only two and a half miles away.

The team were in high spirits now we were so close to Roraima.

Sunday 22 August

Our trail, at this moment in time, ended at a wide shallow river, a tributary of the Waruma, cascading from north-east to south-west down the Roraima slopes some two miles from Camp 5 and some half mile from the cliffs of the north-western face.

Stephen, Martin, and the leader, cut a trail from this point north-east, which more or less followed the river, for one and a half miles. It was tough going up the steep slopes and the dense vegetation was interspersed with boulders and rocky outcrops of large size. Work stopped for the day after reaching 4,000 feet, where we came across a waterfall with cascades some 150 feet in height. We must surely have been near the cliffs.

Once again assembled at Camp 5, the possibilities of further movement were discussed. We were obviously close to the cliffs, but we felt that we should not pin our hopes on a single approach route from Camp 5. It was therefore decided that one party would cut a trail southwards, down the north-west face, and a second party continue the new section cut today to the north-east. The object of the latter party was to find a way up on to the north ridge, and of the former party to investigate the north-western cliffs at close range for any possible means of ascent. Jerry, Roger, and Henrik, had already reconnoitred the area to the south of the end of the existing trail for the possibilities of cutting a new one.

Monday 23 August

Jerry, Roger, and Henrik, started cutting a trail southwards from the river two miles from camp.

The scientists were hard at work collecting specimens. Wrenton Williams, one of the Amerindian porters, cut a trail to the nearest point on the river Waruma. It was revealed to be torrential and filled with enormous boulders, which presumably originated from the crumbling cliffs of Roraima. From the river a good view of the cliffs was obtained, but not good enough to quash any possibilities of finding any ascent routes.

Derek and David went to investigate the trail to the north ridge; Harley went to the river two miles from camp where, from a certain position, he was able to take bearings of the cliffs.



Montane forest

Stephen and Harley have volunteered to continue the trail to the north ridge while Roger, Henrik, Derek, and the leader, have chosen to investigate to the south. David, Martin, and 'Quash', were to remain at Camp 5 and continue scientific collections.

Roger and Henrik were to leave early tomorrow with Jerry and two Amerindians to go south and set up Camp 6. Derek and the leader would follow the next day.

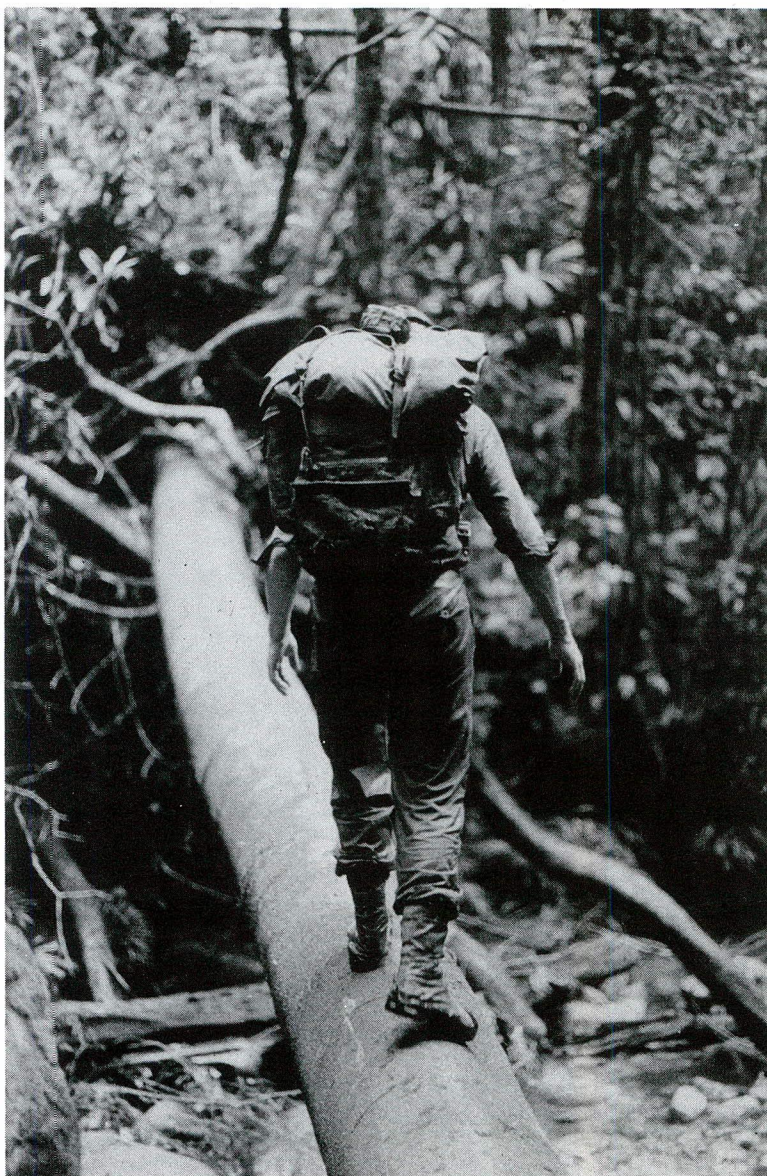
Meanwhile we contacted Kamarang by radio with a message to be cabled to our rear party in Britain, Major John Blashford-Snell:

PARTY AT FOOT OF NORTH FACE OF RORAIMA CONDITIONS DIFFICULT
AND UNPLEASANT STOP SCIENTIFIC SURVEYS GOOD STOP ALL IS WELL
STOP

Tuesday 24 August

At about 0500 hours howler monkeys (*Alouatta sp.*) came very close to camp. Very early Roger, Henrik, Jerry, and two Indians, moved off towards Camp 6.

Wrenton Williams, one of the Amerindians, managed to climb a tall tree in camp which we wanted to climb to take bearings on the mountains and thus fix our position. He looped a rope over a fork and we made a rope ladder. Stephen volunteered to climb the seventy-five feet to the top, and spent many hours squatting precariously in the crown while taking bearings and many photographs. It was at this point that we discovered that a large section of Kukenaam was covered by cloud in the aerial photographs, and in fact the mountain extends much further north than we had realised.



A fallen tree forms a convenient bridge over a forest creek

Two of our Amerindians had gone back to Camp 4 today to collect two packages which had been left behind. They returned with the packages and also with a 'crappow-head labaria', a particularly vicious form of fer-de-lance with a large head (*Bothrops brasili*). This specimen was about eighteen inches in length.

'Quashi' was growing up. He was now out of the liquid feeding stage (he had been very fond of army ration evaporated milk packed in tubes rather like toothpaste), and was now on the chewing stage. He was consequently weaned on to rice, like the rest of us. He was to stay at Camp 5 with David and Martin.

Wednesday 25 August

It rained incessantly during the night. Derek, the leader, and three Indians—Robert, Jonathan, and Richard—left at 1045 hours for Camp 6. Jerry's trail ran south-west and was very rough and Derek, who has seen jungle in many parts of the world, remarked that it was the thickest bush he had ever encountered. As we followed along the side of the mountain the trail would be up a small hill, down the other side, across a creek, up a small hill, etc., as there are so many streams flowing from the mountain and each has its own gully. We moved over slippery moss-covered logs and boulders, under rocky outcrops, walking on the roots of trees which would often conceal an expanse of nothing underneath, into which every so often one leg would disappear up to the thigh. We sweated until it poured from us. We each carried over 60 lbs. on our backs and in addition Derek carried the Bolex (H16 reflex ciné camera) which he had to offload on to Richard.

After two and a half hours we came to a creek where we had a wonderful view of the cliffs of Roraima. Our altitude here was only 3,500 feet, so the cliffs towering above us must be all of 4,000 feet in a single sheer drop. Half an hour's rest and we continued, the terrain becoming more and more difficult. Derek called to stop because of cramp at a point where we could see the cliffs of Kukenaam towering out of the jungle only two miles away.

A little further on we found a microhylid frog, *Otophryne robusta*, of which very few had ever been collected, and for which the leader had been searching and hoping for throughout the expedition. It was a peculiar, brown, flat, slimy frog, about three and a half inches long, and looking exactly like a leaf.

Almost at the same spot we came across a large bird-eating spider, *Theraphosa*, which Derek caught by hand.

Five and a half hours after leaving Camp 5 we crossed a large stream and, mounting a small hill, found Camp 6 and a note from Roger and Henrik in a cleft stick.

Roger and Henrik, together with Jerry and two Indians, had pressed on to cut a trail to Camp 7, very close to the cliffs of Roraima.

Stephen and Harley, attempting with three Indians to cut a trail onto the north ridge from Camp 5, had attained a point at 4,800 feet on the steep slopes of Roraima, and had set up Camp 8.

Thursday 26 August

At Camp 6 it had rained fairly steadily all night. Our wet, muddy rucksacks had rubbed our backs and shoulders raw, and putting them on this morning was a very uncomfortable process. The trail was rougher than ever as we climbed up the slopes, always becoming steeper. Looking behind us we would every so often see the cliffs of

Kukenaam glowing pink in the sunlight before we again returned to the dark green tangle, through which we were forcing our path.

Suddenly we met Roger, Henrik, and party, coming back towards us. They took us up the slope to a point where we could see the north-western cliff of Roraima—there were no places where a possible ascent could be made. The only possible ascent point was further down the western face, but inside Venezuela. We had to turn back, our efforts wasted, and we struggled in silence back to Camp 6. Roger and Henrik had made Camp 7 a little further on from the point at which we met, at an altitude of just over 5,000 feet.

Feelings at Camp 6 were heavy, but gave way to new feelings of determination to find a way up onto the north ridge.

Friday 27 August

We made our way back to Camp 5 where we found a note from Stephen and Harley, at Camp 8, to say that the north ridge was feasible but was causing some difficulties. We planned to rest tomorrow, our backs and shoulders had been rubbed raw, and our hands were splintered with spines from a palm, *Astrocaryum*. Henrik's back was particularly bad with ulcerated boils; it was obvious that he would be unable to carry a pack for several days.

Milton, one of the Indians, was stung by a scorpion in camp and became feverish, vomiting blood. The scorpion was a small black species with a white patch on the dorsal surface. The Indians told us that the sting from this was more virulent than that from a larger scorpion. Henrik administered an old Brazilian antidote called 'Especifico', which we all had our doubts about but which seemed to work.

David and Martin had been continuing their collecting work, in our absence, at Camp 5.

Saturday 28 August

A day of rest before making our way to Camp 8 tomorrow. But there was plenty to do: drying out camera equipment and sorting exposed film, labelling specimens, and washing and drying clothes and hammocks.

We sent Wrenton and Jonathan, two of the Indians, to Camp 8 to give news to Stephen and Harley of the failure of the southern route, and to find out how far they had progressed on the north ridge. They returned to say that Stephen and Harley were having difficulty finding a way round an escarpment, and to climb it would need climbing aids such as pitons, carabinas, and ropes.

We could take the necessary equipment tomorrow.

Sunday 29 August

During breakfast an enormous bird-eating spider wandered into the kitchen, a small shelter built from saplings and palm leaves. It was caught easily and added to Martin's collection.

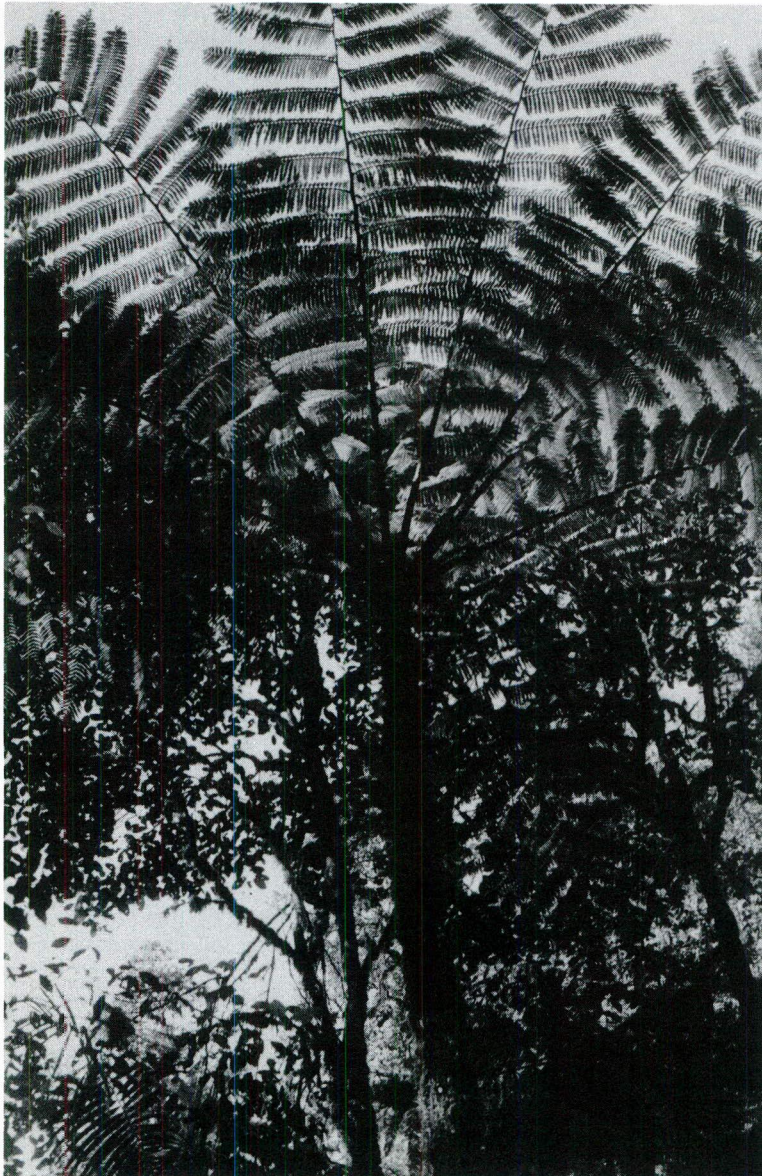
The Indians set off for Camp 8 at 0930 hours; Roger, Henrik, Derek, the leader, and Jonathan, an Indian, following one hour later.

Camp 8 was two and a half hours' walk from Camp 5, and although the trail was steep it was nothing like as difficult as that we had experienced on the southern trail. However,

the vegetation changed quickly and dramatically, culminating at Camp 8 in open scrub forest with many tree ferns and palms. Trees were covered in moss and masses of epiphytes. The ground was muddy and rocky.

Situated on a steep slope, high above the valley, with a little effort in clearing a few trees and undergrowth, we were able to see the northern end of Kukenkaam across the valley and the northern ridge of Roraima, and the 'prow' of the north face itself. Scenery such as this was a tonic after being enclosed in the darkness of forest for so long.

On arrival Stephen and Harley were not in camp, but we found a note to say that they had at last found a way round the obstructing escarpment and had set off to clear a trail to the top of the ridge. We could do nothing until they returned.



Tree fern at Camp 8



Behind swirling mists, the north face of Roraima, from camp 8

At 1730 hours they came into camp, very weary, but they had forced their way to a flat part of the ridge below the face at 6,750 feet. This was indeed good news, and a great achievement for both Stephen and Harley.

Monday 30 August

The amphibian collection had profited by a night hunt at Camp 8, an ideal place for tree frogs. The best finds were two specimens of *Oreophrynella*, a genus endemic to Roraima of which there are only two species, one of which lives on the summit plateau and the other in the talus forest, in which Camp 8 was situated.



North ridge and face of Roraima from camp 8



North end of Mt. Kake-aam from 4,800 feet on Roraima

The boils on Henrik's back had worsened and he was to remain in camp while the remainder of the party pressed on up the ridge to set up Camp 9. We realised that it would be impossible to find palm leaves for building a shelter, so we carried with us a large polythene sheet, to make a tent.

We left at 1000 hours with Jerry and five Indians. We each carried 40 lbs. The trail was very steep and slippery. After forty minutes we reached the troublesome escarpment which we ascended up a steep cleft; at one point having to improvise a rude bridge from cut saplings over a steep drop. The side of the ridge was now very steep, in some places almost vertical, and it was only by heaving ourselves up on the vegetation with our hands that we attained the knife edge, leading to the cliff face, two hours after leaving Camp 8.



Waterfall of 1,500 feet on the north-east face of Roraima

We joined the knife edge at 6,000 feet.

Here the whole flora was different. We came across *Heliamphora nutans*, the gigantic pitcher plant, well known to visitors to Roraima. Beautiful orchids clung to the thick, black slime covering the branches of the stunted, gnarled trees. It was a strange experience walking along the knife edge ridge being surrounded by cloud both above and below. Now and again the clouds cleared, revealing the forest in the valley far below where we could see the Waruma and Kako rivers.

At 6,500 feet we came to a gully forcing us to descend some 40 feet and ascend vertically 80 feet, for which we had to use a rope. Fortunately there were roots to help in pulling ourselves up, but the Indians were none-too-happy climbing with sheer drops each side.

Half an hour later we came out of the cloud forest onto the open flat area which Stephen and Harley had reached.

The north face of Roraima towered over us ahead. On the north-eastern face a fantastic waterfall of some 2,000 feet plummeted off the summit to flow directly into the Paikwa river. From time to time cloud would smother us in a moist blanket. It was cold. The Indians were cold too, but when the mist cleared they forgot their discomfort, pointing out the Kako river to each other and the possible locations of their homes and villages.

The ground was sodden with dark soil interspersed with patches of white sand and white rocks. There were no permanent streams, only a few temporary pools from which we had to take our supply of water. The flora consisted of large numbers of *Heliamphora nutans*, growing so densely in some places as to form a thick carpet of them. *Brocchinia* (a bromeliad), too, was abundant, as were *Utricularia*, *Befaria*, succulents, mosses, and liverworts.

There was little wood to build a shelter, but we improvised with some very twisted pieces over which we stretched the polythene sheet. There were some stunted trees some twenty yards away whose branches were just strong enough to hold hammocks.

From Camp 9 we had a clear view of all the other mountains: Maringma, Weiassipu, Kukenaam, Eluwarima, Waikepaie, Iwalkarima, and Ilutipu.

The Indians returned to Camp 8 for the night, as it was cold, taking with them large bags of plant material we had collected for David.

Tuesday 31 August

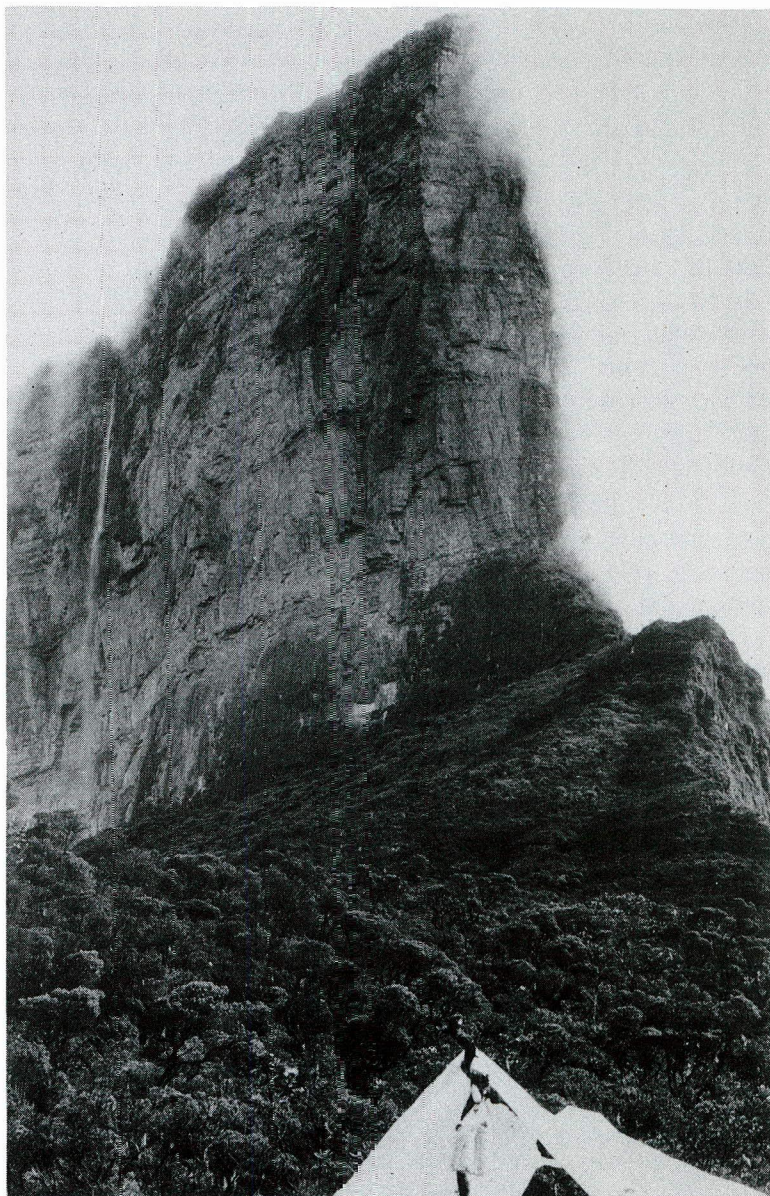
A cold night. The temperature fell to 12°C (54°F). None of us slept well because of being cold and also because of the hordes of mosquitoes which attacked us relentlessly.

At first light the mountains in the distance were very clear, with white clouds filling the valleys in between. At about 0815 hours clouds came in, enshrouding the view, followed by rain.

At 1000 hours Stephen and Harley set off for the top of the ridge, at the base of the north face, cutting a trail for us all to follow. Roger, Derek, and the leader, were busily collecting plant material for David, who was to move to Camp 8 today. David would not have been able to reach Camp 9 because, only having a single lung after suffering from tuberculosis when he was much younger, the climb would have been too strenuous.

At 1130 hours Henrik arrived, followed closely by three Indians, Wrenton, Jonathan, and Milton, who had come up to ferry botanical specimens down to Camp 8.

At 1300 hours Henrik and the leader set off in thick mist for the top of the ridge. It



Camp 9 at 6,750 feet on the north ridge of Roraïma

took one hour to reach the top, though it had taken Stephen and Harley three times as long to cut the trail.

The highest point on the north ridge registered 7,700 feet altitude on the aneroid barometer, and cannot be more than 1,200 feet below the summit plateau.

The mist cleared on reaching the top and we were able to take bearings on all the mountains, and a thorough photographic record. After the rain Paikwa head falls had swollen out of all proportion, and was thundering over the cliff. A slight wind whipped it into a horse-tail spray, showering us and the cameras with water.

The ascent point of Kukenaam was clearly visible through binoculars. We stayed at 7,700 feet for about two hours, collecting rock samples and botanical specimens.

Animal life was very scarce anywhere on the north ridge. Frogs could be heard calling 'pip-pip-pip', but were difficult to trace; one specimen, however, was collected at 7,000 feet. The only birds seen so far were *Zonotrichia*, endemic to this area, and a Harpy eagle, observed soaring between the north ridge and Weiassipu. Black butterflies were abundant, but again were difficult to capture; one specimen, however, was caught at 6,900 feet. This specimen is now in the collections of the British Museum of Natural History at South Kensington.

Back at Camp 9, Derek and Roger had used up over 2,000 feet of film. It was remarkably clear all day and distant mountains were still visible in the fading sunlight at 1845 hours.

Wednesday 1 September

At first light it was raining and everyone stayed in their hammocks until 0800 hours. It had been even colder than the night before, the temperature falling as low as 10°C (50°F). Even the mosquitoes must have felt the cold since we all had a trouble-free night's sleep.

Food was beginning to run short and we suffered a diminutive breakfast; an unfortunate situation because, all being so fit, our appetites had grown to dimensions unprecedented.

Jerry and the Indians arrived soon after 1000 hours. Most of the morning was spent in collecting more botanical specimens for David in Camp 8.

Some flowering bushes by the camp were visited by a green and orange humming-bird which seemed unconcerned by our presence. We managed to capture it on film.

We broke camp at 1430 hours to make Camp 8 well before dark. Henrik had already



Mt. Iwalkarima from Camp 9



Mt. Weiassipu from Camp 9

gone ahead with the Indians, and Derek wanted to film the cloud forest, so he lagged behind with Roger and Harley.

The Indians had worked hard to make the trail between Camps 8 and 9 easier, by building ladders and bridges over difficult parts.

After the low temperatures of the north ridge we even found Camp 8 warm, and it was almost good to get back into the forest. David and Martin had already left to return to Camp 5.

Thursday 2 September

Another diminutive breakfast. The food situation would probably have been fine, except that on about 28 August the Indians began to run out of their own food. This is a common fault with Indian porters. However, the situation was not too serious, and we felt we could last for about another week.

Stephen and Harley returned to Camp 5; the rest of us were to follow tomorrow. Jerry and the Indians have also returned to Camp 5 to make new 'warishis', since the original ones have practically disintegrated.

Derek spent most of the day filming and took some very good footage of leaf cutter ants.

Jonathan brought a note from Camp 5 from David, with details of remaining food supplies and to say that he and Martin were moving to Camp 4.

Friday 3 September

We left Camp 8 for the last time and returned to Camp 5. There were specimens to label, exposed film to sort, and all the expedition equipment at Camp 5 had to be sorted

out and repacked for the journey back to Camp 1. The Indians took one load to Camp 4 today and another is to be taken tomorrow.

Saturday 4 September

We left Camp 5 and returned to Camp 4 where the first river wide enough to swim in for some time welcomed us with its cool waters, soothing our sores and our aching limbs. From the river we nostalgically took our last close look at the cliffs of Roraima.

At dinner Roger's appetite wasn't too good, and, complaining of stomach-ache, he disappeared to his hammock.

Sunday 5 September

During the night Roger's pain had worsened, and Henrik diagnosed the complaint as appendicitis.

There was no question of what had to be done. Either Henrik could operate on the spot, or we could evacuate Roger as quickly as possible to hospital. Henrik pointed out that the risk of infection from operating in the jungle was high, and elected that we should evacuate Roger and, if necessary, Henrik could stop and operate at any time during the journey.

Roger was in great pain and was dosed up with Pethadine to relieve him.

Rapid discussions were made with Jerry, who told us he had experienced a similar situation before, and although the person in question was evacuated successfully, he died after arrival in hospital. We all realised that, at worst, Roger could die and it was up to us to make his exit from the jungle as rapid and as comfortable as possible.

The Indians cut a long, straight pole, strong enough to support Roger's weight, and lashed his hammock to it. Roger climbed painfully in and, with two Indians carrying him like some eastern potentate, and accompanied by Henrik and two reserve Indians, they left at 0745 hours for Camp 3.

Harley and Stephen attempted to make radio contact with base camp and main base without success, so we rapidly broke camp and made for Camp 3. We were still 70 miles from the nearest airstrip and 340 miles from a hospital in Georgetown, so there was no time to lose.

At Camp 3, after an hour of trying, Harley managed to get an emergency message through to Kamarang. He asked them to arrange to send a motor-boat from Kamarang up the river Kako to the mouth of the Waruma, and also for an aircraft to evacuate Roger to Georgetown the next day.

By 1700 hours the Indians had carried Roger as far as Camp 2. There was only another six miles to Camp 1, where two dug-outs were moored and prepared for the evacuation down river. The Indians were so tired after carrying Roger all day, they had no desire to continue through the night. Not only that, but an Indian would need a lot of persuasion to go into the forest at night on any account.

The expedition members discussed the situation. Henrik said very quickly: 'We must go on immediately, otherwise I will have to operate in the bush and I have not the best of equipment.' That decided it. With the aid of torches, the expedition members set off down the narrow trail which was often difficult enough to follow by day, but by night—well—we should see.

For the first half hour everyone was in high spirits, until the weight of the pole began

to dig into their shoulders. With four men to the pole, and three men ahead finding and clearing the trail, the slow column moved on. The talking and joking ceased as individuals struggled, slithered, and sweated down the trail, stumbling and falling over hidden roots or dark logs. It took until 1130 hours to reach Camp 1: six hours to cover six miles.

Monday 6 September

On arrival at Camp 1, Roger was in a very poor condition and was slipping into a coma. But the appendix was still intact.

Just after midnight Roger was gently laid flat in the bows of a dug-out. Lincoln and Milton were to navigate the canoe, and Henrik and Derek (who had experience in veterinary surgery) were to accompany Roger, in case an emergency operation had to be performed at Kamarang.

Derek writes:

From my position I had a clear view of Milton standing in the centre of the dug-out with his legs wedged against the sides for support. He had a powerful torch in one hand and a paddle in the other. He would shout in Akawaio to Milton in the stern as soon as he saw an obstacle, then, placing the torch between his legs, would paddle the canoe to the left or right. It poured with rain for a full hour, cutting down visibility to a minimum. Yet between them they manoeuvred the canoe with amazing skill through four sets of rapids, half-submerged tree trunks, between rocks and small islands. The narrow canoe was carried along with the fast flowing water on into the night.

By 0200 hours they reached the Kako river and, the motor-boat not being there, continued with the current down towards Makuripai. By 0300 hours they arrived and transferred Roger to the motor-boat, and headed off downstream immediately at a good twelve knots, powered by a 20 h.p. engine.

At 0800 hours, only an hour after their arrival at Kamarang, a G.D.F. 'Islander' arrived to fly Roger to Georgetown where an ambulance was waiting to take him from the airport to hospital. Henrik accompanied him.

The evacuation had gone well despite some bad moments. Exactly 48 hours after the initial pangs of pain, the badly swollen appendix was being removed in St. Joseph's Hospital in Georgetown. We are all deeply grateful to the Guyana Defence Force and the staff at St. Joseph's Hospital for saving Roger's life, and in particular to Sammy Edwards at Kamarang, who had sent his own motor boat to Makuripai, with 'Floyd' as coxswain, when he discovered that both the G.D.F. and the Police motor boats were out of action.

Derek returned to Camp 1 and arrived the following day just as we received a radio message from Kamarang to say that the operation had been successful.

There was still a trail of expedition equipment at various camps, and the day had been spent in ferrying it to Camp 1. Sammy and 'Floyd' had been asked to come to Camp 1 in time to take us to Kamarang on the 8th September.

Tuesday 7 September

There were still a few loads at Camp 2 to be brought to Camp 1. Sammy and 'Floyd' arrived later in readiness to take us down river tomorrow.

Wednesday 8 September

The team and baggage moved to Makuripai and on to Kamarang, where the Indians were thanked for all their help and paid fully for their services.

It took all day to make the journey down river, the boats loaded to the absolute maximum.

At Kamarang a party was given for the Indians at the guest house where the expedition was staying. Music and drink were organized and a ball was had by all.

All, except for 'Quashi', whose inquisitive nature led to his death. He had found some rat poison on the floor, had eaten it and after an hour and a half of suffering, he had died. We had all become very attached to the little animal, and it was a sad end to the expedition. But perhaps it was for the best; all of us would have preferred to see him run off into the forest, but he was too young and too tame to be wild again. None of us wanted to see him behind bars in a zoo and perhaps it was providence that killed him so close to Roraima, his home.

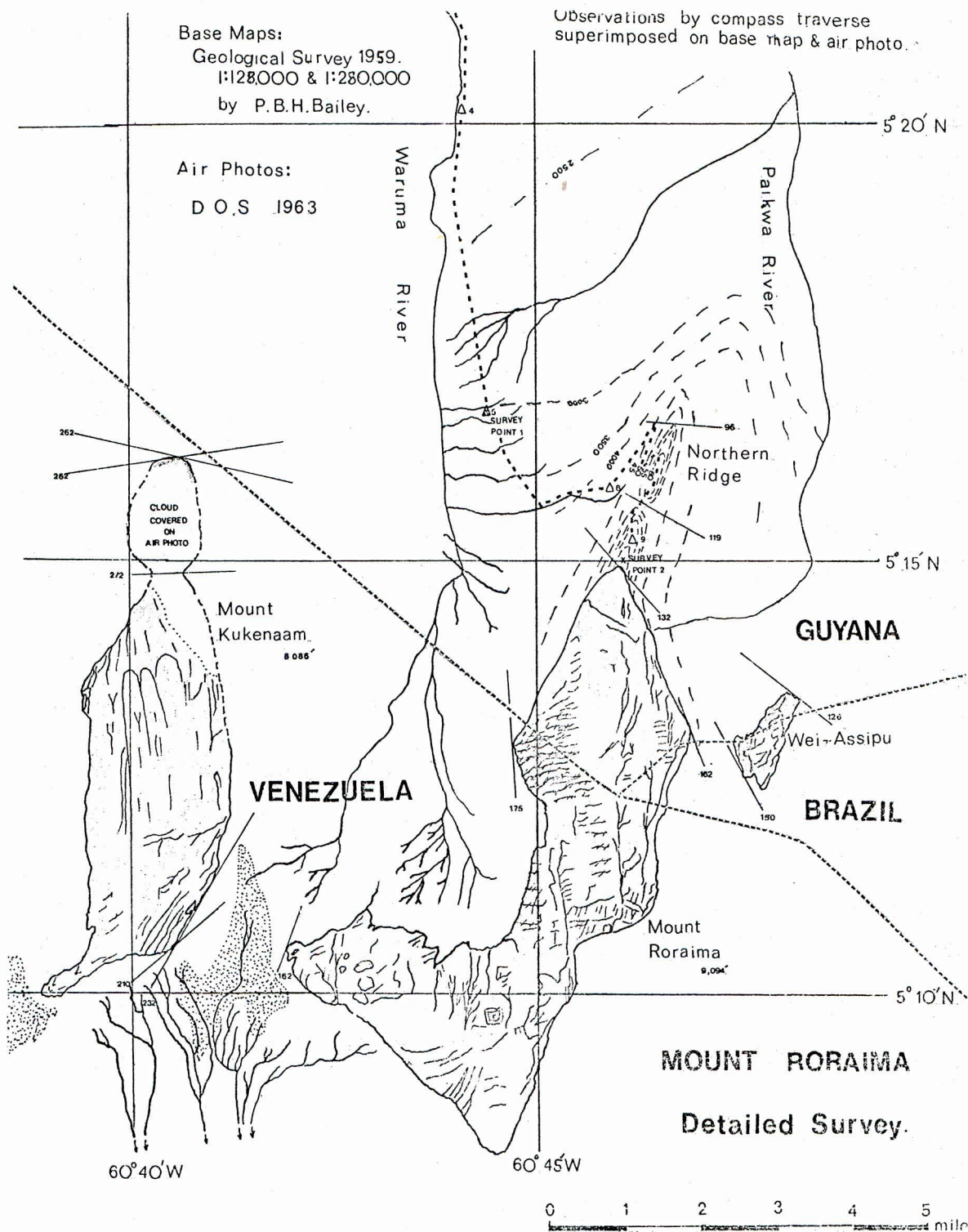
Thursday 9 September

The team moved to Georgetown in two 'plane loads. The G.D.F. had again kindly given us the use of an 'Islander' and Derek Murphy, the pilot, had brought mail which caused an immediate stampede for the hand-out.

We sadly said farewell to the Indians and took off from Kamarang for the last time. The individual trees slid away to a meaningless carpet of green, and it was all over.

As an expedition we had not been able to carry out the original surveys on top of Roraima and Kukenam for political reasons, but we had been successful in penetrating the northern slopes and in climbing the hitherto unexplored north ridge. We had brought back over 2,500 plants, snakes, spiders, bats, fish, and frogs, many of which were endemic to this part of the Pakaraima mountain range. Above all, we had returned with a great love for the fascinating and friendly jungle, and a deep respect for the remarkable people who inhabit its deep interior.

We did not feel that we had returned from a 'lost' world or a unique world in terms of modern tropical exploration, but it was a world which, by its remoteness and inaccessibility, amply rewarded any traveller who, through it, sets out to seek the ultimate in exploration: himself.



BRITISH RORAIMA EXPEDITION, 1971

Mount Roraima. Detailed survey

SCIENTIFIC REPORTS

Botanical Report of the British Roraima Expedition

David Philcox, M.Sc., Royal Botanic Gardens, Kew.

Before leaving England the aim of the botanist was to make a general collection of dried plants from Mt. Roraima. If this was not practicable, he intended to concentrate on collecting living plants from three selected families to enhance the living collections at Kew. He reasoned that, as there were likely to be difficulties encountered from the terrain and the inevitable delays in transportation, the best plants to collect were those most likely to survive these hazards. With this in mind he decided to collect orchids and bromeliads—the latter being members of the *Bromeliaceae* or pineapple family. Both groups of plants, as represented in Guyana, are mainly epiphytic on trees, and generally able to withstand removal from their hosts for considerable periods of time. A further reason for his choice was that these two families were being actively worked on taxonomically at Kew, and new glass-houses were in preparation for them. The third group chosen was *Lentibulariaceae*—or bladderwort family—also currently being studied for ‘Flora Neotropica’.

His decision to concentrate mainly on living plants proved, at Pipilipai, very early in the expedition, to be a fortunate one. It was after only two days in the field that he had the misfortune to see his plant-drying frame and presses destroyed in a fire caused by a faulty oil-heater. Only prompt action by him and his colleagues prevented the burning down of the mission hut in which the plants were being dried. From this point of the expedition no further dried plant collections were made, and all efforts were concentrated on collecting living and spirit-preserved specimens.

On the journey by canoe from Kamarang to Base Camp at Makuripai it became obvious that, had the accident to the frame and presses not happened, much botanical equipment would have been carried by the porters to little avail. This was because the whole area was thick riverain forest with apparently very few trees in flower—a fact later to be borne out when reaching dry land. The forest throughout this journey was quite dense, with trees rising to a height of from 15-30 metres, and unbroken until Base Camp was reached. From the river one could recognise many epiphytic *Ficus* spp., along with *Aechmea*, *Guzmania* and *Vriesia* spp. (*Bromeliaceae*), various *Gesneriaceae* and *Piperaceae*, while the only splash of colour was from the occasional occurrence of a large yellow-flowered member of the *Bignoniaceae*. In fact the forest so far impressed one by its apparent sterility.

Base Camp was situated at the small native settlement of Makuripai, set high above the Kako river at about 50 metres. The white sand savannah surrounding this area eventually proved to be a most profitable one botanically, as from here six species of *Lentibulariaceae* were collected, viz. *Utricularia hispida*, *U. longeciliata*, *U. juncea*, *U. sandwithii*, *U. triloba* and *Genlisea pygmaea*. Also here was *Brochinia reducta*—one of the rarer bromeliads and probably the most valuable member of this family collected during the expedition.

Between Camps 1 and 4 the riverain forest varied very little. The tree cover was

estimated to be between 80% and 90%, giving very little concentrated sunlight through to the forest floor, hence the ground flora was comparatively sparse in herbaceous plants. It was, however, variously covered with small undershrubs of *Rubiaceae*, *Leguminosae* (*Caesalpinoideae* and mainly *Bauhinia* spp.) and the spiny-leaved *Astrocaryum* (Palmae). With these occurred two large-leaved (c. 1.5 m long) *Rapataceae* and a huge spiny-leaved bromeliad (? *Bromelia* sp.). It must be stated here that the trail cut was rising only very slowly in altitude, rising only about 70 metres between Camps 1 and 4. The tall tree species here were many, but appeared to be dominated by *Lecythidaceae*, *Ebenaceae*, *Rosaceae* and *Leguminosae*.

From Camp 3 to Camp 4, however, change in forest type became clear. Although basically it remained as riverain type forest, the tree-cover lessened to about 70%-80%, giving rise to a rather dense ground layer of a small species of bamboo at the most about 2 m tall. In this area, among the leaf litter, were collected *Gymnosiphon cornutus* and *Apteris aphylla* var. *hymenanthera* (Burmanniaceae), two small saprophytes which were collected into spirit preservative.

The trail from Camp 4 to Camp 5 became far more arduous and the difference in altitude between these two was some 400 metres. The change in vegetation, too, was apparent. The forest continued dense, but its ceiling lowered, and what was once riverain in type gradually gave way to sub-montane type. In this type moss abounded everywhere. The trees were hung with great festoons of it and, with the constant rain and high humidity, gave rise to many moisture-loving epiphytes and filmy ferns. Among the species collected from this area were *Utricularia amethystina*, *U. alpina* and *U. jamesoniana*, all growing epiphytically in the dense moss on the larger trees, the latter being recorded from as high as 5 m on one tree. Several fine small species of orchids were also collected, such as a species of *Pleurothallis* and two of *Cheiradenia* spp., one with flowers only 3 mm across.

Above Camp 5 the vegetation clearly changed to montane type, and the tall trees of the previous type were replaced by smaller species and, below the northern ridge of Roraima, by tree ferns. The latter were very fine, growing to a height of about 10 metres. Here the ground flora became denser. Once on the ridge the trail rose from about 1,500 m to the final camp at about 2,500 m immediately below the rock-face. It was between this and the penultimate camp that a swamp was encountered, very similar in type and content to that found by Im Thurn on the southern side of the mountain in 1884. This swamp contained many species seen by Im Thurn, the most beautiful and striking being *Utricularia humboldtii*—a bladderwort with huge 8 cm wide leaves and one metre long scapes supporting large violet-blue flowers some 5 cm across. These plants had, as in the southern swamp on Roraima, the habit of occurring in the leaf axils of the giant bromeliad *Brochinia tatei*. Also here in abundance were the yellow-flowered *Abolboda sceptum*, the cerise-flowered *Utricularia campbelliana* and *U. quelchii*, many species of *Eriocaulaceae*, *Drimys brasiliensis* var. *roraimensis* (Winteraceae), *Bonnetia roraimae* (Theaceae) and *Cyrtilla racemiflora* (Cyrillaceae). Most important from the botanical view, however, were the two insectivorous plants collected here. The tall pitcher plant, *Heliamphora nutans* (Sarraceniaceae), with its large snowy white flowers and brick-red pitchers, and the much smaller white-flowered sundew, *Drosera montana* var. *roraimae* (Droseraceae).

The policy of the botanist had been to spend at least two days at every camp on the outward journey in order to collect his plants. These were listed and labelled and then left above ground level on a hastily made rack in the forest. This was to try and protect them

from attack by ants and termites, while at the same time allowing them to receive as much rain and sun as they normally would. On the return journey the plants were checked for damage by insects or the elements, labels or plants replaced where necessary, and the plants packed and carried back down the trail.

In all 512 individual plant gatherings were made, comprising 457 living collections and 55 either dried or in spirit preservative. The living collections included 131 bromeliads and 315 orchids, while 26 gatherings of *Utricularia* spp. were made, representing 15 distinct species.

On arrival in England it was found that 147 collections had not survived the journey, showing survival of about 68%. This is a very good figure of success when it is realised that most of the plants had to survive up to six weeks in the forest, detached from their hosts, and then to endure a rise in temperature of up to 40°F between their native locality on Mt. Roraima and sea-level Georgetown. One ripe fruit of *Heliamphora* was collected containing sixteen seeds. Of these, thirteen proved to be viable and successfully germinated. The resulting seedlings enabled precise studies to be made by specialists, of growth rate and plant habit in relation to light, temperature, and humidity requirements. Of the many mature plants of this species collected, only about a dozen have survived, but of those two have already flowered, and it is hoped will produce ripe fruits. Three fruiting heads of *Thurnia sphaerocephala* (Thurniaceae) named after Everard Im Thurn, were also collected bearing ripe and viable seed, from which numerous young plants have been successfully produced.

It is far too early yet to consider whether any new species were collected, but the value at the moment is in the fact that each and every record is new to science. Hitherto the area had never been collected from, and all plants previously recorded from Mt. Roraima came from Venezuela, not Guyana. As one can only accurately determine the specimens when in flower, identification of any expedition collection is a lengthy process. However, many of the plants have already flowered in cultivation at Kew, and below is a complete record of these determinations so far as is known.

List of Plants identified to date.

Lentibulariaceae

<i>Utricularia alpina</i> Jacq.	<i>U. pubescens</i> Sm.
<i>U. amethystina</i> St. Hil.	<i>U. pusilla</i> Vahl
<i>U. campbelliana</i> Oliv.	<i>U. quelchii</i> N.E. Br.
<i>U. hispida</i> Lamk.	<i>U. sandwithii</i> P. Taylor
<i>U. humboldtii</i> R. Schamb.	<i>U. subulata</i> L.
<i>U. jamesoniana</i> Oliv.	<i>U. triloba</i> Benj.
<i>U. juncea</i> Vahl	<i>Genlisea pygmaea</i> St. Hil.
<i>U. longeciliata</i> A. DC.	

Bromeliaceae

<i>Aechmea mertensii</i> (Meyer) Schult. fil	<i>Tillandsia bulbosa</i> Hook.
<i>A. nudicaulis</i> (L.) Griseb.	<i>T. flexuosa</i> Sw.
<i>A. tillandsioides</i> (Mart.) Baker	<i>T. monodelpha</i> (Morr.) Baker
<i>Brocchinia reducta</i> Baker	<i>T. pulchella</i> Hook.
<i>Guzmania lingulata</i> (L.) Mez.	<i>T. stricta</i> Lindl.
	<i>Vriesia splendens</i> (Brongn.) Lem.

Thurniaceae

Thurnia sphaerocephala (Rudge) Hook. fil.

Orchidaceae

Cheiradenia cuspidata Lindl.

C. imthurnii Cogn.

Batemannia colleyi Lindl.

Elleanthus linifolia Presl.

Epidendrum churuense Garay & Dunsterv.

Gongora quinquenervis Ruiz & Pav.

Maxillaria uncata Lindl.

M. amazonica Schltr.

M. candida Lindl.

M. ringens Rchb. fil.

M. reichenheimiana Rchb. fil.

Notylia aromatica Barker ex Lindl.

Octomeria filifolia C. Schweinf.

O. deltoglossa Garay

Ornithidium vestitum Rchb. fil.

Pleurothallis monocardia Rchb. fil.

P. stenopetala Lodd. ex Lindl.

P. orbicularis (Lindl.) Lindl.

P. wendlandiana Rchb. fil.

P. villosa Knowl. & Westc.

Scaphyglottis violacea Lindl.

S. reflexa Lindl.

Secaphyta diffusa (Sw.) Pfitz.

Stelis guianensis Rolfe

S. argentea Lindl.

Zygopetalum rostratum Hook.

Also:

Bifrenaria, *Bollea*, *Brassia*, *Catasetum*, *Coryanthes*, *Dichaea*, *Elleanthus*, *Fragia*, *Hexadesmia*, *Hexisea*, *Hormidium*, *Ostylis*, *Reichenbachanthus*, and *Sobrelia* spp.

Sarraceniaceae

Heliophora nutans Benth.

Zoological Report of the British Roraima Expedition

Introduction

1. Arachnid Survey
2. Fish Survey in the Roraima region
3. Herpetology Survey in the Roraima region
4. Bat Survey in the Roraima region
5. Zoological Work in the Kaieteur-Echerak region
 - a. Fish
 - b. Herpetology
 - c. Bats
6. Limnological Work in the Roraima region.

Introduction

The zoological team consisted of

1. Adrian Warren, working on bats and amphibians;
2. Martin Lyes, working on fish, arachnids, and other invertebrates of interest.

Full identification of the species in these groups is impossible in the field, with the possible exception of the bats. Therefore, the work was directed to making comprehensive collections and detailed observational data.

The original surveys proposed in the planning instructions of the expedition were prevented from reaching their conclusion by the alteration of route, a decision made necessary by a situation beyond the control of the expedition.

The original route of the expedition was to have approached Roraima from the southern savannahs, the usual approach route of expeditions and visitors to the area, since the only known ascent route to the plateau lies on the south face. Consequently, a certain amount of scientific work has already been carried out in that area.

However, the decision by Venezuela to refuse visas to the expedition, forcing an approach from the north, within Guyana, was a blessing in disguise. The region to the north is totally different in character, being densely forested. Much of it is totally unexplored, including the north ridge of Roraima until the expedition finally ascended it. Certainly no zoological or botanical work had ever been carried out in the area and, although the course of the expedition was to be far more difficult and uncomfortable, every single specimen we collected was to comprise a new record.

On any expedition traversing a region from A to B, scientific work is frustrated because workers may have to leave an interesting area prematurely, only to find they have to spend several days in an uninteresting one. To make this situation a little easier, the scientists formed a rear party throughout the approach phase. Thus the trail-cutting group, the advance party, would always be one camp ahead, leaving the scientists to work in peace and quiet.

The zoological work was hindered by the fact that one of the zoologists was also leader of the expedition.

The main areas visited by the expedition were as follows:

Pipilipai, an Amerindian village on the Kukui river

Consists of small patches of savannah bounded by primary forest at an altitude of 1,600 feet. Pipilipai lies 30 miles due east of Roraima, within Guyana, and is surrounded by densely forested hills.

The village itself has a resident nurse and missionary for the Pilgrim Holiness Mission. The majority of huts are well built with more than one room. There is a hospital and a small school. Close to the village is an airstrip which is serviceable for single engine 'Cessna' and twin engine 'Islander' aircraft.

Kamarang

Kamarang is a small settlement with an all-weather airstrip, situated at the confluence of the Kamarang and Mazaruni rivers. There is a hospital, school, general store, guest house, and a permanent field base for the Guyana Defence Force. Kamarang is also the residence of the District Commissioner for the Mazaruni area.

The region is forested and the rivers are wide and slow-flowing.

Makuripai

A small area of savannah, about four hundred yards square, bounded on three sides by riverain forest and on the fourth by the Kako river. It is the home of an Amerindian family. The savannah was used as the parachute dropping zone for the advance party of the expedition in the initial approach.

The river Kako here is fairly deep and is some hundred yards wide.

Upper Waruma river, Camps 1-4

The Waruma river and its tributaries are here typical of upper reaches, with stony beds, occasional rapids, and great variation in the daily volume of water carried.

The forest is riverain and is fairly flat, any slopes being gradual. There are low-lying areas which tend to flood in the wet season. Altitude 2,000-2,500 feet.

Northern slopes of Roraima, Camps 4-8

The forest here is typically montane. Everything is wet; thick moss covers the branches and trunks of trees, ferns and moss cover the ground, which is rocky and uneven with a thin layer of leaf litter. Streams and rivers are torrential; rain is frequent, even in the dry season. Altitude 2,500-5,000 feet.

North ridge of Roraima, altitude 5,000-6,500 feet

The ground is very steep, in places precipitous, with exposed rock. Trees present are stunted and gnarled, typical of cloud forest, with branches covered in thick black slime, which harbours orchids and bladderworts (*Utricularia*). Bromeliads are abundant, in particular *Brocchinia*, growing in dense clumps. Also present is *Heliamphora nutans*, the large pitcher plant.

North ridge of Roraima, 6,500-7,700 feet

At this altitude the north ridge opens out to a wide flat area. The cloud forest being largely left behind, the vegetation consists of low scrub and scattered patches of white sand. This area is dominated by the overhanging north face of Roraima. The vegetation is better described in the botanical section.

As a common misconception, people generally believe that the jungle is teeming with

wild life and dramatic films of it are generally backed by much fabricated dubbing.

The jungle is certainly very rich in wild life, but much of it remains hidden except to the most enquiring visitor. Indeed, it is possible to walk all day through the jungle and not see a single animal, the only sounds being the occasional call of a bird, alarmed by one's presence, and the eternal hubbub of the insect world undisturbed by the presence of a stranger.

It is not surprising that the larger animals remain elusive; most of the mammals are normally only active at night, and most of the birds live up in the tree-tops, invisible from the forest floor a hundred feet below.

However, when living in the forest for a period of weeks, the visitor inevitably comes across the odd animal. Giant otters ('waterdogs') were abundant in the Kako and lower Waruma rivers, and a giant ant-eater, *Myrmecophaga*, was observed swimming across the Waruma river during the early stages of the expedition. Later we came across tapir, *Tapirus*, coatimundi, *Nasua*, howler monkeys, *Alouatta*, the sloth, *Bradypus*, and rodents. As far as birds were concerned, many different species were observed, too many to name individually here, but curassow ('powis'), *Crax alector*, and tinamon ('ma'am'), *Tinamus*, were shot in the forest and made good eating. The expedition also came across macaws, toucans, cock-of-the-rock, humming-birds, kingfishers, woodpeckers, flycatchers, antbirds, duck, tanagers, manakins, and vultures. It is a pity that an ornithologist did not accompany the expedition.

Inevitably no single expedition can carry out all the work possible in any one area. If the Roraima expedition had had more funds, a total of five zoologists would have been desirable.

Within the limits of the groups studied, however, a fairly comprehensive survey was carried out. It is still too early to give detailed results, the long task of identification still continuing at the British Museum of Natural History, at the Rijksmuseum at Leiden, and the many other places to which the specimens had to be distributed after their arrival in England.

1. The Arachnid Survey

Martin Lyes, B.Sc.

Introduction

So little of the South American arachnid fauna has been taken from Guyana that it was decided to spend the short time at Echerak and Karisparu making a general routine collection. This period of time was also used to overcome any psychological problems of collection that might have existed in the author. Upon reviewing the arachnid fauna of Roraima, I found that only a few specimens were brought back by Im Thurn in 1884, and among those I noted were members of the Ctenidae. It was, therefore, decided to collect members of this group and attempt to bring back some data on their behaviour and habitat preferences. A simple collection was also made of the scorpions and Myriapods of the areas.

Methods

The methods used were similar on both phases of the expedition, most specimens

being captured by means of a sheath knife and a polythene bag or a forked stick. There were no casualties during the actual collecting, although one of the porters was stung by a scorpion (believed to be a member of the Chactidae). The majority of the material was preserved in formalin (5%), although some of the specimens which were brought in dead were dried in entomological boxes. This latter method was found to be most unsatisfactory, as the humid climate caused decay even if precautions were taken to prevent it. Any collector in South America would be advised to enlist the aid of the Amerindians, as a lively market can be created using small inessential items for trading, in this case packets of chewing gum for Theraphosids.

Before leaving for Guyana I consulted Dr. D. Clark of the B.M. (N.H.), who displayed great interest in the area and promised to review the collection upon the expedition's return. Unfortunately, Dr. Clark died the day the specimens returned to this country, thus depriving the museum of an excellent member of their staff and causing the collection to be shelved. Since that time efforts have been made to contact various world authorities in an attempt to get the material identified. Thanks to Dr. Hyatt of the B.M. (N.H.), the following people kindly agreed to review a part of the collection with these results.

Results

A number of scorpions were sent to Dr. Herbert L. Stahnke at the Poisonous Animals Research Laboratory, Arizona State University, and he confirms that the majority are Chactidae or Buthidae. Dr. Stahnke has only had time to look at the scorpions quickly, and has promised to complete species determination later this year.

The spider collection which Dr. Clark would have reviewed was sent to Dr. Wolfgang Bucherl, Instituto Butantan, Brazil. He has sent the following results:

Phoneutria sp.

P. sus of *fera*

Ctenus amphora

Ctenus albofasciatus or *amphora* several females

Ctenus albofasciatus Male—new to science from the Echerak area

Ancylometes bogotensis

The majority of the Roraima collection were *Theraphosa blondi*. However, some of the specimens appear to be very small for *T. blondi*, and Dr. Bucherl thinks further investigation would be interesting.

The Myriapods were passed on to Dr. R. L. Hoffman at Radford College, Virginia, and he reported the following:

Platyrrhacidae: *Rhyphodesmus drurii* (Gray)

Spirostreptidae

Chelodesmidae: *Zigwadesmus* or *Camptomorpha*

Euryuridae: new species and probably a new genus.

Unfortunately, many of the specimens were females and much of the classification is based upon the male genitalia. Dr. Hoffman is interested in describing the Euryurid as, although it is a female, nothing like it has previously been found in the Guyana region.

There are still a few specimens left at the museum, including an Onychophoran, presumably *Peripatus*, for which there appears to be no authority to identify it. However, efforts are still being made to find a taxonomist willing to take a look at it.

Conclusions

With the death of Dr. Clark of the museum, the prospects of getting the collection identified were slim. However, with the aid of the aforementioned scientists, the arachnid specimens have proved to contain new species, and even the possibility of new genera.

Acknowledgements

I would like to thank Dr. W. Bucherl, Dr. H. L. Stahnke, and Dr. R. L. Hoffman for their enthusiasm and co-operation in the identification of the arachnids, and also Dr. K. Hyatt at the B.M. (N.H.) for his invaluable advice.

The late Dr. D. Clark of the museum for his advice and encouragement.

2. The Fish Survey in the Roraima region

Martin Lyes, B.Sc.

Introduction

A more ambitious programme was planned involving the Venezuelan savannahs, which had to be abandoned when the route was altered. I finally decided that it was feasible to carry out a survey of the fish of the Waruma River and its tributaries for the following reasons. As we would be proceeding along the length of this river on our way to Roraima's northern slopes, it would be interesting to observe any zonation of species on our journey. Many notes were also taken upon the adaptations of the fishes to torrential stream life found on the river's upper reaches.

Methods

Before the expedition left England, a gill net (30 yards, 1½ in. mesh) was kindly donated by Bridport Gundry Ltd., which was employed in the slow-moving creeks surrounding Kamarang, although its use was restricted further into the interior due to the great variation in water speed and the presence of semi-submerged debris. Hook and line proved to be the most effective method of capture under the varying conditions (size 14, 10, and 8, and some unspecified hooks were purchased in Georgetown). Again the fish survey was greatly affected by the variations in water speed, for, as the expedition moved up the northern slopes, the slow creeks became either torrential deep waterways or very shallow rapids. The former were almost impossible to collect from, except in isolated bank contours. The latter areas were fished with a hand net, the majority of specimens being found in clumps of water vegetation. These fish were usually catfish, e.g. *Chaetosoma*, with highly modified mouthparts with wide lips and an abrasive tongue for rasping algae from stones. Camp 3 proved to be most productive for these fish.

Results

The following Characins have been identified by the museum:

Hoplerythrinus unitaeniatus

Erythrinus erythrinus

Pyrrulina melanostoma

Astyanax faciatus

Characidium pteroides

C. fasciatum

and also the following catfish:

Rhamdia quelen

Chaetosoma nudirostris

and a number of the common Cichlid, *Aequidens potaroensis*.

The remainder of the collection, mainly Trichomycterids, have been sent to Dr. Baskin in California, who is a private individual specialising in the classification of this group. This type of fish has never been collected from this area, and it appears that some of the specimens may represent new taxa.

Conclusions

There are no encompassing conclusions to be made from the fish collection at Roraima, as the actual size of the survey negates any statistical work. The very heavy rainy season of 1971 made for considerable difficulty in collecting and also a distortion in some of the local forms. The survey, however, does retain its validity as a collection of fishes from an area previously untouched, and it remains to be seen if the Trichomycterids provide us with any new taxa.

Acknowledgements

B.M. (N.H.)—for advice and equipment.

Dr. R. H. Lowe-McConnell—for her advice and the use of her Guyanan collections.

Bridport-Gundry—for the kind donation of a gill net and also general fishing kit.

Mr. G. Howells—who identified the Characins, Catfish, and Cichlids at the museum.

3. The Herpetology Survey in the Roraima region

Adrian Warren, B.Sc.

This report has been dealt with under two sections:

(a) Amphibians

(b) Reptiles

and constitutes an account of the collection made on the northern slopes and ridge of Roraima between 2,000 and 7,700 feet.

The primary interest lay in the collection and gathering of ecological data, of species known to be endemic to the region, but also to the comprehensive collection of material from the wet montane forest. This aim was unaltered by the change of plan to approach Roraima from the north; in fact, it is felt that the herpetology survey was greatly enhanced by an approach through dense wet forest and by the fact that all records were original from this unexplored area.

(a) Amphibians

Over 130 amphibians were collected in the area under study, and it is interesting to note that approximately half this number were collected above 4,600 feet and nearly three quarters above 3,000 feet.

The collection was despatched to Dr. M. S. Hoogmoed of the Rijksmuseum in Leiden by Miss A. G. C. Grandisson, Curator of Herpetology at the British Museum of Natural History at South Kensington, where the collection was deposited on arrival from South America.

Too little is known of South American frogs, and they cause great difficulties in identification, but Dr. Hoogmoed, a world authority on the amphibians of the Guiana region, has to date identified just over two-thirds of the collection.

In a letter, Dr. Hoogmoed said that the collection was very interesting, and that there were several species which he could not identify and which might prove to be undescribed.

The list of species as so far determined is as follows:

- ? *Sphaenorhynchus aurantiacus*
- Leptodactylus mystaceus*
- Leptodactylus rhodomystax*
- Leptodactylus minutus*
- ? *Eleutherodactylus marmoratus*
- Centrolennella fleischmanni*
- Hyla boans*
- Stefania evansi*
- Osteocephalus buckleyi*
- Phyllobates spec. 1* see explanation
- Phyllobates spec. 2* below
- Bufo g. guttatus*
- Bufo sp.* see explanation below
- Oreophrynella macconnelli*
- Otophryne robusta*

Phyllobates spec. 1

Unidentifiable to species level. Smooth, light brown above with or without dark brown markings, black temporal and lateral stripe, ventral parts immaculate.

Thirty-six specimens of this frog were collected, all between 2,500 and 3,500 feet altitude, in lower montane forest. The small frog frequents the forest floor and is very rapid in movement.

Phyllobates spec. 2

Unidentifiable to species level. Warty, dark brown above with black markings, black temporal spot, ventral parts spotted with brown (or not), sometimes throat even entirely black from high altitudes.

Six specimens were collected; one from Camp 8 at 4,800 feet at the foot of the north ridge, and five at 6,500 feet on the crest of the north ridge in cloud forest. The latter were found in bromeliads, e.g. *Brocchinia*.

Bufo sp.

Earlier in the expedition, the two zoologists had spent some time in the Kaieteur-Echerak region of Guyana. One of the aims of this visit was to secure further specimens

of a toad, a *Bufo*, which the leader had first encountered in 1968 and which promised to be a new species.

It was interesting therefore to find a new locality for this toad in the upper Waruma river region at Camp 2 and also at Camp 5 on the northern slopes of Roraima, at 3,050 feet in montane forest. Four specimens at Camp 2 and two at Camp 5 were collected.

Further details and a description of this toad may be found in the relevant section describing work in the Kaieteur-Echerak region.

Discussion

The most interesting feature in a collection such as this is the altitudinal zonation of species. As the expedition proceeded from camp to camp, each higher in altitude than the last, the emphasis became not so much on the species living on the forest floor but on to the tree frog types. Montane forest, as at Camps 5-8, is much wetter than riverain forest found at lower altitudes, and the moss and ferns of montane forest gives much more cover for tree-living forms; and the moist environment is ideal for frogs.

At lower altitudes then, we find the Leptodactylids living on the forest floor: *Leptodactylus rhodomystax*, *L. minutus*, and *L. mystaceus* from 1,600 feet at Pipilipai on the Kukui river to Camp 3, at 2,250 feet, in the Waruma drainage. Riverbank forms such as *Bufo g. guttatus* and another *Bufo* sp. (discussed earlier), occur along the Waruma drainage.

Between 2,250 and 2,300 feet occurs *Osteocephalus buckleyi*, a small tree frog with a green, warty skin, typically living on low water weeds, particularly sedges, in small sheltered streams. This species is active during the day, and was heard croaking on several occasions. Strangely, these frogs have a strong musky, vegetable-like odour.

How far this species extends outside this apparently narrow altitudinal range here is not known.

An isolated specimen of another tree frog species, *Hyla boans*, was found at 2,250 feet.

At 2,300 feet, at Camp 4, a single specimen of *Centrolenella fleischmanni* was found in a bush on the banks of the river Waruma. The centrolenid family of frogs, to which this species belongs, are arboreal in habit, very small in size (28 mm maximum snout-vent length) and are generally encountered clinging closely to the leaves of herbs and trees in the immediate vicinity of running water. The eggs, in some if not all species, are placed on leaves above the water, the young hatching and falling into the water to continue their development as tadpoles. *C. fleischmanni* is bright green above, the flesh on the ventral surface being almost transparent.

Above 3,000 feet, Phyllobatids occur in two, at present unidentified, species. The first occurs between 3,000 and 4,600 feet, the second occurring between 4,800 and 6,700 feet. The latter may extend further; a frog collected at 7,000 feet remains unidentified.

Stefania evansi is a species which frequents small forest creeks, especially where there is a waterfall or cascade with plenty of rocks overhanging the water. *Stefania* seems to have a wide altitudinal range, specimens being found between 1,600 and 4,500 feet.

At Camp 8, at 4,800 feet, the character of the forest changed; tree ferns and palms becoming dominant features. Here *Oreophrynella macconnelli* occurs, this species later being found to extend up to 6,000 feet. *Oreophrynella* is a genus endemic to Roraima and specimens found constitute the first records of this species in Guyana. Previous to this collection this species was only known from the type specimen collected in 1898 by

McConnell and Quelch, on the Venezuelan side of Roraima.

Another first for Guyana is *Otophryne robusta*, a microhylid frog, flattish in shape, and living on the forest floor. Two specimens were found between 3,700 and 4,800 feet. Previous to this collection, this distinctive genus was known from only four specimens.

Many of the frogs from Camp 8 at 4,800 feet have still to be identified, but among these is a probable *Eleutherodactylus marmoratus*, a species previously recorded from the south side of Roraima and Mount Marahuaca in Venezuela. This particular specimen was caught concealed in moss, thirty feet up a tree.

If the expedition had been able to reach the summit of Roraima, it would have expected to find *Oreophrynella quelchii*, a species typical of the summit plateau and closely related to *O. macconnelli*, found in the talus forest. Whether these two are really separate species or only different races of the same form is an interesting problem, and is one which could be elucidated by further work.

Summary

This collection is probably one of the largest to come out of Guyana and contains several possible new species, and several firsts for Guyana. It was a great privilege to work in a region totally unexplored by the biologist, where every creature found is interesting because it constitutes a new record.

(b) Reptiles

The collection is comprised of only twenty-eight specimens, but constitutes fifteen species, all of which are new records for the area. The material has been determined by Mr. J. Stimson at the British Museum of Natural History at South Kensington.

Methods

No individual emphasis was placed on the reptiles, the aim being to collect reptiles as and when they were found. Labelling and preservation of specimens was easy to carry out along with the amphibians.

Most specimens were caught alive, .22 dust shot only being employed with those difficult to catch, for example, many of the lizards. All the snakes were caught alive.

Results

The following is the list of species as determined to date:

Anolis chrysolepis planiceps

Gonatodes annularis

Anolis ortonii

Plica plica

Anolis fuscoauratus

Bothrops atrox

Ameiva ameiva ameiva

Bothrops brasili

Leptosoma percarinatum

Chironius multiventris

Neusticurus rudis

Chironius fuscus

Kentropyx calcaratus

Leimadophis reginae

Arthrosaura sp.

The collection includes two species of fer-de-lance (*Bothrops*), and two specimens of a

lizard, *Arthrosaura* sp., which lives amongst forest litter and which is a genus of difficult characteristics for the taxonomist, specimens of different areas showing a great range of variation.

4. The Bat Survey in the Roraima region

Adrian Warren, B.Sc.

The collection is comprised of forty-eight specimens and only five species.¹ This paucity in number of species in the area is worthy of note. The collection is not remarkable for any rare or new species.

Technique of capture

The techniques used may be split into three categories:

1. Fixed mist netting
2. Netting bats by hand at daytime roosting sites
3. .22 dust shot.

The first method was by far the most successful. Six large mist nets, each twenty or thirty feet in length, were at the disposal of the expedition. These were set out at each locality, as far as possible across probable flight runs. In dense forest, for example, a usual flight run would be along a small creek where a natural tunnel is formed through the vegetation and where insects are abundant.

When in one locality for a long period, nets can be placed methodically and the survey may be carried out efficiently, but when moving from locality to locality with only two days in each, positioning of the mist nets is largely pot-luck.

When roosting sites of bats were found during the day, bats were captured with small scraps of net held in the hand. Although this is rather a hit-or-miss procedure, for those specimens which are captured much interesting information on their preference for roosting sites, numbers in a roost, other species in the roost, etc., can be taken which would not be available if the bats were merely caught in a fixed net at some obscure location.

Shooting bats with dust shot tends to be unsatisfactory at the best of times. Even if a bat is hit, it is often difficult to recover the specimen, especially at night. Under some circumstances, in a cave for example, where a hand net cannot be employed, it is a useful method to fall back on.

After capture

The bats were killed with 'Euthatal', a pentobarbitone solution which was injected intravenously. The following data was recorded for each bat: date and time of capture; locality and altitude; sex; weight (in grams); head and body length, tail length (if present), hind foot length, ear length, tragus/antitragus length, forearm length (all measurements in millimetres); method of capture, place of capture; height above ground of flight path; presence (or not) of ectoparasites (if present, collected and preserved separately).

The bats were finally preserved in a 5% solution of formalin which was changed as

¹ Fourteen specimens, held by the Guyana museum, are still to be identified.

frequently as possible.

After arrival in England they were deposited at the British Museum of Natural History at South Kensington, where they were transferred to spirit.

The bats collected in each locality

(a) Pipilipai, on the river Kukui

Mist nets set up in the riverain forest by the river yielded several specimens of *Carollia perspicillata*, a small fruit-eating Phyllostomid. Flight paths varied between two and four feet, with the exception of one specimen which was extracted from the net only six inches above ground level.

A cave was investigated on the edge of the savannah revealing a colony of several hundred bats, probably all *Carollia perspicillata*. Dust shot was used for sampling. One female taken was carrying a young one (head and body length 39.8, forearm 34.2).

Examination of human dwellings revealed numbers of *Molossus molossus*, a common house bat throughout Guyana.

(b) Makuripai, on the river Kako

Mist nets were set up on the high bank of the river Kako, near the Indian huts, and on the savannah. Bats were seen and heard on the savannah and they were possibly *Myotis*, but it was not possible to confirm this.

A mist net on the river bank yielded a female *Artibeus cinereus cinereus*, flight path four feet above ground.

Slightly further up river two separate colonies, of less than a dozen in each case, of *Rhynchonycteris naso* were observed on branches hanging over the water. This bat, of the group of sac-winged bats, is alert during the day.

(c) Upper Waruma river, Camps 1-4

Mist nets were set out on the river bank, over small creeks in the forest and in the forest itself. It was strange then that only three species were caught.

Rhinophylla pumilio, a small insectivorous species was the most common, three specimens being caught in Camp 1, six in Camp 2, two in Camp 3, and ten in Camp 4. They were never caught away from water, usually over a small creek in the forest. Flight path height varied very little, always being between four and five feet above ground level.

Carollia perspicillata, a small frugivorous species, was present in all camps except for Camp 3. It was not possible to stay at Camp 3 for long, but it seems certain that this species must be present there. It was caught in mist nets set on the river bank or over small creeks in the forest, always between four and six feet above ground level.

Only at Camp 4 were two specimens of *Artibeus lituratus fallax* caught, above a small creek in the forest, between four and five feet above ground level.

Not caught, but observed and identified without any difficulty whatsoever, was one specimen of *Vampyrus spectrum* at Camp 4. Its flight path followed a section of the river Waruma, here fairly wide, about ten feet above the water.

(d) Montane forest, Camp 5

Mist nets set up over a torrential stream fairly close to camp yielded *Rhinophylla pumilio* and *Artibeus literatus fallax*, between four and five feet above the water.

Though mist nets were set up, no bats were collected beyond this point, neither were

they observed or heard. The paucity in both numbers and species of bats was amazing.

The apparent absence of bats from the higher slopes and the north ridge may possibly be explained by the low temperatures. Certainly there is no lack of roosting sites with so many scattered boulders, forming boulder caves, and so many fallen trees.

It would be interesting to compare the results of this with those of any future expeditions in the area.

My thanks are due to Mr. J. E. Hill and Miss Paula Jenkins at the British Museum of Natural History for their aid in identification of the bats.

Note

Experiments are being carried out at the Polytechnic of Central London, under Dr. J. Tampion, to test fat samples from *Rhinophylla pumilio*, an insectivorous species, for presence of D.D.T. deposits. The discovery of the presence of D.D.T. in such a remote area as Roraima would be an interesting one.

5. Zoological Work in the Kaieteur-Echerak region

Adrian Warren, B.Sc.

On the 27 June 1971, Martin Lyes and I left England for South America, our aim being to spend two weeks in the Kaieteur-Echerak region of the Guyana highlands before joining the Roraima party in Georgetown on the 18 July.

I had visited the area in which we were to work twice previously, once in 1968 as the junior member of an expedition led by Mrs. Christina Wood,¹ and again in 1969 with Dr. Pat Morris and Mr. Hilary King.

The object of revisiting the area was to collect further material of a possible new species of toad, genus *Bufo*, the first specimen of which I collected in 1968, an adult female. It was inadvisable to describe it as a new species at that time, since it had certain affinities with an Eastern Andean species, *Bufo ceratophrys*, known only from adult males. In 1969 only one further specimen was collected, this time a juvenile, leaving the controversy unsolved.

The problem was described in *Nature*, vol. 225, no. 5235, and it was finally decided to make a third and last effort to collect further material.

Thus, on 3 July, Martin Lyes and I flew in a single-engined 'Cessna' aircraft to the small landing strip at Karisparu, a day's walk from the collecting area at Echerak.

A further aim of this small expedition was to make a collection of fish and arachnids, the interest of Martin Lyes, and to supplement collections of amphibians, reptiles, and bats, already made in 1968 and 1969.

It was still the wet season, and after the worst rains in thirty years serious flooding was being experienced all over Guyana. Much of the forest was flooded, and when we crossed some of the wide rivers to reach the collecting area we knew we ran the risk of being stranded if there was any more heavy rain.

Although we were unable to get out to return to Georgetown until 19 July, a day later than planned, the small expedition was successful in achieving its aims, three further specimens of the unknown toad being collected.

¹ This expedition formed the basis for her book *The Magic Sakis*, published in 1972 by Nelsons.

(a) *The Fish Survey in the Kaieteur-Echerak region*

Martin Lyes, B.Sc.

Introduction

The collecting was to be of a general nature, an attempt being made to bring back a sample of the local fish fauna present at that time.

Methods

The main water masses encountered at Echerak were either very fast flowing rivers or small isolated pools, prevented from stagnation by frequent flooding of the area. The majority of the specimens were obtained from these still pools by means of a hand net, the hook and lines being negated by the speed of even narrow creeks. A useful technique employed during night fishing was the beam from a head torch. The light is sufficient to illuminate the fish, but not so great as to startle it.

Results

All the fish were killed and preserved in 5% formalin, and passed to the British Museum (Natural History) for identification. The identification of the fish is still not complete, but a few of the common species are given below.

Pyrrhulina melanostoma

Characidium fasciatum

Chaetostoma nudiostrois

Also various Trichomycterids.

Summary

Although the classification is not complete, it is possible to see from notes taken at the time that many of the species were found in all habitats, and showed none of their usual habitat preferences. It seems feasible that the very heavy rains of March, April, and May 1971, did have a considerable effect upon the local fish fauna. The sudden increases and decreases in water volume and speed may have forced fish not usually found together into temporary pools, whilst much of the aquatic fauna was flooded downstream. This hypothesis could only be proved by another visit to the area in the dry season, when a collection would find a different fish fauna present.

(b) *Herpetological work in the Kaieteur-Echerak region*

Adrian Warren, B.Sc.

i. *Amphibians*

The collection comprises twenty-eight specimens constituting nine species which have been determined by Dr. M. S. Hoogmoed at the Rijksmuseum in Leiden.

The list of species is as follows:

Leptodactylus mystaceus

- * *Leptodactylus rhodomystax*
- * *Leptodactylus pentadactylus*
- Leptodactylus rugosus*
- Stefania evansi*
- * *Phyllobates* sp.
- * *Atelopus spumarius*
- * *Rana palmipes*
- Bufo* sp.

various unidentified small frogs in stages of metamorphosis.

Discussion and summary

The most important specimens in the collection were *Bufo* sp., and it was especially interesting to find several further specimens of the same species in a new locality, on Roraima. It is strange that previous collectors have not found this particular species. It is now hoped that this toad may now be properly determined.

Of the nine species in the collection, five are new records for the area, and are indicated in the list of species with an asterisk. Among them is *Phyllobates* sp., collected later on Roraima between 2,500 and 3,500 feet altitude, but in Echerak at only 1,500 feet.

A report on the 1968 and 1969 collections is lodged in the British Museum of Natural History, at South Kensington.

ii. Reptiles

The collection comprises only nine specimens constituting five species, which have been determined by Mr. J. Stimson at the British Museum of Natural History at South Kensington. This collection supplements those made in 1968 and 1969, a full report of which is lodged at the B.M. (N.H.).

The list of species in the 1971 collection is as follows:

- | | |
|-------------------------------------|------------------------------|
| * <i>Bachia parkeri</i> | * <i>Leimadophis reginae</i> |
| * <i>Gonatodes humeralis</i> | <i>Chironius fuscus</i> |
| <i>Anolis chrysolepis planiceps</i> | |

Discussion and summary

Of the five species collected three are new records for the area, and are marked in the list with an asterisk. *Bachia parkeri*, a small legless lizard, was found under woodcuttings on the edge of savannah; two specimens were collected. *Gonatodes humeralis*, a small gecko, was caught in a human habitation.

Anolis chrysolepis planiceps was caught in 1969 in forest leaf litter. Three specimens were collected in 1971 under the same conditions.

Only three snakes were encountered during the two weeks. *Chironius fuscus* was caught in undergrowth by a small forest creek, a typical habitat for this water-loving snake. *Leimadophis reginae* was caught in forest leaf litter. The third snake was a large pit-viper, between five and seven feet in length and black in colour. We encountered it on the forest trail between Karisparu and Echerak. It reared up into strike position and our efforts to secure it alive proved to be too dangerous, the snake eventually slithering away at such a speed that we had to run to keep pace with it.

(c) *Bat collecting in the Kaieteur-Echerak region*

Adrian Warren, B.Sc.

The collection comprises twelve specimens and six species, and has been deposited at the British Museum of Natural History at South Kensington.

The collection supplements those of 1968 and 1969, and brings the total number of species recorded from the area to thirteen.

The 1971 collection has been determined as follows:

- | | |
|--------------------------------------|--------------------------------|
| * <i>Chilonycteris rubiginosa</i> | <i>Carollia perspicillata</i> |
| * <i>Tonatia sylvicola laephotis</i> | * <i>Trachops c. cirrhosus</i> |
| <i>Carollia castanea</i> | <i>Desmodus r. rotundus</i> |

Discussion and Summary

Three of the six species collected are new records for the area. All specimens were caught in fixed mist nets, *Chilonycteris* and *Tonatia* preferring dense forest, *Carollia* and *Trachops* preferring a clearing with a deep, still pool. *Trachops* was entangled in the net only six inches above the water.

A pigpen at Karisparu, which in previous visits has shown signs of vampire bat activity, yielded seven vampires, *Desmodus r. rotundus*, in one night, when a pen occupied by a sow and two piglets was completely surrounded by mist nets. Four specimens were caught between 2130 and 2230 hours, and the remaining three were found just before dawn. There was no moon that night; it seems that *Desmodus* prefers moonless nights.

6. Limnological work in the Roraima region

Adrian Warren, B.Sc.

A certain amount of limnological work was carried out in the Waruma river and its tributaries. This work took the form of recording physical factors, collecting water samples and specimens at fourteen different stations between Camp 1 at 2,100 feet altitude and camp 9 at 6,750 feet.

This report unfortunately can only be an indication of work done, since none of the water samples have been chemically analysed nor have the zoological specimens been identified. While this will be completed as soon as possible, it may be useful to include here some of the physical factors recorded during the expedition by Lt. Stephen Cobb.

Many of the results, such as current speed when related to width and depth to give the volume of water carried by the stream, have little value here since heavy rain or a period of drought can dramatically alter the volume of water.

If the expedition had been able to reach the summit of Roraima, the limnology would have been especially interesting in the study of two large lakes which were visible from the air during reconnaissance.

Limnology report—Results

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Station	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Date	11 Aug	14 Aug	15 Aug	15 Aug	17 Aug	20 Aug	23 Aug	23 Aug	25 Aug	27 Aug	28 Aug	30 Aug	30 Aug	30 Aug
Camp	1	2	2	2	3	4	5	5	5	8	8	9	9	9
Alt. (ft.)	2100	2100	2100	2100	2275	2300	3050	3175	3000	4800	4800	6750	6750	6750
State	Dense Trop. Riv. For. /High banks	As stat. A 8 ft. banks	As stat. A 6 ft. banks	As stat. A 8 ft. banks	As stat. A 3 ft. banks	As stat. A 5 ft. banks	Mont. for. 3 ft. banks	Mont. for. Low banks	Mont. for. 20 ft. banks	Mont. for. Low banks	Mont. for. Low banks	Scrub/ cloud for. puddle	Scrub/ cloud for. puddle	Scrub/ cloud for. puddle
Width	25m.	30m.	30m.	20m.	20m.	37m.	2m.	1m.	25m.	0.7m.	1m.	—	—	—
Depth	5m.	1.5m.	0.5m.	0.2m.	0.6m.	1.3m.	0.25m.	0.20m.	—	0.1m.	0.1m.	—	—	—
Current speed	1.25m. /sec.	1.0m. /sec.	2.0m. /sec.	0.8m. /sec.	0.8m. /sec.	0.5m. /sec.	0.5m. /sec.	0.2m. /sec.	3.0m. /sec.	0.05m. /sec.	0.05m. /sec.	—	—	—
Water type	black	black	black	black	black	black	black	black	black	clear	clear	clear	clear	clear
Substrate	mud/silt	mud/silt	stones	mud	mossy stones	large mossy stones	rocks /sand	rocks /sand	rocks /boulders	rocks /silt	stones /silt	pitcher plant	bromeliad	sand
Water surface	swift/ foam.	swift/ foam.	swift/ foam.	swift/ foam.	swift/ foam.	swift/ foam.	torr. /str.	torr. /str.	torr. /riv.	casc. /pools	casc. /pools	still	still	still
Air temp. (C)	30	23	23	25	26	25	22	24	22	19	19	—	—	—
Water temp. surface	21	20	20	23	21	22	20	20	19	18	18	—	18	19
bottom	21	20	20	23	21	22	20	20	19	18	18	—	18	19
pH	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	6.0	5.5	5.5	5.5	5.5

SCIENTIFIC REPORTS

Climatological Report of the British Roraima Expedition

Maj. J. R. Chapman, M.B.E., F.R.G.S.

Introduction

Climatological observations made by the British Roraima Expedition were all taken at Camp sites lying between latitudes 5 and 6 degrees North. Thus, their climatic regime would be equatorial in character, but with the modifications imposed by altitude, distance from the ocean and exposure.

The ultra-short term nature of the observational record for any one camp site, dictated by the need to move quickly from Base Camp to Mount Roraima—a disadvantage from the standpoint of an intensive study of the area—is offset by the scarcity value in an otherwise unobserved section of South America. It is interesting, therefore, to see how the observed weather of a few individual days at a series of differing altitudes in an unexplored countryside, fits in or differs from any longer term records taken at distant climatological stations.

Observations

Observations were made daily at 0700, 1200, and 1800 hours (local time), between 6 August and 4 September 1971, at a series of elevations from the Base Camp at Makuripai at 2,050 feet to Camp 9 at 6,750 feet.

Figure 1 gives a sketch map to show the relative position of the various camp sites.

Figure 2 gives an approximate distance/altitude cross section of the route taken by the Expedition and, at the same time, shows the natural vegetation zones encountered.

The thirty days of readings in this part of the expedition were made as follows:

		<i>Camps</i>								
<i>Site:</i>	<i>Makuripai</i>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>
<i>No. of days</i>	5	2	3	3	2	4	1	1	1	3

Additional individual days of observation were made subsequently at Camps 6, 8, and 4, with two non-sequential days at Camp 5.

Instrumentation

As a result of the mobile nature of the entire expedition, instrumentation needed to be simple and rugged. Each observation consisted essentially of dry and wet bulb readings, maximum and minimum temperature readings, and hand anemometer readings of wind speed. Notes accompanied each instrument reading on state of the sky, visibility, rainfall, sunshine, thunder, and wind direction. Temperatures were read in degrees Fahrenheit and wind in miles per hour. Cloud cover and visibility were recorded as an index with the maximum value in both cases as 10. Rainfall and sunshine were recorded in hours' duration during 24 hours of the day from 0001-2359 hours.

Figure 1.

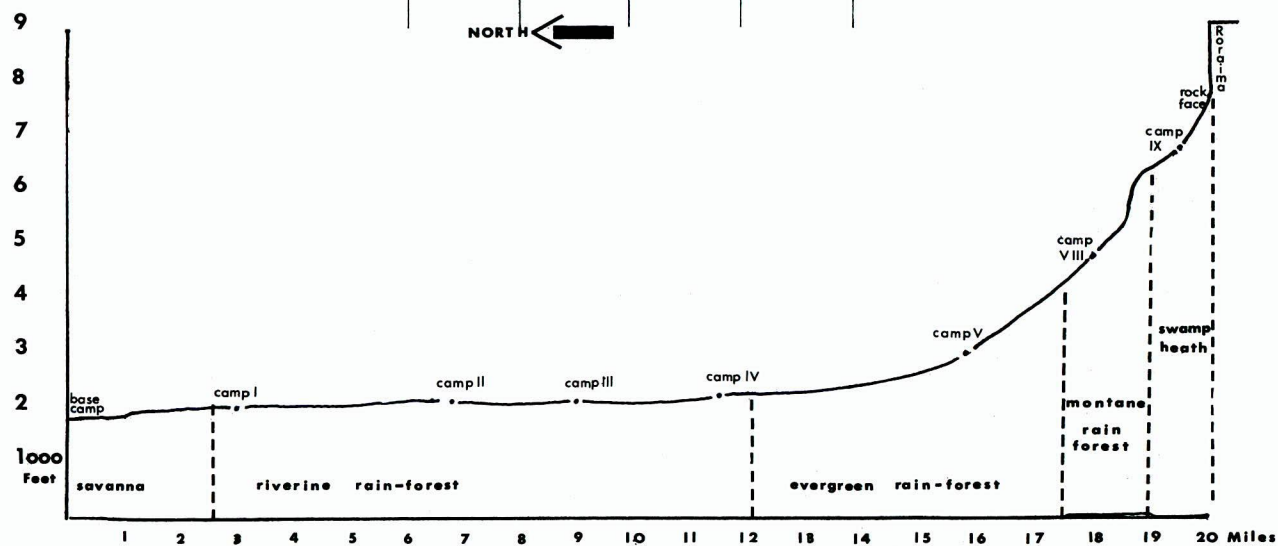
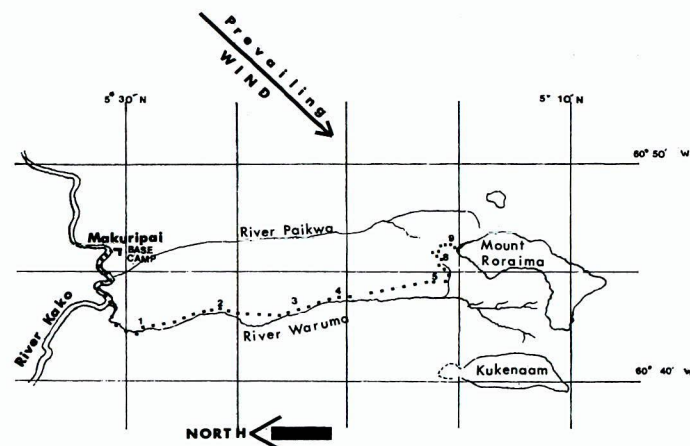


Figure 2.

Analysis of Observations

1. A useful start to the climatological programme was the discovery of a monthly rainfall record at Pipilipai, situated some 30 miles to the east of Mount Roraima at a height of 1,800 feet (see Appendix 1).

This record, kept consistently since March 1968, demonstrates clearly the equatorial regime of two rainfall maxima, May, June, July, and December; January, February, and two relatively dry periods in February/March and October. It demonstrates also the marked variation from year to year not only in the amount of rainfall received but in the times of onset and duration of the wet seasons. More rainfall had already fallen by the end of September 1971 than fell in the whole of 1969. (Jan.-Sept. 1971 = 113.42 inches. Jan.-Dec. 1969 = 110.30 inches.) Moreover, whereas in many years the months July/August and September might be regarded as transitional between heavy rains of May, June, July period and the relatively dry month of October, in 1971 there was still heavy rainfall in the 'transition' period, during which the British Roraima Expedition took place.

In other words, 1971 may be rated a heavy rain year in an area noted for its consistently high rainfall. The period of heaviest rain in May, June, July, continued with little abatement through into September. Movement of the expedition was seriously handicapped from the outset by the rain, especially as the rainfall was considerably in excess of that experienced and recorded at Pipilipai, which is situated in savannah at a much lower altitude.

2. The main rainy season coincided with the presence of Equatorial Tropical Central Zone (ETCZ) over the Pakaraima Mountain Range. The secondary rainy season appears to be associated with the High Equatorial (HE) trade wind belt carrying water vapour from the Atlantic Ocean into the Guyana lowlands as far south-west as the Pakaraima Mountain Range. Rainfall in this period is heavily convective, giving rise to late afternoon and night time thunderstorms, especially when the terrain allows a sufficient amount of cooling to take place after sunset or when heavily saturated warm air is forced to rise by orographic means.

Since winds are predominantly north-easterly throughout this Guyana region, orographic influence could be expected to have a marked effect on both rainfall amount and thunderstorm frequency on the east side of the Pakaraima Range and in the vicinity of the still higher eastern edge of Mount Roraima. (See Expedition Climatological Log, Appendix 2.)

3. Two observations of significant interest concerned the River Waruma (see Appendix 2, dated 12, 14, 16 August).

It was noted that, after at least 4 hours of continual heavy rain, the river rose between 5-8 feet. The maximum height occurred some 2-3 hours after the rain stopped falling. It took no more than 2-3 hours for the river to fall to its original height after reaching its maximum.

4. Perhaps of most interest is the discovery that the temperature record over ten sites provides a useful correlation with altitude over the relatively short horizontal distance explored by the expedition.

Dry bulb readings taken at noon at Makuripai, at 2,050 feet, were in the eighties, while

those taken at the same time at Camp 9 at 6,750 feet were only in the sixties. *Figure 3* presents the temperature/altitude relationship in more detail for diurnal maximum and minimum temperatures and dry bulb temperatures at 0700 hours and 1200 hours.

5. Although much work has recently been done by the U.S. Forces Climatological Branch in Vietnam, noting temperature variation in different rain forest canopy, it is useful to record the effect on maximum and minimum temperatures by riverain (60-70%), evergreen (75-85%), and montane (80-90%) tropical rain forest during the comparatively short period of the expedition. *Figure 4* presents the diurnal maximum-minimum temperature in relation to altitude and forest canopy. It quite clearly shows that the temperature variation decreases in direct proportion to the amount of canopy cover.

Conclusions

Although the climatic record of the 1971 British Roraima Expedition is short, it was taken in an area where few such observations have ever been made. Records were also taken in a transition period between very wet doldrums season and a drier season that was extremely slow to materialize. In other words, further information of equatorial variability was gathered.

This record has also yielded valuable data on the relationship between temperature and altitude at low latitudes as well as demonstrating the regularity in time of occurrence of rainfall and diurnal weather pattern. It has shown the effect of canopy cover on temperature variation, and finally it has made possible a quantitative estimate of the relationship between rainfall duration and intensity with river rise.

Acknowledgements

To Mr. C. G. Smith, M.A., of the School of Geography, Oxford, for loan of equipment.

To Dr. E. C. Frisby for her analysis of the climatological data.

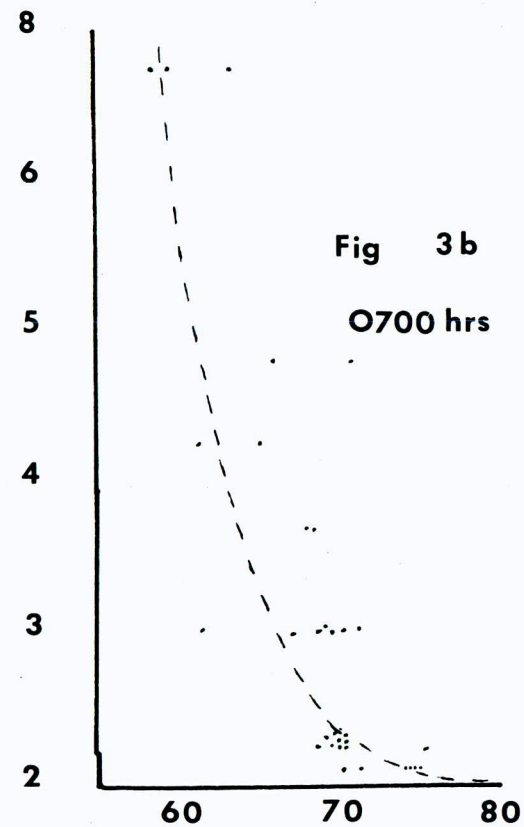
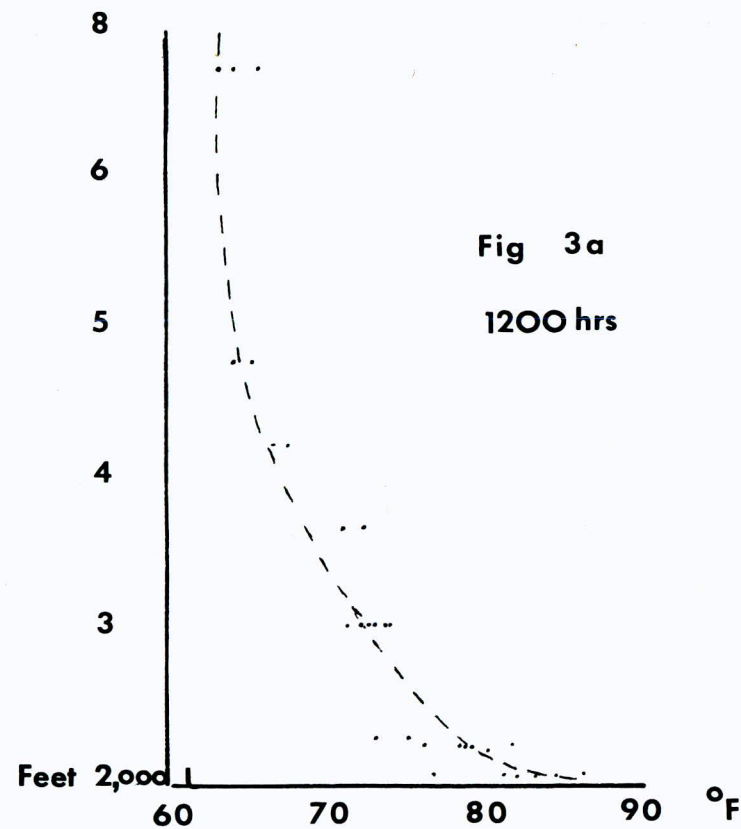


Figure 3

APPENDIX 1

Total monthly amount of rain 1968-71, recorded at Pipilipai, 28 miles east of Mt. Roraima at an altitude of 1,600 feet.

	1968	1969	1970	1971
January	—	13.05	7.81	14.16
February	—	14.13	7.98	7.08
March	3.70	3.70	9.06	4.75
April	13.56	7.51	7.00	10.84
May	10.30	15.85	17.58	20.22
June	18.30	14.06	17.41	20.10
July	24.27	6.83	17.10	15.98
August	9.24	5.92	11.59	12.75
September	7.44	7.09	6.51	7.24
October	2.61	3.31	5.05	—
November	12.15	7.52	8.11	—
December	9.16	11.33	—	—

It will be noted that 1971 had an exceptionally wet and late wet season.

APPENDIX 2

Location	Hour	Day	Date	Cloud	Wind D. mph	Dry	Wet	Hum. %	Temps. max. min.	Visibility	Weather	rain hrs.	sun hrs.	Remarks	
Makuripai	0700	F	6	8	—	—	70	70	100	60	4	m			
	1200		Aug	4	NE	2	82	71	57		8	s	4	6	Thunderstorm at Roraima at 1700 hrs.
	1800			2	—	—	76	72	79	108	9	s			
	0700	S	7	6	—	—	75	71	80	62	8	d			
	1200			5	—	—	86	74	55		8	s	1	8	Thunderstorm near Roraima at 1630 hrs.
	1800			9	NE	10	76	70	74	115	6	s			
	0700	Sun	8	8	—	—	74	78	80	61	4	m			
	1200			5	NW	2	83	72	57		8	s	—	7	
	1800			9	ESE	3	75	72	85	113	7	m			
	0700	M	9	9	—	—	75	72	85	54	6	m			
	1200			4	W	2	84	75	65		7	s	2	5	
	1800			7	—	—	75	73	95	102	6	d			
	0700	T	10	9	—	—	71	69	95	64	6	m			
															— moving to Camp 1 —
Camp 1	0700	W	11	9	—	—	70	68	90	67	6	m			
	1200			3	—	—	81	76	78		9	s	2	4	Torrential rain 2200-2400
	1800			8	—	—	76	74	90	83	7	m			
	0700	Th	12	9	—	—	70	95	95	68	4	m			Torrential rain 0000-0100,
Camp 2	1200			2	—	—	77	74	85		8	s	7	4	0200-0500, 2000-2300
	1800			8	—	—	76	74	90	86	7	r			River rose 5 feet by 0400
	0700	F	13	9	—	—	68	68	100	68	4	r			
	1200			6	—	—	80	79	95		6	s	4	3	Heavy rain 0300-0500, 1400-
	1800			8	—	—	76	72	80	84	4	m			1500, 2300-2400
	0700	S	14	9	—	—	68	68	100	68	3	m			Heavy rain 0200-0400, 1630-
	1200			3	—	—	79	74	78		8	s	5	6	1700, 2000-2330
	1800			8	—	—	75	73	90	84	8	r			River rose 5 feet by 0500, fell 4 feet
	0700	Sun	15	8	—	—	76	74	90	68	4	m			by 1200
	1200			5	—	—	79	74	78		8	s	3	3	Light rain 1500-1600, 1900-2000,
Camp 3	1800			8	—	—	74	72	90	82	5	r			Torrential rain 2300-2400
	0700	M	16	9	—	—	68	68	100	68	4	r			
	1200			—	—	—	—	—	—		—	—	10	3	Rain 0000-0900, 1500-1600,
	1800			9	—	—	72	72	100	76	4	r			River rose 8 feet; 0800-1100, fell 6 feet
	0700	T	17	9	—	—	70	69	95	66	5	r			by 1300
	1200			4	—	—	76	74	90		8	s	4	2	Thunderstorms and rain 2000-2400
	1800			9	—	—	76	74	90	78	5	r			

Location	Hour	Day	Date	Cloud	Wind D. mph	Dry	Wet	Hum. %	Temps. max. min.	Visibility	Weather	rain hrs.	sun hrs.	Remarks	
Camp 3	0700	W	18	9	—	—	68	68	100	68	4	r			
	1200			—	—	—	—	—			—	3	3	Rain 0300-0600	
	1800			—	—	—	—	—			—				
Camp 4	0700	Th	19	9	—	—	70	68	90	68	4	r			
	1200			7	—	—	73	72	95		5	s	3	4	Torrential rain 0200-0500
	1800			7	—	—	74	73	95	78	6	m			
	0700	F	20	9	—	—	69	69	100	68	5	m			
	1200			8	—	—	75	75	100		5	r	6	3	Heavy rain 1400-2000, 2200-2400
	1800			8	—	—	73	71	95	85	5	r			
Camp 5	0700	S	21	6	—	—	68	60	95	66	6	m			
	1200			5	—	—	71	70	95		7	s	6	3	Heavy rain 0200-0600, 2200-2400
	1800			4	—	—	74	73	95	78	4	s			
	0700	Sun	22	9	—	—	69	69	100	68	3	r			
	1200			9	—	—	73	72	95		4	r	6	3	Heavy rain 0000-0300, 1100-1200, 2200-2400
	1800			6	—	—	74	72	90	74	7	s			
	0700	M	23	9	—	—	69	67	100	66	4	r			
	1200			5	—	—	73	73	100		7	s	4	3	Heavy rain 0000-0200, 1530-1630, 2200-2300
	1800			9	—	—	73	71	90	73	3	r			
	0700	T	24	9	—	—	69	69	100	64	3	r			
	1200			8	—	—	72	72	100		4	r	4	2	Heavy rain 1100-1200, 1530-1600, 2200-2400
	1800			4	—	—	73	70	90	73	7	s			
Camp 6	0700	W	25	9	—	—	69	67	95	64	2	r			
	1200			5	—	—	71	69	90		7	s	7	3	Heavy rain 1700-2400
	1800			9	—	—	69	69	100	71	4	r			
Camp 7	0700	Th	26	9	—	—	65	65	100	60	3	r			
	1200			—	—	—	—	—			—	—	—	3	Heavy rain 0000-0300
	1800			9	—	—	71	70	95	70	4	r			
Camp 6	0700	F	27	9	—	—	68	68	100	64	3	m			
	1200			6	—	—	73	71	90		6	s	5	5	Torrential rain 1815-2300
	1800			9	—	—	70	70	100	73	3	r			
Camp 5	0700	S	28	6	—	—	73	71	90	65	7	m			
	1200			9	—	—	73	72	95		3	s	4	4	Heavy rain 0200-0400, 2300-2400
	1800			6	—	—	71	70	95	73	5	m			
Camp 8	0700	Sun	29	6	—	—	71	70	95	61	5	m			
	1200			9	—	—	65	65	100		3	m	3	1	Heavy rain 0000-0130, 1330-1430, 2100-2300
	1800			5	—	—	64	63	95	71	6	s			

Location	Hour	Day	Date	Cloud	Wind D. mph	Dry	Wet	Hum. %	Temps. max. min.	Visibility	Weather	rain hrs.	sun hrs.	Remarks
Camp 9	0700	M	30	6	—	—	64	62	90	60	5	d		
	1200			7	—	—	63	62	95		4	d	—	3
	1800			5	NW	10	61	61	100	64	8	s		
	0700	T	31	8	—	—	59	59	100	54	5	m		
	1200			9	NE	10	66	66	100		3	r	4	1
	1800			8	NE	5	58	57	95	66	9	s		
	0700	W	1 Sept.	7	NE	10	58	58	100	52	7	m		
	1200			9	—	—	64	64	100		2	r	5	0
	1800			9	—	—	62	62	100	64	3	r		
Camp 8	0700	Th	2	9	—	—	66	65	95	56	3	r		
	1200			9	—	—	64	63	95		3	r	6	2
	1800			9	—	—	69	68	95	68	3	r		
Camp 5	0700	F	3	3	—	—	61	60	95	61	7	s		
	1200			2	—	—	74	73	95		9	s	—	3
	1800			4	—	—	66	65	95	74	5	s		
Camp 4	0700	S	4	4	—	—	64	63	90	62	5	s		
	1200			4	—	—	82	74	70		7	s	2	4
	1800			9	—	—	76	75	95	82	5	r		

Weather: r — rain
 m — mist
 s — sun
 d — drizzle

Visibility: taken as a subjective index ranging from
 10 (good) to 0 (heavy fog)
 Cloud cover: subjective index ranging from
 10 (complete cover) to 0 (no clouds)

The Geology of the Roraima region

Adrian Warren, B.Sc.

Introduction

The only recorded work in the area covered by the northern part of Roraima and the Waruma drainage has been carried out by P. B. H. Bailey for the Department of Geological Survey in Guyana.

During an expedition he conducted in 1959, Bailey explored part of the valley between Mts. Roraima and Kukenaam, having cut a trail 26 miles long from the Kako river to an altitude of nearly 5,000 feet.

A geomorphologist was to accompany the 1971 expedition, but due to unforeseen circumstances had to drop out at the last minute.

Physical features

The region is generally forest-covered, although some savannah has developed near the Kako around the lower courses of the Paikwa and Arabaru rivers. Many of the best rock exposures are seen in the rivers and creeks at low water.

Surfaces which are elevated within the Roraima Formation form more resistant beds. In these cases, there are few surface streams and there may be exposed rock pavements with hardy bushes in crevices, infertile sandy savannah, or perhaps a low stunted tree cover. The scarp edges may become deeply serrated with fissures providing channels for, and being deepened by, the rush of water after heavy rain. Often drainage from an elevated mass such as Roraima or Kukenaam is outward and downward, under-ground, with points of emission in delayed discharge through the talus slope below. These slopes therefore generally have an adequate supply of water which has percolated through a considerable mass of sandstone. In contrast with the tops, therefore, the flanks of these mesas often have luxuriant forest growth.

Geology

The area consists entirely of members of the Roraima Formation, younger basic intrusives and their weathering products. The Roraima Formation is a dominantly quartz sandstone formation with subordinate conglomerates, shales, siltstones and jaspers; frequently the sandstones are appreciably feldspathic and some, particularly those close to intrusions, are more properly termed quartzites. The formation is horizontal or very nearly horizontal in attitude in this area, but on a large scale it appears to have a very low dip of 0.3 degrees to the south or south-west.

The younger basic intrusives (gabbros, norites, and dolerites), intrude the Roraima Formation conformably in sills several hundred feet thick.

For further details, readers are referred to the report by P. B. H. Bailey, for the Department of Geological Survey in Guyana, entitled the *Kako-Mazaruni Area* (April, 1960; 9 pages and a map).

Both soil and rock samples were collected by the 1971 British expedition; the soil samples have undergone extensive analysis at GLAXO and BEECHAM laboratories and are now undergoing separate analysis at the Polytechnic of Central London, under Mr. Geoff Holt.

Medical Report of the British Roraima Expedition

Henrik Forss, M.O., D.P.H. (London).

General

The main task of the M.O. was to take care of the health of the members of the expedition (19 persons). Secondly, as agreed with the Ministry of Health, Guyana, to assist Government Health Workers in remote areas visited by the expedition.

There was no special scientific survey included in the programme of the M.O. However, some general observations on the occurrence of certain diseases were made during the course of the expedition. Actions taken before the expedition include collection of medical equipment and vaccination.

The Medical Equipment was collected from the following sources:

From Britain an assortment of dressings, bandages, Sulpha-drugs, Penicillin for injections, and various ointments; all Army stock.

Personally purchased special drugs such as Cortisone, analgesics, plasma substitute, and instruments for surgery.

From the Ministry of Health, Guyana, some antibiotics, Codein and Adrenalin solution.

From the Guyana Defence Force, anti-snakebite serum, antibiotics, and bandages.

A complete list of the medical equipment follows this report.

The above-mentioned assistance greatly helped to ensure the success of the expedition. The M.O. would also like to express his thanks to the following persons for their help and advice: Dr. Egbert, Chief M.O., Ministry of Health; Major Hamilton, G.D.F. (M.O.); Dr. Denbo, Georgetown Hospital; Miss Doris Wall, nurse at Pipilipai Hospital.

Vaccination and other preventive measures prior to the expedition:

Members were asked to have the following vaccinations: smallpox, yellow fever, TABT, polio, diphtheria.

They were advised to have the following vaccinations: cholera, rabies, typhus.

The injection of Gammaglobulin was recommended as well as the early use of Avlo-chlor (chloroquine phosphate) for malaria prevention.

A short briefing was given to the members about health hazards in the tropics.

Next will be treated the record of illness and accidents among the expedition members; thereafter some observations from four Amerindian villages, and last some medical conclusions, based on the experience gained.

Illness and Accidents among Expedition Members

(a) *European members*

In general the state of health was good. Three members were struck by epidemic influenza, but recovered well. Minor ailments such as athletes' foot, prickly heat, diarrhoea, were kept under control.

However, in the village of Makuripai, an army of sandfleas (chigger, *Tunga penetrans*) invaded the feet of most members. This ensured work for the rest of the time, since

new impregnated chiggers were always found. Fortunately, no infections occurred after the removal of the insects. A few ticks were found and removed. No attacks of fever occurred.

On 4.9.71 Captain R. Chapman developed signs of acute appendicitis in Camp 4. Considering the risks of operating in the jungle and the fact that no helicopter was available in Guyana, it was decided to transport the patient either to Kamarang or Georgetown for operation. He was given Chloromycethine and analgesics, together with some liquid, during the transport. He never developed high fever, but the local signs of appendicitis became more and more marked with the travel. In summary, Captain Chapman was carried for 15 hours in his hammock, then travelled for 6 hours in an Indian long-boat, thereafter being transported by air for more than one hour, and lastly brought to hospital by ambulance (1 hour). The operation, performed by the local surgeon, was successful. The appendix was very inflamed, but had not perforated.

Lieutenant H. Nott cut two fingers on a machete on 13.8.71. The wounds were fairly deep, almost to the bone, but fortunately on the sides of the fingers. Thus the tendons were not injured. The wounds were stitched and Penicillin in tablet form was given. The fingers healed in one week.

(b) Amerindian members

Also in this case the general state of health remained good during the expedition.

At the beginning the porters complained of bruises on their shoulders. Old Army Shell Packs proved to be the best remedy, combined with soothing ointment.

One Indian was stung by a small black scorpion in the hand. He developed only a minor swelling at the site of the sting, and the pain lasted only for about three hours. He was given a Brazilian drug, used by Indians against snake bites and scorpion stings, 'Especifico-Pessoa'.

From time to time the porters complained of attacks of fever combined with headache and cough. Aspirin, Codein, and a course of Sulphadimidine proved to be successful treatment.

Another Indian suffered from two attacks of fever with one fever-free day between. As he did not show any signs of influenza a course of Avlochlor was given. (All the Indians were given Avlochlor as malaria prevention.)

The Amerindians very much appreciated vitamin pills (B-comp. and C). As their nourishment sometimes was poor, the use of vitamins certainly could be defended.

The two Negro observers of the expedition did not suffer from any medical troubles.

Observations from four Amerindian villages

Observations were made in the following villages: Pipilipai, Amokokopai, Kaimalu, and Makuripai. They are all in the Roraima area. The impression is that, thanks to various health campaigns (i.e. anti-malaria) and the construction of health centres ever since the British rule, the Indian population has become conscious of their health and large epidemics have been avoided.

However, since long ago, the Indians have developed their own native medicines, based mainly on the use of herbs, roots, etc. They still play an important part.

Because of the lack of proper laboratory facilities, it is difficult to give any figures concerning the prevalence of common tropical diseases. Here are just a few notes:

Malaria seems to be eradicated, but an effective control is impossible because of

migrating Indians. They are crossing border areas and, in Brazil, malaria still is very common, especially in the region of Amazonas.

Filariasis is common; according to the G.D.F. M.O. about 80% of the population is infected, although only a few have clinical signs.

Leishmaniasis (cutaneous form) is occurring and rather difficult to treat.

Hookworm is very common and, together with amoebiasis, is adding to the list of various other stomach disorders caused by unsuitable diet (too hot peppers) and extensive use of fermented drinks (casiri). Food poisoning also occurs.

Epidemic influenza was common in the Roraima region.

Snake bites occur from time to time and the Crotalidae Antivenin is used.

The river water in the Roraima region had been examined in 1967 (Ram Singh Survey). It is said to contain a fair amount of silicates and B-1 Vitamin, the last element being extracted from fallen trees in the water.

There are no Piranhas, electric eels, or anacondas in the region.

The expedition members were bathing frequently, and the above-mentioned properties of the water perhaps added to the fact that skin infections from wounds, etc., were extremely rare.

Some conclusions gained during the expedition.

Food

The Army Assault Ration Packs are very good, although somewhat heavy to carry. Enrichment with spices is recommended: red pepper, garlic, curry powder. Coffee is certainly needed, too.

Weather and clothing

The climate in the Roraima region is always wet, and in the lower regions hot, becoming cooler higher up. Army OGs (olive green shirt and trousers) proved to be ideal—light, easily dried, and protection enough against bush vegetation. Light jungle-boots are probably better than the so-called Astronaut boots or ordinary army boots.

Insect repellents

These should be used more frequently in order to avoid infection carried by mosquitoes, sandflies, ticks, etc. US-622 Compound is a new, excellent, repellent. DDT is also recommended to keep hammock ropes, kitchens, and so on, free from invasion by ants and other troublesome insects.

Question of Radio

From the standpoint of an expedition M.O. obviously a radio (if functioning!) is a great relief in case of serious disease or accident. With a radio in the base camp the medical equipment can be reduced to a minimum, which is 'a must' when the expedition is split into several parties.

Medical Stores & Equipment**1. Surgical**

Supramid 000 and 4/0 sutures and needles (20)
Catgut 000 sutures and needles (3)
Citanest-Exadrin 1% (2 x 50 ml), Citanest 1% (2 x 20 ml)
Knife holder No. 3 and surgical blades No. 10
Arterial and Tissue forceps (together 5)
Scissors, straight and bent (3)
Tweezers (4)
Needle-holder
Tourniquet, Blood-pressure meter, stethoscope
Four assorted sizes of disposable needles
Syringes, 20ml, 10ml, 5ml, 2ml (several, also used for zool. sampling)
Macrodex 6% (plasma substitute) and NaCl Physiol. plus infusion set (500ml)
Nobecutan Wound Spray (300g)
Ethyl Chloride Spray (2 containers)
Assortment of dressings, bandages, elastic bands, gauze, cottonwool
Dettol (1/21. concentrate)

2. Injectable drugs

Pethadin ready for inj. 6 x 1ml (50mg) and 10 x 1ml ordinary amp.
Solu-Cortef Mix-o-vials, 5 x 2ml (0.1g) and 1 x 0, 25g
Narkotal i.v. 2 x 10ml
Calcium Sandoz 10% (3 amp.)
Niceamid 10 x 1ml (0.25g)
Chrotalidae Antivenin (2)
Adrenalin 3 x 1:1.000 (1ml)
Triplopen 10 vials and sterilized water

3. Other drugs

Antibiotics: +50 Penicillin Tablets (500.000-1.00.0001.U)
Chloromycethine @ 250mg (50), Tetracycline 250 (60)
Mexaform Ciba 100 tablets, Codein tablets @ 0,1g (40), Aspirin 0,5 (60)
Buscopan Comp. Supp. (12), Doloxene Forte Caps. (16), Mandrax tab. 125
Sulphadimidine @ 0,5g (500), Anthisan tabl. @ 100mg (100), Salt tabl.
Eye and Ear drops, Caladryl ointment, Mycil ointment, Iodex ointment and various
other ointments against itching, sore lips etc.
B-comp. and C-Vitamins in tablet form
Avlochlor tablets (200)
Anusol supp. (10), Meggezones (Lozenges)
'Especifico Pessoa' liquid (against snake bites etc.)
Entero-Vioform tablets (100), Silomat tablets (50).

Photographic Report of the British Roraima Expedition

Derek Bromhall, M.A.

Several hundred photographs in black and white and colour were taken during the course of the Expedition, as well as some 10,500 feet of ciné film. The cameras and lenses used were as follows:

35 mm: Nikon F, standard lens;

Nikon F, micronikkor lens, 200 mm Nikkor telephoto, 400 mm Novoflex;

Nikonos 35 mm underwater camera;

Exakta

2¼ x 2¼: Rolleiflex

Yashika D

Ciné: 16 mm Bolex, set of three standard lenses, Novoflex x 400 lens, POE 100 zoom lens (on loan from Department of Zoology, Oxford); motor drive.

A generous donation of films to the value of £150 had been made by the Public Relations Office at Kodak's (Mr. Tredwen), on the understanding that Kodak's would be given the opportunity of using the Expedition's photographs for a window display in London following our return. Additional film was acquired with Expedition funds. Except for a few rolls of Ilford black and white film, all the film used was from Kodak: Kodachrome II, Ektachrome X, High-Speed Ektachrome (35 mm), Professional Ektachrome (2¼ x 2¼") Plus-X and Tri-X.

The film stock chosen for the ciné camera was Eastman colour negative 7254. An important advantage in using this stock is that in conditions of poor light, common in deep jungle, the effect of under-exposure of the film may be minimised by special development of the negative. In the event, there was very little spoilage of the film from incorrect exposure and the results were satisfactory, even where film had been exposed in deep jungle in the early morning.

Climatic conditions for photography during the expedition were poor. Temperatures were high and humidity approached saturation for much of the time. There was much free water from rain, condensation, dripping from foliage, and underfoot. With the exception of the underwater Nikonos camera, all photographic equipment, as well as film, had to be protected by being sealed in polythene bags containing silica gel as a dessicant except when actually being used. At each camp, once a day where practicable, all silica gel was dehydrated over a stove and the equipment and film repacked. Except for a seized lens turret on the Bolex, caused by heavy rain, all equipment so treated functioned normally, and no film was spoiled by excessive heat or humidity.

On the Expedition's return to Georgetown from the interior all the ciné film taken during the expedition was seized by the Guyana Government. The exposed negative was subsequently developed in the U.S., and in due course the processed negative was returned intact to the Expedition. The Guyana Government retained a print of the film.

A rush print of the total footage was produced in the U.K. by the Army Kinema Corporation and the Rank Film Laboratories, and an edited version was shown to Granada Television and the B.B.C.

The B.B.C. accepted it for production in the 'World About Us' series, and the finished film, running for 50 minutes, was first screened by BBC 2 on July 1, 1973. Supplementary footage had been shot at Kew, emphasizing the botanical aspects of the Expedition. The title of the film is 'To Catch an Orchid'.

In the summer of 1972 Kodak's mounted a window display of photographs taken during the course of the expedition at their showrooms in Kingsway, London. Thirty transparencies were made into prints 10" x 15" and these have since been given to the Expedition for its own displays.

Four sets of duplicate transparencies have been made for use by members of the Expedition for lecture purposes. For philatelists, a set of three black and white photographs is included in each envelope stamped and posted at Kamarang, the last village with a post office *en route* to Roraima.

GENERAL REPORTS

Quartermaster's Report of the British Roraima Expedition

Lt. C. A. H. Nott.

Annex A: Individual Kit List

Annex B: Expedition Kit List

General

The main source of equipment for the Expedition was the Army; in particular we are indebted to:

The Scientific Exploration Society
Cambridge University O.T.C.
Cambs. and Hunts. A.C.F.
39 Engineer Regiment Waterbeach
Junior Leaders' Regiment R.E. Dover
S.C.R.D.E. Colchester
19 Fd. Amb. R.A.M.C. Colchester
R.M.A. Sandhurst
Queen's Depot Bussingborn
Regional Depot R.A.O.C. Thatcham

Individual kit

Bergan Rucksack. This was adequate for the job, having a fair amount of space available and side-pockets, useful for small items in constant use. It was also possible to strap extra equipment onto the top. By its nature, being not very tall, it was particularly suited to jungle use as it did not catch too often on low obstacles. However, by the end of the expedition the canvas of some had rotted away in the very damp climate. The only solution would be to have rubberised canvas or plastic covered canvas rucksacks, but these are normally rather tall and, although suited to most terrains, would be unsuitable in the jungle for the reasons mentioned above. (The new light-weight backpack, with an aluminium frame and a nylon sack, is ideal—Ed.)

Sleeping Bag. This was unsuitable for the purpose due to the fact that it was designed for dry cold and not humid warmth. One tended to sweat rather heavily and, although some form of sleeping bag was almost essential, this bag was often discarded for an extra sweater and parachute silk. The other disadvantage was its weight.

Groundsheet. The S.A.S. light-weight groundsheet is ideal. However, since none were available at the time of the expedition, we had to use the rubberised canvas sheet from the Army issue I.P.K. With permanent strings tied to each corner, these made excellent shelters, water-proof and easy to erect above the hammock.

Boots. A wide variety were used, from Astronaut boots to ordinary Army issue boots. A sturdy pair of boots was essential, and it helped if they came quite high up the calf.

The Astronaut boots varied in performance, some being excellent and others disintegrating before the end of the expedition. (Many of us preferred Spanish fell-type boots—Ed.)

Cagoul. Not an essential item, but useful in very wet periods and at higher, colder, elevations. Brightly-coloured cagouls are invaluable in heavy mist.

OG Clothing (Army issue). Invaluable as it is strong, light-weight and dries out quickly when wet. It stood up very well to the damp climate that will rot inferior cloth.

Polythene Bags. An essential item. Clothes and equipment not in use could be stored in bags and remain dry in the wettest weather. It is very important to have at least one set of dry clothes all the time.

Foot and Body Powder. This prevents athletes' foot, prickly heat, blisters, etc., and is therefore well worth carrying.

Mess Tins (Army issue). Essential for cooking and eating out of, and are both light and sturdy.

Torch. A light torch is useful, especially if it is waterproof. Spare batteries should also be carried.

Hammock. In jungle terrain a hammock is the best form of bed. Ideal are the Australian Army or Brazilian hammocks, but failing those light net hammocks are almost as good.

Mosquito net. An essential. Light-weight mosquito nets, designed for use with hammocks, are best. (Some of us did not find mosquito nets essential—Ed.)

Hexamine Cookers. Useful for small parties away from the main camp. They are small, light in weight, compact, and ideal for heating small amounts of dried or tinned food.

Silva Compass (Type 4). Being both light and simple, these are often preferable to a standard prismatic compass; although for taking accurate bearings the prismatic type is necessary.

Waterbottle and Mug. Waterbottles and mugs which fit together are good.

Expedition Kit

Air Panel Markers. These were very useful and filled two roles. Firstly, they marked the Dropping Zone (DZ) at Makuripai, and secondly they were used for marking landing stages of campsites by the river where the undergrowth on the bank was thick.

Optimus Stoves. Two, two-burner, petrol stoves were ideal for the permanent eight-man team. Using little fuel, they regularly produced good meals.

Optimus Lamps. As it gets dark at about 1830 hours, it is necessary to have some form of lighting in camp. This lamp tends to be somewhat temperamental, and we found it necessary to carry a large number of spare mantles. It is bulky and easily breakable.

Polythene Bags. We had some 500 large pink waste-bags and we used them all.

Millbank bags and water-sterilising tablets. Although we took these, we found little use for them as there was always an abundance of fresh water.

Nylon Cord. Better than string as it does not rot.

Canvas Buckets. Both light and serviceable, essential for fetching water from distant supplies.

Polythene Sheet. With a large polythene sheet a dry comfortable camp can be erected in a few minutes.

Summary

Owing to weight limitations, the equipment we took with us was the absolute bare minimum. Other useful items might include:

Axe	Thermos flasks
Hand axe	Wire
Hammer and nails	Washing bowls
Collapsible chairs	Camp beds.
Large tent	

ANNEX A**Individual Kit List**

Bergan rucksack	Housewife
Sleeping bag	Dubbin
Light-weight groundsheet	Mess tins
Boots	Knife, fork, spoon
Tennis shoes (or equivalent)	Penknife
Cagoul	Torch and spare batteries
Sun glasses	Machete (and sheath)
Socks (three pairs)	Matches
Sweaters (1 thick, 1 thin)	Compass
Shirts—2	Toilet paper
Trousers—2 pairs	Waterbottle
Swimming trunks	Candles
Shorts	String
Towel	Whistle
Toilet kit	Hammock
Washing powder or bar of soap	Mosquito net
Polythene bags	Notebook and pencils
Elastic bands	Hexamine cooker and refills
Foot and body powder	Insect repellent
First-aid kit	Water sterilising tablets

NOTE: Many of these items are not really necessary, especially when it is considered that they all have to be carried.

ANNEX B**Expedition Kit List**

2 reels climbing rope @ 100 yards	Air panel markers
1 reel climbing rope @ 30 yards	Parachute equipment (see relevant section)
Pitons	Jerry cans
Carabinas	Spare batteries (assorted)

Mini flares
Optimus stoves
Optimus lamp
Polythene bags
Packing tape
Parachute cord
Millbank bags
Hexamine refills
Canvas buckets
Tent skewers
Wire wool

Scrubbing brush
Tea towels
Candles
Saucepans
Large spoon and ladle
Fish slice
Large fork
Polythene sheeting
12 bore shotgun
.22 rifle
Ammunition

Catering Report of the British Roraima Expedition

Lt. S. S. Cobb

Total food to last ten men for 42 days:

	<i>Quantity</i>	<i>Weight/item (lbs)</i>
Army assault ration packs	14 doz.	31 per doz.
Army ten-men compo packs	9	35
Swell outdoor life packs	9	8
Swell mince packs	12	1.5
Tinned biscuits	4	25
Tinned egg powder	6	3
Dried milk	12	1
Ovaltine	12	1
Tins Blue Band margarine	24	1
Box Batchelor's dried soup	1	6
Large tins margarine	2	5
Brown sugar		30
Rice		40

Sundries

Coffee	Tinned vegetables
Tea	Chewing gum
Marmalade	Curry powder and seasoning
Corn Flakes	Rum
Tinned milk	

Army assault ration packs

Each weighs 2.5 lbs. and contains the following:

2 oatmeal blocks	tube jam
3 pks. biscuits	sweets
cheese	matches
1 pkt. dried beef	tea and sugar
1 pks. soup	salt
tube condensed milk	toilet paper
tube margarine	

This pack should last one man for 24 hours, and proved to be extremely useful when away from the main camp for any length of time. However, we did feel that some items could be reduced and that others could be added. Our idea for an ideal pack at the same weight is thus:

2 oatmeal blocks	soup
2 packets biscuits	dried meat block
margarine	pre-cooked rice
cheese	raisins/nuts
tin sardines	condensed milk (2 tubes)

sugar
tea/coffee—choice
matches

toilet paper
salt

The bag should be waterproof, and all the air excluded. A tin-opener should be provided in each. Matches should be in a plastic folder. Vitamin tablets could be included.

Swell outdoor life packs

Each contained the following:

1 pkt. dried meat	1 pkt. apple flakes
2 pkts. soup	3 pkts. dried vegetables
1 pkt. potato flakes	

Good but an excess of vegetables.

Sundries

Milk, sugar, cheese, and jam all ran out too quickly. Curry powder and seasoning were essential for a little day-to-day variation in taste.

Conclusion

Morale on an expedition is often directly proportional to the proper management and cooking of food. The cook's job is a thankless task, but at the same time a very rewarding one. On the whole the expedition ate very well; but careful planning of the food for a strenuous expedition is essential to give good results.

Signals Report of the British Roraima Expedition

Lt. S. S. Cobb

General

The expedition was loaned three RACAL 'Squadcall' sets by RACAL Ltd., of Reading, and three A13 sets from PLESSEY of Ilford. Unfortunately these went no further than the Customs authorities in Georgetown, where they were held as guarantee for the rest of the expedition equipment.

However, the 2nd Battalion of the Guyana Defence Force (G.D.F.) kindly loaned to the expedition one Hallicrafters H.F. set. One G.D.F. soldier then set up a relay point at Makuripai with a second set for the duration of the expedition, and both sets assumed call-signs on the Battalion net.

The net

54a Roraima

88 Makuripai

54 Kamarang

Control at Timehri (Georgetown)

Operation

Due to the conditions in the jungle, it was decided to open up communications daily only between 0600-0700 hrs. and 1200-1400 hrs. At other times there was far too much interference.

We set up the radio at each new campsite and opened up as soon as we could.

As we came closer to Roraima communications became more difficult, and beyond Camp 3 it was often difficult to make oneself understood.

Dipole aerials, running SE-NW, were used all the time and could be erected in about ten minutes about 12-15 feet above ground level.

From Camp 3 we could speak clearly to the relay station at Makuripai (distance 20 miles) and also to Kamarang (distance 60 miles).

The set

Weight 34 lbs. approx.

The tuning was on six pre-set channels and the controls were very easily grasped by most members of the expedition.

The batteries did not last long.

Conclusion

Considering it was a last-minute addition to the equipment, the radio made an enormous contribution to the expedition's welfare. Lt. Harley Nott successfully contacted Kamarang at a vital time when Roger Chapman went down with appendicitis. If no radio had been available, Roger may not have lived.

Administration behind Scientific Expeditionary Work in the Mazaruni Area, Guyana

Maj. J. R. Chapman, M.B.E., F.R.G.S.

Introduction

This section is designed to help any expedition who might be planning to work in the Mazaruni Area in Guyana. It was not the initial aim of the British Roraima Expedition to enter this area, as it was expected to approach Roraima from Venezuela, but circumstances made it necessary to adopt a secondary plan. A great deal of time could have been saved, and mistakes not made, if some details about working in the Mazaruni area were available. The details outlined below may well help to make the administration run smoothly.

Permission to work in Guyana

It is essential for a Prospectus of the Expedition Work, which includes the name, age, background, qualifications, and expeditionary role, of each member; an outline scientific programme; an administrative plan; reference letters and liaison agent in Guyana, be sent to the Ministry of Home Affairs; Ministry of Information. The Ministry of Agriculture must be contacted if the work is of a zoological, botanical nature or the Department of Land and Mines if it is of a geological nature.

If the Government gives this permission, it is likely that they will ask the expedition to work in close collaboration with the University of Guyana, the Museum, and the Zoo. These bodies must be fully informed in advance of the nature of the work. Representatives must liaise in advance to consider the percentage of specimens to be left with each Department.

Special written permission must be obtained to enter the interior from the Ministry of the Interior before the expedition leaves Georgetown.

The British High Commission, Main Street, Georgetown, should be approached from the outset, to seek advice on protocol, procedure, and general administration. They should be kept informed of every move in the planning and execution stages of the expedition.

Costing and Transportation

This is the most difficult phase of the expedition. With an expedition lasting for up to three months for ten men, above £3,000 will have to be raised by letter or application to grant-giving funds. This may mean that fund-raising will have to start at least one and a half years in advance of the expedition.

All equipment will be required to be shipped to Guyana either through Bookers Shipping Ltd. or Harrison Line at least three weeks before the main body arrive in Georgetown. It is advisable that two members travel with the equipment and stores by ship.

The cheapest air flights to Georgetown are from Luxembourg on the ICA flight to Barbados and the Air France or BOAC flight from Barbados to Georgetown. Travel Agencies will give detail cost, and it is advisable to book the flights well in advance.

Customs and Excise

An expeditionary representative must be in Georgetown before the equipment arrives by ship, in order to liaise with officials from the Customs and Excise Department about documentation. Special Yellow Forms have to be purchased from Bookers Shop and filled in for all imports, so the representative must know exactly what is in each Expedition case or box. Equipment and stores will be unloaded at La Penitance Wharf, some two miles from the centre of Georgetown and the Customs and Excise Department on Main Street.

It is necessary to pay Import Duty in cash on *all* consumable items and leave a Guarantee in cash or kind, for all equipment brought into the country. This will be repaid once the equipment leaves the country. With a large expedition this Import Guarantee of between 12-20% can be enormous. The British Roraima Expedition had to leave a WILD T2 Theodolite and three Racal radios in bond to guarantee the remainder of the expedition.

Documentation may take between 2-7 days before release, depending upon the size and amount of equipment being brought into the country. An equal amount of time must be made available after the expedition, to ensure that documentation is complete for stores to pass through Customs and be loaded aboard the carrier ship.

Use of Firearms

Permission is required from the Ministry of Home Affairs to use firearms in Guyana. British Firearms Certificates should accompany the weapons. On arrival in Georgetown, Police H.Q. in Georgetown should be informed. Only shotguns or .22 rifles are necessary for hunting in the interior. There is no need for weapons of self-defence.

Accommodation

During the liaison phase of the expedition, prior to entering the interior, it is advisable for members to live in the centre of Georgetown, to save travel time. Members of this expedition stayed at 'La Grille' hotel on Middle Street at a cost of approximately 12.00 dollars (Guyanese) a day for bed, breakfast, and dinner meal. Mrs. King, the proprietress, was a constant source of good information. This hostel is no more than 5-10 minutes' walk from all main Government Ministry Buildings, the British High Commission, and Customs and Excise Department.

Banking

The Barclays Bank D.C.O. on Main Street will deal directly with any Barclays' representative in U.K. They will provide a cheque book once expedition money is banked with them. It is advisable to take all the cash required for payments into the interior, in notes and small cash. The notes can be 'banked' with the District Commissioner, whilst a bag of small change can be taken for immediate transactions.

Strict accounting in a cash book must be adhered to at all times.

Administration in the Mazaruni Reservation

The Amerindian Reservation to the north of Mount Roraima is over 4,000 square

miles in size, and is controlled for the Government by a District Commissioner, Mr. McConnel, in Kamarang. Each large village in the Mazaruni Area Reservation has an elected Captain, or Chief, of the village. Although there are several tribes with different tongues, English is spoken by the majority of people living in the interior. There is radio link from the British Commissioner's Office to Georgetown and all corners of the Reservation. There are also Police and G.D.F. signal stations which are in voice control link to Georgetown.

Kamarang

Kamarang is built on the junction of the Kamarang River and the Mazaruni River. There is an all-weather airstrip plus an AVGAS storage centre in the centre of the village. There is a daily DAKOTA air-lift schedule from Kamarang to Timehri Airport, Georgetown.

Most of the transport from Kamarang into the interior is by water. There are many long-boats for hire, plus 20 h.p. and 40 h.p. engines. Petrol can be purchased from the General Stores in 45 gallon drums, along with all aspects of food provision. Prices are expensive.

There is an old Guest House alongside the airstrip, which can accommodate up to eight persons if they bring their own sleeping bags and hammocks, and are prepared to cook their own food.

Hire and Transport Costs

<i>Water Transport:</i>	1 long-boat (holds 8 men & kit)	5.00 dollars (Guyanese) a day (possibly 5.00 dollars a day for the helmsman
	1 20 h.p. Engine	
	45 gallons of petrol	32.00 dollars (Guyanese)
<i>Air Transport:</i>	Dakota. Kamarang to Georgetown (twice a week)	45.00 dollars (Guyanese) per person (280 miles)
<i>Exchange Value:</i>	Porters	5.00 dollars (Guyanese) a day if they provide their own food
£1 = 5.00 dollars (Guyanese)		or 4.00 dollars (Guyanese) a day if you provide food for them.

It is advisable for any expedition to have a plentiful supply of small change during the whole duration of the expedition for small transactions.

Porters

The expedition was fortunate in obtaining the services of Mr. Isaac Jerry, of Jawalla Junction, as the Foreman of the Porters. He was strongly recommended by Mr. Adrian Thompson.

It is usual to obtain the services of a Foreman for the duration of the expedition and

leave the hiring of the porters to him. All orders, pay transactions, and instructions, should be directed to the porters through the Foreman.

A good Foreman will ease members of the expedition of most of the administrative problems in the interior, as long as he is told exactly what is required of the porters. His advice on the amount of equipment to be carried and the distance to be travelled in a day should be noted. It would be foolish to attempt to force the porters too far, too fast. Most Amerindians can carry between 80-100 lbs. of equipment in their warishis. These basket-work rucksacks take about one day to make, but can last for about six weeks of heavy carrying.

Trail Cutting and Camping

On an average, the porters are willing to carry equipment for between 7-10 miles a day, along a cut track, or do two journeys of 4-5 miles. They will also cut a campsite, setting up a shelter and poles for slinging hammocks for the members of the expedition, whilst preparing their own shelter some 50 yards away. They prefer to cook for themselves and stay in their own camp during nightfall.

The porters will be up at dawn, taking about one hour to cook 'bake' for their breakfast meal and mid-day meal. They can be ready to move at about 7.30 a.m. onwards.

A small party of three usually go ahead with one of the expedition members, cutting and navigating the trail, whilst the remainder of the porters ferry equipment forward up to the camp nearest the fresh-cut trail. This gives time during the march for scientists to collect specimens. No hard-and-fast rules can be given on the distance cut in a day, because it depends on the thickness of the tropical rain forest, but two and ten miles are the extremes.

Hunting

Unfortunately the porters inevitably run out of their own food nearing the end of the expedition, and will ask for expedition members' food. It is wise to take extra food as a precaution, but also allow the Amerindians time off to hunt for the pot. Tapir, ma'am (tinamou), 'powis' (curassow), and fish can be caught in most parts of the reservation.

Relationships

The British Roraima Expedition were indeed fortunate in having a cheerful, hard-working, and resourceful team of porters under the capable leadership of Mr. Isaac Jerry. At all times the relationship between team members and the Amerindians was friendly and respectful. This helped enormously towards efficient management within the interior.

THE USE OF PARACHUTE TECHNIQUES ON SCIENTIFIC EXPEDITIONS

Maj. J. R. Chapman, M.B.E., F.R.G.S.

Introduction

The use of parachutes as a means of entry into inaccessible or difficult terrain is a comparatively recent innovation in exploration. (See *Nat. Geog. Mag.*, 1964 and *Geog. Mag.*, Feb. 1971.) However, resupply of food and equipment by parachute has been used extensively by large expeditions since it was first experimented with in 1942 on the Wood Yukon Alaska Expedition. (See *Geog. Review*, 1943.)

Free fall parachute techniques provide a safe means of entry into difficult terrain, which otherwise would demand a long and arduous approach march. By this method, scientific explorers can arrive at their destination not only fresh, but with all their equipment, food, and instruments, intact without wasting time, food, and energy, on an overland trek.

Once at the destination it is possible to cut a small landing strip—if local labour is available—in a comparatively short period of time, so that a small light aircraft (e.g. 'Cessna') can land and take away scientific specimens. At the end of the expedition, the team members can be picked up in the same manner.

Training

As free fall parachuting has become such a popular sport in Great Britain, there are many clubs where the scientist can be trained in such techniques.

The most experienced organization for training scientists for this type of exploration is the Army Free Fall Centre at Netheravon, Wilts. Captain Don Hughes, M.B.E., the Officer in Charge of the Centre, has already personally supervised the training and despatching of scientists on at least two expeditions.

Before making the first jump with a static line from 2,800 feet, it is essential for each expedition member to be fully trained in:

- a. Flight theory
- b. Aircraft drills
- c. Stability drills
- d. Emergency procedure
- e. Landing drills
- f. Packing

It is important that each member should have completed a minimum of 5 static line jumps using a Double L Parachute, before parachuting into an expedition area.

It is essential that an experienced Despatcher (with a minimum of 100 jumps) who has reached B.P.A. Category 10 Standard, is responsible for all the despatching of personnel and equipment on the expedition. The safety of the operation is his responsibility.

Training does not take a long time, for the scientist need spend no more than 4-7 days on an Army Freefall Course or 3 weekends at a Civilian Freefall Centre before he has achieved the minimum amount of parachute training jumps. The cost is approximately £1 per jump.

Just prior to the drop, the team members should have a practice jump with the pilot and despatcher responsible.

Equipment

The following amount of equipment must be accounted for by the expedition organizer:

a. Personnel

Each person who is parachuting requires:

- 1 x Helmet 1½ lbs.
- 1 x Reserve Chute 12 lbs.
- 1 x Main Chute (Double L) 30 lbs.
- 1 x Static Line ½ lb.

b. Despatcher

- 1 x Despatching Parachute 15 lbs.
- 1 x pr. Goggles
- 1 x Wind Drift Indicator
- 1 x Knife
- 1 x Air Photo of Dropping Zone or Map/Diagram
- 1 x Safety Strap 2 lbs.

c. Equipment

For every 100-150 lbs. the following will be required:

- 1 x Canvas Kit Container 5 lbs.
- 1 x Cargo Parachute 8 lbs.
- 1 ft. Nylon Parachute Cord
- 1 ft. Nylon Parachute Twine.

The Dropping Zone (DZ)

The expedition organizer should choose an area for the DZ as close to the area of operation as possible, with the following requisites:

- a. Should be a 400 yds. x 400 yds. (if static line drops)
- b. Dry and secure underfoot
- c. Flat with no undergrowth, or obstacles
- d. Free from boulders as this may be the future landing strip
- e. Trees surrounding DZ should be no more than 50 ft. in height.

The DZ should be thoroughly reconnoitred before the parachute drop. If the area is occupied by indigenous people, they should be warned in some way of the forthcoming drop.

The Parachute Drop

The size of each drop will be dictated by the number of expedition members taking part and the size of the aircraft.

The whole responsibility for the drop is in the hands of the Despatcher, who will apply the normal safety rules as applied in the B.P.A. Handbook.

The Equipment Drop

Usually equipment is packed in 100 x 150 lb. loads of sufficient size to fit through the side door of the aircraft.

The Despatcher is responsible for packing and loading the aircraft. All delicate instruments must be well padded and positioned sensibly to each load.

The size of the aircraft will dictate the weight and amount of equipment carried in one flight.

All packs should be well marked with contents.

Equipment which is to be free-dropped (without a parachute) must be brightly marked with daglo paint or material, for easy identification.

Team members should spread themselves along the length of the DZ to await the arrival of the equipment. They should note what drops into their area of observation, and collect it when the aircraft finishes its dropping flight.

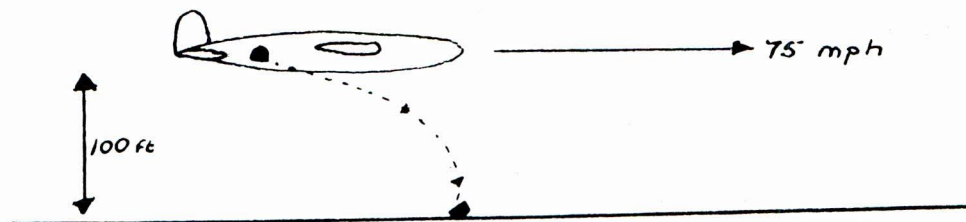
Team members should know exactly how many loads are to be dropped.

The Drop

All equipment such as tinned food, ropes, tentage, which is non-breakable, should be dropped without parachute.

All such cartons should be well bound with black rope, but at the same time made clearly recognisable by daglo paint.

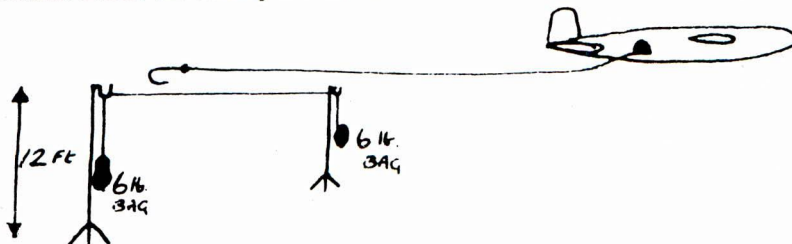
The aircraft should fly a level course, as slow as 75 mph at 100 ft. from the ground, over the DZ. If the aircraft flies too low, the packs will hit the ground at almost the same velocity of the aircraft. Thus the free drop should curve a parabola in flight.



It is important that the collecting party notes the number of packs dropped and the exact location of impact.

Building the Airstrip

Specimens or mail up to the weight of 12 lbs. can be extracted from the DZ by the hook and line method before the airstrip is constructed.



For a fully loaded light aircraft (e.g. 'Cessna') the minimum safety length of airstrip is 600 yds. The width should be more than 20 yds.

The landing strip should therefore be cleared of large stones, undergrowth, and small bumps or obstacles. Any swamp should be clearly indicated and avoided.

When the aircraft comes into land, the airstrip should be marked clearly by white stones and a form of wind sock erected. Smoke may be used as long as it does not obliterate the LS.

Practical Application of Parachute Techniques in Guyana

Maj. J. R. Chapman, M.B.E., F.R.G.S.

Introduction

The aim of the British Roraima Expedition was to parachute an advance party of four men with most of the equipment as close as possible to the northern slopes of Mount Roraima.

Three suitable patches of savannah were noted in the midst of tropical rain forest, ranging from 12-18 miles from the mountain. Unfortunately, the high rainfall, prior to the drop, swamped two of the possible Dropping Zones (DZ), thus the third patch of savannah some 300x x 400x alongside the River Kako, 18 miles north of Roraima, was chosen as the Expedition DZ.

This DZ, although further away from Roraima, had the added advantage of accessibility by long-boat. The expedition Main Body, with the Amerindian porters, could, therefore, motor in long-boats up the river towards the DZ, whilst the advance party were carrying out a reconnaissance of the best route to Roraima.

Training

Each member of the Advance Party had received training in the Army Parachute Centre at Netheravon prior to arriving in Guyana.

Further training jumps and equipment drops were practised at Timehri and Pipilipai in Guyana, with the same pilots and despatcher, who were to co-ordinate the actual jump into Roraima.

The Guyana Defence Force kindly gave full co-operation to the expedition by providing the use of one of their 'Islander' aircraft, for training and jumping into Roraima.

The supervisor of the parachute jump was Captain Don Hughes, M.B.E., who flew out from U.K. to Guyana with the parachutes, for 10 days. Captain Hughes had the opportunity to teach selected members of the G.D.F. how to pack and parachute equipment and stores by air, as well as despatch three Officers of the G.D.F. on parachute training jumps.

Mounting Base

As a result of the co-operation and hospitality of the G.D.F., the Barracks of 2nd Battalion G.D.F. at Timehri acted as the Mounting Base for the expedition. The two 'Islander' aircraft were also situated at the International airport alongside the barracks. Timehri is approximately 300 miles from Mt. Roraima.

A forward air mounting area was located at Kamarang airstrip (70 miles from Mount Roraima and approximately 45 miles from the DZ).

The 'Islander' could re-fuel at the Kamarang airstrip.

The Parachute Drop

The chronological order of the Parachute drop and parachute recovery was as follows:

4 August

Personnel and equipment flown into Kamarang

Reconnaissances of the DZs.

5th August

- 1000-1115 Flight from Timehri-Kamarang
 - 1200-1250 All equipment packed with cargo 'chutes whilst Capt. Hughes reconnoitred DZs (two of the DZs noted to be swamped)
 - 1300-1330 Four members of Advance Party parachute into Makuripai DZ.
 - 1330-1415 'Islander' returns to Kamarang and loads up first equipment drop.
 - 1445 First Equipment Drop (Aircraft returns to Kamarang)
 - 1545 Second Equipment Drop (Free Drop) (Aircraft returns to Timehri)
 - 1630 Main Body arrive at Makuripai.
- The parachutes were returned with the long-boats to Kamarang, from where they were picked up by aircraft on a routine flight to Kamarang and returned to the Mounting Base at Timehri.

Lessons Learned

There were two *minor* mishaps in an otherwise completely successful parachute drop:

1. Our cargo load was pushed out late, and thus drifted into the jungle half a mile from the DZ. It was recovered.
2. About eight cardboard boxes of food, shattered during free-drop phase because the pilot was flying too low. Most of the food was recovered.

The drop was successful because:

- a. All members were well practised and had done two complete practice jumps in Guyana with pilot and despatcher who organized the Makuripai jump.
- b. Thorough reconnaissance of the DZ in advance, as well as one hour before the jump, confirmed its suitability.
- c. Full co-operation of the Guyana authorities and the Guyana Defence Force.

Advantages

The use of aeroplane took five hours to move four men and most of the expedition equipment 270 miles to a DZ north of Mount Roraima. It would have taken up to one week by boat.

From the Mounting Base it was possible to carry out a similar parachute drop in any part of the country, as long as a suitable forward air mounting area (an airstrip with AVGAS) was within 80 miles of the DZ.

After only five static line jumps in U.K., and one practice jump in Guyana, any member of the expedition could be dropped into a suitable DZ—as long as the despatcher is experienced and of category 10 standard.

Disadvantages

Expense. Fortunately, the G.D.F. gave their full co-operation by providing their aircraft free of charge for the parachute drop. However, if an aeroplane had been hired in this situation, it would have cost:

- 5 hours, hire of aircraft £150.00
- 1 hour, for practice jumps £30.00

Much of this would, of course, be offset against the cost of a 270 mile river journey for four men, with its subsequent loss of time, food and energy.

Conclusion

This novel form of entry by parachute was highly successful in its execution, apart from the destruction of certain food packs during the free-drop phase. It cost no money, thanks to the G.D.F. co-operation. It was not necessary for the team members to clear and cut an airstrip, because the River Kako provided a means of exit.

As a new technique, it proved to be flexible, simple, and time-saving. This has to be offset against the problems of expense, and time taken for political acceptance by the country in which the expedition is being mounted.

Acknowledgements

This method of entry into Makuripai would not have been possible had it not been for the kind co-operation and assistance of:

The Officer Commanding the Army Parachute Centre, Netheravon.

The Officer Commanding 2nd Battalion, The Guyana Defence Force, Timehri.

Officer Commanding, the Pilots and Aircrew of The Air Wing, G.D.F., Timehri.

NOTES ON SOME CUSTOMS OF THE AKAWAIAN INDIANS

Background

The expedition was operating in an area of Guyana inhabited by the Akawaian Indians. At one stage, prior to moving towards Roraima, the expedition was camped at the small village of Pipilipai. The resident nurse and missionary for the Pilgrim Holiness Mission, Miss Doris Wall, kindly gave expedition members details of her research into the customs of the Akawaian Indians living in the village. Miss Wall spoke their language and had been collecting information for over a year.

Most expedition members also visited the small village of Amokokopai, which is the centre of a remarkable Christian-based religion called 'The Halleluya Sect'. Some details about this religion were also collected from the leader of the group, Mr. Peter Williams.

There is virtually no written literature by the Akawaian Indians, so customs, histories, and stories, have to be handed on by word of mouth. Unfortunately, this method of transmission through the ages does tend to distort the truth. It is, therefore, up to the recipient to discern the truth.

The following information has been faithfully recorded from Miss Wall's notebook—with her permission—and from personal observation. It is set out for general interest rather than serious anthropological study.

Food and drink

The staple food of the Indians includes both animal and vegetable substances. The men provide the former and the women the latter.

Cassava Bread. The roots of the cassava plant (*Manihot utilissima*) is made into bread, like oatcakes, or into farine, a rough sort of meal. It is the woman who prepares the cassava. She peels the roots with a knife, then scrapes it up and down on an oblong board or grater studded with small fragments of stone. The cassava, which slips as pulp from the scraper into a trough, is collected and put into a wicker woven matapie, which hangs from the roof. This matapie, or cassava squeezer, is seven or eight feet long, and five or six inches in diameter, made from closely-woven strips of bark. The cassava, saturated with highly poisonous juice, is forced into the matapie. The matapie is then stretched downwards from its connection to the roof, elongated under the weight of the woman who sits on a pole which is passed through the bottom loop of the matapie. The pressure applied forces the poisonous juices to run out of the wicker of the cassava squeezer, into a buck-pot which stands on the ground. This juice is then boiled into a thick treacle called 'Cassareep', which is used in the manufacture of 'Pepper Pot', which will be described later. The cassava, now dry and free from poisonous juice, is taken from the matapie, broken into a sieve, and sifted so that it becomes a coarse flour. A large circular iron griddle or plate is placed over the fire. A thin layer of the damp flour is spread on the griddle. The woman smooths the upper surface of the cake and makes its edges round. In a very few minutes the outside of the cake is done. It is then turned, until both sides of

the bread is baked. When a sufficient number of these oatcake-like pieces of bread have been made, they are taken out of the house and placed outside on the roof of the house to dry in the sun. When thoroughly dried the bread is hard and crisp, with a slightly doughy nutty flavour. In this state, if guarded from damp, it can keep for an indefinite time.

Pepper Pot. All mammals, birds, and fish, are meat to the Indian. However, the meat is prepared in the bush, either by roasting, smoking, or boiling, before it is cut into small chunks, then placed in a large boiling pot with peppers (chillis) and Cassareep (mentioned above). It reduces the flesh to one common flavour. It has an antiseptic effect which allows the meat in it to last for a long time, turning the whole contents into a thick soup.

Eating. Indians eat at no regular times, but whenever and as often as they feel inclined. No variety of food is required, for pepper pot and cassava bread invariably forms the meal. The boiling pot is never emptied, with more meat or cassareep being added all the time. The thick soup in the pot will be heated up, whilst the eater breaks off a piece of cassava bread, dips it into the pepper pot, then chews the sodden end. Very little is eaten at a time. The women, generally, do not eat with the men but carry and serve for them.

Casiri. This is a drink made of sweet potatoes and sugar cane. A little cassava is sometimes added. Generally it is prepared by boiling the ingredients and allowing them to ferment. It has a pink colour, due to the sweet potatoes, and if well made has a not unpleasant light wine taste.

Paiwari. This is the chief Indian beverage. Cassava bread which is to be transformed into paiwari is thicker and is baked or burnt until it is quite black. It is then broken into small fragments and mixed with water in a large jar or pot. The larger fragments are picked out, then chewed by women, then replaced into the jar. As soon as the jar is sufficiently filled, its contents, after being slightly stirred, are slightly boiled and then poured into a trough. More and more is added to the liquid until the trough is filled. The mixture is allowed to stand and ferment for some days. This fermentation is accelerated by the mastication of the bread. The result is a brownish liquid with a sub-acid, but not unpleasant, taste.

Bake. It was noted that on the expedition the Amerindian porters spent at least one hour in the morning preparing 'bake'. Flour and water were mixed into a dough, then placed in hot oil in a frying pan. The bake, rather similar to scones in appearance and taste, provided the breakfast meal and the packed mid-day meal for the day. Tapir meat was eaten with rice and potatoes in the evening in what was termed a 'cook up'.

Hunting

This is the main occupation of the men in the village. Western civilization has brought the use of both shot-gun and .22 rifle to assist in hunting, but the now traditional hunting weapons are still to be seen.

Blow Pipes. These are usually about 10 ft. long and made of two parts—an outer casing of polished palm wood and inside a straight piece of reed of a similar length. The hollow reed, after rubbing, is dried thoroughly, first by fire and then by the sun. It is then inserted into the rigid tube of palm wood as if into a sheath. The mouthpiece remains as it is, whilst the opposite end is fitted with the cup-like half of a round hollow palm seed, like the lip of a trumpet. Two labba, or peccary, teeth are fitted into the outer palm wood, near the end, to act as 'sights' for the hunter.

The darts are made from the splinters of cokerite palm wood and are about 9 inches

long. They are 'feathered' at one end by a twist of cotton fibre to fill the diameter of the blow pipe, so that when the Indian blows into the tube behind the dart, the latter is propelled with force along the tube and expelled into the air. The dart end is sharpened and often dipped into *curare* poison. This will be mentioned later. The darts are generally kept in a quiver, but if poisoned are fitted into a plaited double thong, which is rolled up like a rope ladder, and placed in the quiver with the dart heads protected.

Bows and Arrows. The bows, which are very long and straight, are made of various sorts of wood, generally of purple-heart wood. The bow-string is twisted of crowia fibre. Bows for children are made much smaller. The design of the arrows varies according to the type of hunting.

A great skill is required to shoot fish with a bow and arrow. The arrows for this purpose differ according to tribe, but generally the arrow-head is barbed, often with three prongs, as opposed to one to give a great degree of accuracy with the ensuing problem of water refraction. Sometimes the arrow-head is detachable from the shaft and attached to a length of twine, which in turn is attached to the arm of the hunter.

The arrows for shooting game, as for fish, are of several kinds. Today all arrow heads are filed by the Indian out of metal, such as the iron hoop of a barrel or any other metal he can lay his hand on. Arrow-heads vary according to the quarry—some are diamond shaped, others barbed, and some with a blunt head.

Poison. Poison is used for hunting, for dipping the heads of arrows and spears, or for poisoning stretches of fishing waters. The former, called *curare* or *ovrali*, is made from many ingredients such as barks, roots, peppers, oats, the poison-fangs of snakes. Apparently the bark of a creeping plant (*Strychnos toxifica*) is alone essential.

Modern Hunting. The male is still the hunter in the family, but today western influence, seen largely through trading stores, has replaced the above methods of hunting by shot-gun and .22. However, these are expensive and special licences have to be obtained through the District Commissioner before they can be used. Thus bows and arrows, blow pipes, and spears, have become more of an ornament or children's toy. We only saw small children using the fish bow and arrow, for the majority appeared to prefer line and hook bought at the local trading store in Kamarang.

Yet, even hunting with modern weapons, the Akawaian has lost none of the skill of his forefathers. All were excellent mimics of animal noises; some used charms which had been passed on to them through the family; but above all their skill at fieldcraft was remarkable to behold, ensuring that the pot was filled with meat for the majority of the expedition.

The following information was obtained from Miss Doris Wall of the Pilgrim Holiness Mission at Pipilipai—it is in note form:

Puberty

The young girl must stay in her hammock for the whole length of her first period. Similarly her hair is cut—if this is not done it is believed that there will be a death in the family. She is only allowed to eat cassava made into a weak porridge and small fish called Kulak. If she eats anything else she will get toothache. She is told not to walk around in this state lest a snake smells the blood.

Menstruation

The woman must not eat meat during this period or make any of the food for the rest

of the family. If there is anyone who is sick in the house, then she must go elsewhere. The woman should eat only small fish and quail. If the woman suffers for a great length of time she will be given charms or 'blown upon'.

Pregnancy

Pregnant women eat only small fish and quail. The right type of food is very important because, if she is given the wrong food, the child might die or be deformed. For example, to eat deer meat means that the child will have a large brow and chin; eat pig and the baby will have large shoulders; eat beef and the baby will have a head as large as a cow.

Birth

The placenta is thrown away in the bush, not burned. It is believed that the old placenta comes back into the mother and delivered when the next baby is born. The mother must not eat walak or wu (fish) or the baby will wake up and cry at night, because these fish do not sleep.

Death

Young children are not allowed in the same house as a dead person or one who is about to die. Those men who carry the corpse or dig the grave cannot eat at the same pot as others for some time afterwards. Individuals do not work the same fields or walk the same trail as the deceased, otherwise they may be visited by the dead man's spirit and also die.

Illness and Cure

It was noted that many of the women had cut themselves on their arms and legs. We were told that these are called *ipataputu*, and are made on the body to ease pain or release sickness. *Malipa* is grated, mixed with water, and drunk by the woman, to enable her baby to be delivered safely and quickly. It is also used to bathe her child in, so that the child will grow quicker.

Charms

Kumi is an evil charm which makes people vomit or catch gastro-enteritis.

Kanaimi causes people to pass blood and have fever and vomiting (bilharzia?)

Kaiyawaik causes sun-stroke and toothache.

Blowing upon someone with evil intent can cause:

1. Paralysis
2. Pain in the head and cause stomach to swell.

Tattoos

A number of the Akawaian women had tattoo marks, either around the arms or on the mouth like a moustache mark. Wild honey is rubbed into the tattoo mark, which in turn makes the paiwari sweet. As mentioned before, the cassava bread is chewed by the women in the process of making this fermented drink.

The most detailed books on Amerindian Customs are: *Among the Indians of Guiana*, by Everard F. Im Thurn, M.A. Paperback—Dover Publications Inc., New York, 1967. Price £1.50 or 7.50 dollars (Guyanese), reprinted from original publication by Kegan, Trench & Co. 1888. *Indian Tribes of Guiana*, by W. H. Brett.

During the period the expedition stayed in Pipilipai, members visited the small village of Amokokopai, about 12 miles away, and spent a weekend with the occupants who were celebrating the festivities of 'the Halleluya Religion'.

Many are the variations on the derivation of this Christian-based religion. The legend of the start of this religion has been handed down by word of mouth and obviously, as a result, has received many embellishments. The following version is taken from notes of Miss Doris Wall and the word from the leader of the sect, Mr. Peter Williams (most Amerindians amongst the Akawaian have Christian names given by various missionary groups—Jesuits, Roman Catholics, Anglicans, Seventh Day Adventists, and Pilgrim Holiness, etc.)

The Halleluya Religion

The religion was started in the early 19th century by a Macusi Indian named Itanchiwon, who came from Brazil. He was taken to England by missionaries and stayed there for five months. Apparently whilst there he was told to stay in the house the whole time. However, he broke out and went for a walk down the road. A man asked him where he was going, to which he answered 'I am going to heaven'. When he reached heaven, he looked down and saw his own house and naturally wanted to return. It was then that he heard a voice. He could not see the man properly. The man, whom he assumed was God, told him to return and take a song-book with him.

When he returned to Brazil he told his wife not to leave, as he was going to tell her God's word—but she left. He only had his daughter to convert. When his wife returned she heard Itanchiwon and his daughter speaking a strange tongue. He taught the people of his village songs and dances about the great 'Pa Pa' in the sky. People from Pipilipai went to Brazil to hear the songs. One of these men was a Peaiman (witch doctor), called Abel, who had many wives. Before he met Itanchiwon, he wanted to contrive his evil ways. However, when he met those who had been to Brazil, he noticed they had all changed. However, although he tried to change their ways and stop them dancing, it was he who began to change. He stopped being a Peaiman, and began to live with his first wife only. He began to seek God, and contrived to ask: 'God, where are you?' Then he had a vision.

In the vision he was travelling down a path, but a large log obstructed his way. He prayed and the log disappeared. He continued along the path and saw something like a large gateway. He prayed again and the doorway was opened for him. Inside he could see angels worshipping God. As he stood at the door, meat and drink came by itself to him. He tried to get through the gate, but he could only get through as far as his shoulder. From inside he heard a voice tell him that he was not prepared. He was told that he must dance with the other converts, when they were dancing. He was told that he could only enter the nice place after he was prepared. Apparently he had no wish, in his vision, to return after seeing heaven, but he returned and awoke from the vision.

Immediately he began to teach the people of Pipilipai and told them he had found a Halleluya, which the other missionaries did not know, or would not talk about. He preached to the people and told them that, firstly, they must not fight one another; must not sleep with other people's wives and must not smoke. The people stopped dancing the old folk-dances, such as the Palichala, Imawali, and Amanawa, and started learning the songs and dances told them by Itanchiwon and Abel. Abel called the people to pray, from every tribe in the area. A church was built at Amokokopai, where he sang and they

danced. He sent messengers to all the tribes. He told the people that he had stolen the Halleluya, that white people would not talk about, but he told them to invite the white people to dance too.

Indeed missionaries did visit Amokokopai, but branded the new religion as pagan, not appreciating it was based upon Christianity.

Abel and his followers sang similar songs to this, which was being sung as a form of chant to the snake-like shuffle-dance in the church at Amokokopai in 1971.

Literal translation

Because this world is bad, Jesus Christ
Take me to heaven with chariot, Jesus Christ
Because this world is bad, Jesus Christ
Do not let me see evil
Carry me on the chariot

Let me change so I will be God's angel
Brother Christ is coming (repeat)

Chorus: *Hay bok na aleluya to nu toi pa pa*
In heaven, aleluya, come down to here, God.

Abel told his son Moses to dance and dance, as if there was power in the earth. Moses helped his father to teach the people to dance.

Three young men lead a long procession—three deep—towards the church in a slow rhythmic step, two steps forward and one back. The right hand of each person is on the shoulder of his neighbour. Every few minutes the three men turn to face the singers, who change the chant once they have entered the church. They circle food in the centre. After about ten minutes, the singers kneel down and in unison speak a brief and solemn prayer.

Papa, waka antuka
Umduntalu, ny a pitecku ayawan.

Moses helped his father and was being prepared as the next Halleluya leader, but he died before his father. Moses apparently spoke with the voice of tongues. After Abel died, Williams, one of his followers, led the people. Jordan was the next leader, who also had a vision that he was visiting heaven, but unfortunately died on the following day before details of his vision could be recorded. He was succeeded by Joseph. He lived in the village of Kaimalu and was married to a certain Lydia—who, as a very old woman, gave the above details of the sect to Miss Doris Wall. Joseph was succeeded by a man called Ibelebin, who supposedly had the powers to send rain and wind. Apparently he was given his name because he was continually proclaiming 'I believe in Him'.

The present leader of the Halleluya Sect is Peter Williams, who possibly has assumed the trappings of a modern up-to-date leader by wearing a red baseball hat and a vivid shirt. He lives, at the moment, in Amokokopai.

The influence of the religion has obviously spread some distance through the area, for many of the Indians whom we met claimed to believe in the Halleluya religion, but often claiming at the same time to being members of the Seventh Day Adventists or Anglican Church. Indeed, the results of the missionary work of both internal and external missionary organizations is remarkable to behold in the Akawaian Indian Reservation.

THE PORKNOCKERS

The term 'Porknockers' refers to the gold and diamond prospectors who work the rivers and stream beds of Guyana for alluvial gold and diamonds. Their name is said to derive from the days many years ago when the staple protein in the jungle was salt pork; when prospectors fell on hard times, as do prospectors everywhere, they borrowed, or 'knocked', pork from their more fortunate friends or creditors.

The Guyana Government allows Porknockers, under licence, to work in the interior of the country, outside of the areas reserved for Amerindians. Of negroid or East Indian stock, small teams of Porknockers live in the jungle for several months at a time, working the areas licensed to them, which they have discovered by prospecting. The most important village where Porknockers, buyers, and tradesmen congregate is Imbaimadai. Gold and diamonds brought in by the Porknockers are purchased by buyers who sell in Georgetown, where a flourishing trade exists for gold ornaments and jewellery. The diamonds are cut and polished in Georgetown.

The sources of the gold and diamonds found in Guyana are not known. Both are alluvial and thinly distributed over large areas, concentrating in the gravel of the streams and river beds. To recover diamonds from rivers pumps are used, the funnels guided by divers who work at considerable depths in black water.

While in the jungle the Porknockers deny themselves alcohol, and no women are allowed in camp; both women and alcohol are sources of friction and could lead to the break-up of a tightly knit team living in complete isolation where mutual trust is paramount.

From Kamarang members of the Expedition twice visited a Porknocker camp downstream, with Mr. Winter, diamond buyer living at Kamarang, as host. After a two-hour journey downstream by power boat and a 15-minute walk into the jungle, they arrived at the campsite, a clearing in the jungle that looked like a battlefield, with large trees felled in all directions. The licensee, Mr. O. Henry, explained how, once a stream bed is found to contain 'indications'—minerals including tin, which indicate the presence of diamonds—the gravel is panned and the bed deepened and extended, undermining the trees lining the stream. In the same gravel deposits both gold and diamonds are found, the gold being panned in a solid bowl and the diamonds by using a sieve.

The gold dust is first amalgamated with mercury and the amalgam then burned over a fire; the mercury is vapourised leaving a nugget of gold.

FINALE

The Expedition Story

The sun's rays slanted like searchlights through the giant columns of the primeval trees. Scrambling on to the top of a fallen tree-trunk, one of our Amerindians pointed his machete towards a bright gap in the innumerable layers of green.

'Look. The mountain.'

Through the opening we saw the sun plucking at the swirling mists which surrounded the dark shadow of the mountain. Like the prow of some great battleship cutting through the fog, the sheer walls of the mountain emerged, and for the first time we saw the 3,000 feet pink sandstone cliffs of Mount Roraima.

The majestic northern cliffs of Roraima, rising vertically from the green montane forest of Guyana, are often swathed in unshifting clouds for weeks on end. Then they will appear for a tantalizing hour or so before the heavy mists in the valley below lift, or the laden cumulus clouds on top descend to blanket out the sight of the great plateau once more.

The expedition had been cutting its way through the dense forest towards Roraima for over a week, yet this was the first clear view of our goal. The scale—we were now within six miles of the northern cliffs—was almost beyond our grasp. The plateau stands 6,000 feet above the surrounding forest. It is raised on a series of broad escarpments up to the final 3,000 feet, where the sandstone rock rises sheer to the black-capped plateau at 9,094 feet. This plateau, which sprawls for 25 square miles across the borders of Guyana, Brazil, and Venezuela, is surrounded by spectacular cliffs, and for a long time the summit was thought to be totally isolated from the surrounding jungle.

As we looked, we could make out vertical white streaks as waterfalls cascaded from the plateau above. From time to time the wind would catch one of the thread-like columns as it plunged to the green jungle below, and whip it to one side in a horse-tail spray. The forest below would then form a dark backcloth for a small timid rainbow.

Roraima dominates everything; not only by its sheer size, but by the air of mystery which surrounds it, enhanced by the dark jungle creeping up the slopes and the clouds eternally hugging the cliffs. The Amerindians regard it with awe and call it 'the most fertile mother of all rivers', as indeed it is. Waterfalls plummet off the cliffs, on all sides, to swell the Amazon, Orinoco, and Essequibo, the three great rivers of northern South America.

This mountain has also meant much to British scientists and explorers; indeed, for a long time after its discovery in 1838 it had been the centre of a heated debate on evolution.

Before the Ice Age, a great plateau of sandstone covered the north of South America. Over millions of years the sandstone was worn away, and all that remains today is the Pakaraima mountain range, stretching in a cordillera for 160 miles along the western border of Guyana. From the forested escarpment rise a number of mesas, or large plateaux, isolated from the surrounding forest by sheer rock faces. Roraima is the largest of these; its sandstone has been dated as pre-Cambrian, some 1,750 million years old.

An argument arose in the middle of the nineteenth century over the possibility of suspended development, or an evolutionary development different from that of the rest of the world. Indeed, it was believed possible that prehistoric forms of life could still exist on top of Roraima:

Will no one explore Roraima and bring us back the tidings which it has been waiting these thousands of years to give us? One of the great marvels of the mysteries of the Earth lies on the outskirts of one of our colonies—British Guiana—and we leave the mystery unsolved, the marvel uncared for. . . .

thundered the *Spectator* in April 1877.

The discovery of Roraima is generally attributed to Sir Robert Schomburgk, who, in 1838, saw it from the Rupununi savannahs some hundred miles to the south-east. However, it seems likely that Sir Walter Raleigh saw it long before that. He wrote of 'mightie' waterfalls which 'falleth to the ground with a terrible noyse', and legends of diamonds and dangerous Indians.

The imagination of the early explorers ran wild. Schomburgk wrote:

According to the tradition of the Indians, the summit of the flat-topped gigantic sandstone walls, which can never be scaled by humans, is covered by large lakes full of remarkable fish-like dolphins and is continually circled by white eagles—their eternal wardens.

Carl Appun attempted to scale the cliffs in 1864. Later, in 1869, geologist Barrington Brown approached the red mesa from the Venezuelan savannah to the south.

'The summit,' wrote Barrington Brown, 'is inaccessible except by means of a balloon.'

The article which appeared in the *Spectator* inspired further expeditions to go to Roraima. Michael McTurk and Boddam-Whettam approached the mountain from the south and attempted to survey the cliffs on all sides to gain access to that elusive summit, but failed.

It was at about this time that Sir Arthur Conan Doyle wrote his famous novel *The Lost World*, based on the imaginative accounts of the mountain. The idea of dinosaurs and pterodactyls inhabiting the isolated plateau lived on in people's imagination, giving Mount Roraima an air of mystery and romance which still surrounds it to this day.

In December 1884, Everard Im Thurn, curator of Georgetown's museum, and Harry Perkins, assistant Crown Surveyor, after three months of travel, made the first ascent of Roraima. They surveyed the mountain from the Venezuelan savannah to the south, and, having found a diagonal geological fault in the cliff face, cut a trail towards it through the forest:

. . . over high piled rocks and tree stumps and not seldom under boulders of vast size, up tree trunks and along tree branches across the beds of many streams so filled with broken rocks that the water heard trickling below was unseen. Nor did the universal coating of moss, filmy ferns and lungworts, afford any but the most treacherous foot-hold and hand-hold.

They made their way up the fault with comparative ease until they

. . . reached a point where one step more would bring us on a level with the top—and we should see what had never been seen since the world began; we should see that, of which all the few, white men or red, whose eyes had ever rested on the mountain had declared would never be seen while the world lasts—and learn what is on top of Roraima.

Im Thurn took that one step more and found a fantasy world of extraordinary rock

shapes 'seeming to defy every law of gravity'. There were apparently no signs of animal life, but amongst the rocks grew an extraordinary array of flowers and dwarfed trees.

Since that first dramatic ascent, many explorers and travellers 'have thought by day and dreamt by night of Roraima'. Women and even children have scaled the cliffs to see the plateau with their own eyes, but very few have stayed for longer than a few hours. On top of Roraima it is hard to find protection from the biting wind, to keep dry in the continual swirling mists and rain, or find wood to burn when the temperature drops. Only serious explorers have stayed for longer than a week. Some of these determined characters have brought back samples of the unique flora and fauna to be found on the mountain. Yet no scientific expedition has ever carried out a survey of the ecosystem on the plateau of Roraima to allow comparison with mesas in other parts of the tropical world.

Roraima remains the haunt of a few adventurous diamond prospectors from Brazil and Venezuela, who hope to make their fortunes prospecting in the jagged crevasses or in the dark shallow pools on top of the inhospitable plateau.

In July 1971 a group of eight scientists and explorers had gathered together to carry out the first comprehensive survey of the summit of Roraima, and also that of Kuke-naam, a smaller plateau four miles away to the west.

Led by Adrian Warren, a zoologist from the Polytechnic of Central London, the team included Martin Lyes, also a zoologist; David Philcox, a botanist from the Royal Botanic Gardens, Kew, who had previously worked in Amazonia and as a member of the combined Royal Society and Royal Geographical Society Expedition to Central Brazil of 1967-9; two engineers from Cambridge University, Stephen Cobb and Harley Nott; Roger Chapman, a geographer at Oxford and Deputy Leader of the Expedition, veteran of the Blue Nile and the Jostedals Glacier expeditions; Derek Bromhall, a zoologist at Oxford, whose main task it was to film the expedition; and Henrik Forss, a medical doctor from Finland, who had worked with Roger on the Jostedals Expedition, widely experienced in mountain and jungle in many parts of the world.

The primary aim of the expedition was to gather information relating to the origin and evolution of the plateaux, survey the fauna and flora, and bring back a representative collection of living and preserved specimens, collect soil and rock samples, and make a study of freshwater life on the plateaux and in the tributaries of the Orinoco and Amazon rivers. If possible we would make an aerial reconnaissance of the summit and cliffs of Roraima with the object of finding an ascent route from within Guyana. The only known access to the summit was still by Im Thurn's route in Venezuelan territory.

To the south of Roraima is savannah, a rolling grassland leading almost to the ascent point, making our prospective approach route easy. We planned to spend as much time as possible in the vicinity of the mountains, and in order to do this, and to save time and money on a long approach march with a large number of Amerindian porters, we proposed to parachute an advance party with the bulk of the equipment onto the savannah near Roraima. There a base camp would be established within striking distance of the cliffs, to which the rear party and Amerindians would make their way by canoe and on foot.

Our proposals had been well supported by the Expedition's sponsors in England: the Scientific Exploration Society, the Winston Churchill Memorial Trust, the Mount Everest Foundation, the Royal Geographical Society, and the Percy Sladen Memorial Fund. The Slater Foundation was among our major benefactors.

The Government of Guyana had agreed to admit the expedition, and offered its full

co-operation. The Venezuelan Government, into whose territory the expedition would necessarily travel in order to reach the summits of Roraima and Kukenam, deferred its decision until after we had arrived in Guyana.

When our plans were being formulated it had been decided that, in the event of the expedition not being allowed to cross the border between Guyana and Venezuela, we would instead make an assault on Roraima from the north. Such an approach has never been made. The route would be through some of the most difficult jungle to be found anywhere in the world. If we could reach the cliffs of Roraima—we had little hope of finding a way to the summit up the vertical northern face—we would be in unexplored country at an altitude of around 7,000 feet, where we could expect to find animals and plants of great scientific interest.

In the event, the Venezuelan Government refused permission for the expedition to enter its territory. We were then at the small village of Pipilipai, *en route* to Roraima by the regular trail. For practice, four members of the expedition had parachuted into the village from a plane of the Guyana Defence Force, to the great excitement of the Amerindian inhabitants. They named us 'the fallers', and turned out in force to watch, the children running in dozens to meet each parachutist as he hit the ground. We had decided that by whatever route we would take to reach Roraima we would parachute in men and supplies as far forward as possible.

Parachuting is a comparatively new concept in modern exploration. The idea of re-supply by parachute in inaccessible areas had been used since World War II, but the use of the parachute to drop in expedition members has only been attempted on a very limited scale. To use this novel method of transportation in the jungle of South America might have been unnerving had we not been able to rely on the experience of one man, Captain Don Hughes, one of Britain's most experienced parachutists, who now commands the Army Free Fall Parachute Centre in Netheravon. In England he and his instructors had given hours of their time to teach expedition members free-fall techniques. Don had also flown out to Guyana with the parachuting equipment to see for himself and make sure all went well. It was he who would be—as he so aptly said—'throwing us out'.

Before we had set out for the interior we had made a reconnaissance by plane of Roraima and the foothills and rivers to the north. Daunting though it was to see the dense green jungle reaching high up the slopes and ridges leading to the mountain, and the twisting, tortuous rivers descending with many rapids to the wide Kako and Mazaruni rivers, we had concluded that an approach from the north would be feasible.

So from Pipilipai we flew to Kamarang, a settlement with an all-weather airstrip. Amerindian porters were recruited in the surrounding villages and arrangements made for the main party to travel north by river. Meanwhile, an advance party of four prepared to drop in by parachute near the small village of Makuripai, on the Kako river about half-way, as the parrot flies, to Roraima and on the edge of a patch of savannah large enough for parachutists to land on.

A few days after arriving in Kamarang, an 'Islander' of the Guyana Defence Force took off for Makuripai. In the plane, from which the seats and door had been removed, sat three expedition parachutists and a new arrival to the expedition, John Lisners, from the *News of the World*. John, an imaginative and adventurous Australian journalist, now sat uncharacteristically still and silent, occasionally giving his straps a 'final check'. He had been despatched by the *News of the World*, with the same words which must have rung in H. M. Stanley's ears a century before—'Get into that jungle, find them and bring back their story'.

Roger, an experienced free-fall parachutist who had last year dropped onto the Jostedal glacier in Norway, describes what happened next.

We flew along the river Kako and over the unending green of tropical rain forest. The wind whipped in through the open door keeping our minds alert for what was to come. Don Hughes was leaning out trying to locate the small savannah chosen for the jump. Suddenly he spotted it, shouted at the pilot above the roar of the engines to circle round. The savannah was situated by the river Kako and was surrounded by the ever-encroaching forest. We could see three small thatched huts on the edge of the savannah. We wondered how the Amerindians, who lived there, would react to 'flying men' descending in their midst. Unlike the villagers in Pipilipai, they had not been forewarned that we would be dropping in on them. The aircraft flew low at 2,000 feet on a dummy run, and Don hurled out a yellow streamer. This was to help him 'lay off for the wind' when it came to despatching us. As the streamer wriggled down earthwards, we could see the scattered inhabitants of the village staring into the sky. 'I am pretty certain they are not armed with bows and arrows,' yelled Don. The idea of hanging in the straps and being a helpless target for Amerindian marksmen had not even crossed our minds.

However, the time came, the engines cut, a quick nod from Don, a scurry for the door, a push outwards, the feeling of falling like a stone towards the green mass below, a great jerk and the tension was over. Only silence and peace as we slowly floated down under our gaily coloured 'chutes towards the huts. There was no sign of the Amerindians. We rolled up our parachutes and looked around us.

'Have you seen John Lisners anywhere?'

We searched the shoulder-high bracken and eventually found him with his parachute ensnared in a tree. Bursting with enthusiasm, he told us that he had just successfully completed his first parachute jump. We had never realised—we admired his courage but not his landing technique.

At the huts there was no one to be found. Bowls of half-eaten food, chunks of cassava bread drying in the sun, empty hammocks and a fire still glowing, was the sight that met our eyes. The strange silence of the deserted huts was ominous. Apparently they had all fled into the jungle as soon as they saw our parachutes. We felt as if our every move was being watched, and for this reason we did not enter any of the huts, but made a dump of our parachuting gear well away from them, amongst some trees. It would not be good to be misinterpreted as aggressors. We returned to the savannah to await the aircraft which was to drop in equipment and food.

It was two hours before the Amerindians returned, as we were gathering in the last few loads of dropped supplies. We first noticed them watching us sheepishly from behind one of the huts, and lost no time in making friends; in fact we employed one of them, Irving George, to help us in our reconnaissance of the rivers descending from Roraima. Although they had been scared by the parachutes, these Amerindians were by no means uncivilized, having been given European names and education by the Seventh Day Adventist Missionaries.

There were two possible rivers we could use on our approach to the north face of Roraima; the Paikwa and the Waruma. Both rivers flow into the river Kako, a few miles up river from the village of Makuripai. Our reconnaissance by woodskin canoe showed us that the Paikwa was narrow and full of submerged logs. Our best route would be to follow the Waruma, wider than the Paikwa, but even so only navigable for about six miles.

By this time the main party, with a team of Amerindian porters led by the veteran Jerry Isaacs, had arrived from Kamarang. The expedition then split into two, a leading party going ahead by river to set up Camp 1, leaving the botanist and zoologists at

Makuripai to make their collections.

The upper reaches of South American rivers are particularly treacherous. Not only are submerged logs and boulders a menace, but a rainstorm in the catchment areas may cause the water level to rise downstream by eight feet in as many hours, and fall again as quickly.

We were near the end of the wet season when we began our journey up the Waruma river, and there was still water enough to float the canoes over all but the worst rapids. Four times on the way to Camp 1 we had to scramble over the side and manhandle the laden canoes upstream against the current, bouncing over rocks and logs until we reached deeper water. The fifth rapid proved impossible and so, on a bend in the river opposite a spit of sand where the tracks of an alligator could clearly be seen, we made our first camp.

From here we would have to carry all our food, personal gear and equipment on foot. Enclosed in jungle, except where a river or a fallen tree gave us a rare view of the sky, we would have to cut a trail with only the Amerindians' unerring sense of direction to guide us, and our own compasses to confirm their accuracy.

At Camp 1, when we reassembled again, everyone was in high spirits. We all thought it would not be long before we would see Roraima, the mountain that had drawn us from so far. But it was to be three weeks before we broke out of the jungle and looked up at its towering cliffs, glowing pink in the sunlight.

Imagine moving through a dark green tunnel of foliage, tripping over roots, crawling on hands and knees under some obstacle, then suddenly sinking up to the thighs in swamp; clambering over the rotting boles of trees which, having spent years straining upwards towards the sunlight, now lie on the forest floor, strangled by lianes or crumbling with age. And this with a 50-60 lb. pack on one's back, biting into the shoulders and torturing the muscles. We averaged two miles a day through the jungle on the lower slopes, and climbing higher it took us six days to cut a trail of only two miles.

We tried to work a system whereby the zoologists and botanist would stay in camp to work in peace whilst the rest of the team would cut the trail and the Amerindians would be building the next camp and ferrying equipment and supplies.

Some camps were named after their peculiarities. The little village of Makuripai was 'Jigger Camp', because of the hordes of jigger fleas which infected it and attacked us in their hundreds. These tiny pests live in the sand and burrow into the skin of the foot, particularly between the toes or under the nails, where they then swell up as their eggs develop, forming large egg-filled sacs. These cause nasty sores, and can be extremely painful when there are over a hundred on one foot, as the unfortunate parachutists, arriving early at Makuripai, discovered to their cost.

Camp 1 was christened 'Mozzy Camp' because of the mosquitoes which had flown in from miles around to see this new prey called white man. So determined were they that their incessant whining caused us to stuff our ears with paper in order to get to sleep.

Camp 2 became 'Flood Camp' as it was here that we faced one of our worst fears. It had rained continuously during the night and when we awoke at dawn it was to discover that we were no longer on the top of a ten-foot high riverbank; the water was level with us, a raging torrent sweeping past at over 5 knots. We were surrounded by water, the forest was flooded, and the water still rising. We hastily built a frame out of saplings, on which we placed all the equipment and prepared to perch ourselves if the situation worsened. To our relief the water level began to drop as the first eddies licked our feet. Later, when we went out to inspect nets which had been set the night before between

trees to catch bats, we found only two specimens: both fish!

At Camp 2 we had another crisis. The day after the floods Harley Nott, the expedition Quartermaster, walked into camp with two fingers of his right hand cut to the bone. He had been negotiating a slippery log in the forest when he fell, his right hand sliding down the long blade of his machete. Henrik, the doctor, was galvanized into action. Luckily for Harley the tendons were still intact, otherwise he might have had two useless fingers. Now he has the scars of twelve stitches as a souvenir of his journey to Roraima.

Camp 3 was infested with ticks; Camp 4 teemed with ants. Camp 5 was three miles from the north-west face of Roraima and we could just discern the cliffs through the trees as the evening sun brought out the pink colour of the sandstone. For two weeks we had hacked our trail through a forest which became denser every day. We had struggled and sweated for the little enough reward of catching a glimpse of the plateau as we crossed a river before once again being engulfed in our prison with green walls.

Roraima seemed within our grasp.

At Camp 5 we planned to split into two groups to find the easiest route up the slopes which led to the sheer face of the mountain. From aerial photographs and the occasional views we had obtained from a tree-top, it appeared that it would be worth exploring the northern and western ridges of Roraima. In fact the western approach, at this stage, looked the more promising. Adrian Warren and Roger Chapman, with Derek Bromhall and Henrik Forss, were to tackle the west ridge, while Stephen Cobb and Harley Nott would reconnoitre the north ridge. David Philcox and Martin Lyes were to remain in Camp 5 to continue collecting plants and animals.

Each party had its quota of eager Amerindian helpers. Both reconnaissance groups encountered more hostile jungle than ever before, and adding to the difficulties was the need to climb steep hillsides as well as cut through the tangle. Sometimes the montane forest held up progress to no more than a mile a day, after five hours of cutting. The western approach became steadily worse, the higher we ascended, until after three days it was obvious that there was no point in going on.

Disappointment at having to abandon the most promising route turned to elation at the success of Stephen and Harley, who had forced their way on to a knife-edge ridge and ultimately reached a height of 6,700 feet. From Camp 5 they had hacked a trail to a point below the knife-edge of rock. From there, after many attempts, they finally found a chimney which led up the side of the rock to the top and so on to a swamp below overhanging cliffs. We made plans for the main party to follow the next day, and talked late into the night about what we were going to find on top of the ridge.

None of us will forget that journey onto the ridge and the subsequent traverse across the rock face. We had a minor mutiny amongst the Amerindians. Two of them became frightened when we had to use climbing ropes up a particularly steep section, and turned back. It was difficult to keep a foothold on the dark, damp clay or to grasp loose foliage for support in order to maintain one's balance over the many obstacles on the trail—roots, mossy rocks, lianes, and stumps. One slip would mean sliding out of control with a large pack down the steep slope, until one came to an undignified halt wedged by the trees. We crawled on all fours, scrambling over or under logs or fallen trees, floundering and struggling until we reached the next dry ledge where we could sit down, slip off our packs and recover our strength.

At last we reached the ridge and here the flora dramatically changed character. We were now in cloud forest; the trees were black, stunted, and gnarled, and the branches dripped with a covering of thick yellow-black slime. Everything was cold and wet. The

cloud that enshrouded us in a thick mist, gave the place an air of mystery, of a dream-land. Seemingly out of place, sprouting from the slime, were small epiphytes—orchids and bladderworts—with brilliantly and exquisitely coloured flowers. We struggled on through this mass of scratching twigs and groping branches, clawing our way through giant Bromeliads (Pines) which poured water over our already-soaked thighs before springing back. Eventually we broke out of the black forest and in dazzling sunshine stepped into a hillside swamp leading up to the overhanging north face of Roraima.

When Im Thurn had written his account of the first ascent of Roraima, he had described a swamp so rich in its profusion of flowers that he had referred to it as a botanical El Dorado. Unhappily that swamp has since been destroyed, but what met our gaze as we stepped onto the north ridge must have been similar to the sight which so excited Im Thurn. We too were exhilarated, and the grinding effort of the climb seemed well rewarded.

We stayed two days on the ridge, much of it in driving wind and rain. Our hammocks were slung on the stunted black trees, and for cooking and working we put up a plastic sheet over a frame of branches. With rations in short supply we hurried to collect plant and animal specimens, rock and soil samples, which the Amerindians, now excited too at having climbed so high, carried down to the lower camp for David Philcox and Martin Lyes to deal with.

At every break in the clouds we brought out cameras carefully shielded from the damp and rain in plastic bags, and went wild, photographing everything in sight. Derek Bromhall took hundreds of feet of colour ciné film of the summit towering 1,200 feet above us, and of the waterfalls pouring off the plateau and the clouds boiling in the valleys below us, as well as of the extraordinary variety of plants.

The swamp extends across the width of the ridge and upwards over undulating ground. Patches of sand show white between the foliage, holding small puddles of water. Carpeting the ground are scarlet sundews, the hairs on their fat leaves tipped with droplets of a sticky exudate in which small insects are trapped. Everywhere are clumps of pitcher plants, *Heliamphora*, here growing to an enormous size, their bright red and green pitchers over a foot tall, nearly full of acid, much diluted by rain water. Insectivorous plants of various kinds thrive up there. Some of the most varied and beautiful are several species of bladderwort, *Utricularia*. The largest have blue flowers resembling sweetpeas, whose three-foot stems reach up from the axils of the bromeliads, so-called 'pines'; in the water collected in the axils are the roots and 'bladders', in which the bladderwort traps its prey. Other smaller bladderworts, yellow and crimson, grow in the wet sand.

Bromeliads, resembling pineapples, grow everywhere. Some are small and pointed, others nearly six feet tall with large broad leaves. Sedges, mosses, and liverworts are in profusion, revelling in the perpetual moisture. Small trees with large glaucous leaves and green flowers, whose identity we still do not know, were a great attraction to a gorgeous humming-bird, in shining iridescent green, probably the Roraima Emerald, known only from this area.

We made our way up to the base of the rock face at an altitude of 7,700 feet, but it was obvious that, without artificial climbing aids, it would be impossible to climb the last 1,200 feet to the summit.

We did, however, record the rock face in detail on film for Adrian Thompson, the Guyanese botanist and explorer. He had plans to lead a mountaineering expedition in November to scale this, the highest mountain in Guyana. He decided to use our trail up to the cliff face, and with Bev Clark and John Streetly, both British Alpine and Himalayan

climbers, attempt the first-ever ascent of Roraima from the Guyanese side. It was gratifying to know that our efforts were to pave the way for this ascent.

It was on the way down from the north ridge on our return journey, at Camp 4, that something happened which not only escalated our journey out of the interior, but which came as an unwelcome, if dramatic, climax to the expedition. If one were to say that we were now deep in jungle, 70 miles from the nearest airstrip and 340 miles from the nearest hospital, it may give some clue to the nature of the drama. There can be few worse places to develop acute appendicitis. Poor Roger Chapman was the sufferer in the ensuing flight from the jungle. Henrik Forss made the diagnosis soon after the pain became extreme during the night, and warned everybody that Roger must be evacuated at dawn. Every trick was pulled out of the medical bag in order to make Roger as comfortable as possible, by injection, ingestion, and supposition!

At first light the Amerindians cut a long pole to which they tied Roger's hammock, then, with him inside and only half-conscious, they moved off down the trail, supporting the weight on their shoulders, like some eastern potentate being carried home in honour and glory. But the situation was grim. Time was not on our side, and if the journey were too much of a strain, the appendix could burst. We all knew that at worst Roger could die, and it was with this thought filling our minds that we pressed on day and night through the jungle to get him out. Henrik was reluctant to operate in the bush as the chance of infection was so great, but he was ready in case of extreme emergency.

Roger writes:

My admiration for the Amerindians was high by this stage of the expedition but it soared at this critical period, as they carried me, in turns, through the hours of daylight. The dead weight of my body must have been crippling. I could hear them grunting and puffing, but on they went at a fast trot, stopping every half-hour for a five-minute break. At each creek, they stopped and helped me out of the hammock, and guided me like a child down the banks across the slippery tributary and up the other side, before placing me gently in my hammock again. As I lay there, I could not help but feel guilt for the pain I was causing them. Yet they continued to laugh and joke.

Meanwhile Harley was operating the radio, transmitting an emergency message through to the Guyana Defence Force at Kamarang, the nearest airstrip. He arranged for a motorboat to be sent on its way up the river Kako, and was told that an aircraft would be standing by the next day to evacuate Roger to hospital in Georgetown.

Camp 2 was reached by nightfall, but the Amerindians were clearly in no state to continue. But there was no question of stopping for the night; we had to press on. Expedition members took up the weight and struggled on through the night to make the last six miles to Camp 1, where the canoes were moored. Stumbling and cursing, having lost the trail many times, Roger was brought into Camp 1 just before midnight. It had taken six hours to cover as many miles.

After a brief stop for hot soup, gulped down at speed, Roger, chilled, soaked, and in a half-coma, was transferred from the hammock into a canoe. Henrik and Derek were to accompany him, and two Amerindians, Lincoln and Milton, were to navigate. At midnight the canoe set off downstream towards the first set of rapids and as it disappeared round a bend in the river the heavens opened and rain pelted down. In camp the constant splatter of the tropical rain on the water accompanied our silent prayers. For those who had carried Roger, sleep did not come easily that night, although everyone was in a state of exhaustion.

The journey downstream was something of a miracle in itself. The Waruma river in daylight is difficult enough, with rapids to negotiate and submerged logs and boulders a constant danger. At night and in pouring rain the hazards are multiplied. Derek takes up the story:

Almost as soon as we left Camp 1 we were enveloped in torrential rain, which whipped the water around us into a foam and soaked us in seconds. Once caught by the current there was no turning back and we were carried along at a frightening speed. Milton in the stern provided power and steerage, and Lincoln balanced precariously in the bows, alternately playing a torch on the obstructions ahead and then paddling furiously with the torch gripped between his knees. Roger lay comatose in the bottom of the canoe, water slopping around him, while Henrik and I huddled together in the centre of the canoe, chilled and exhausted.

My respect for the Amerindians grew yet more in that first half hour of our journey downstream, when we somehow safely negotiated three sets of rapids. Lincoln in the bows could, incredibly, see the channel ahead through the darkness and rain with just sufficient time to shout to Milton and then lever the bows one way or the other with his paddle, so that the canoe took the best line. Twice we struck something underwater and almost turned over.

On our way upstream at the beginning of the expedition Adrian had been pitched into the water when we hit a log, and I speculated with horror on the prospect of Roger being thrown into the black torrent if the canoe were to be overturned now.

But we came through, into the calm of deeper water as the Waruma joined the Kako river. The rain ceased and a thin moon threw a silver light over the forest. Silently, except for the dip of the paddles, we glided downstream, floating on black water that ran fast and deep with scarcely a ripple. For two and a half hours we paddled downstream, Henrik and I taking turns from time to time, as much to generate warmth as to help Lincoln and Milton.

Chilled, hungry, and tired though we were, that journey will stay in our memories as one of great serenity and beauty. None of us had travelled on the river at night, and even to the Amerindians it is a rare experience; the silence of the jungle hemming us in, broken only by the occasional sound of a night bird, disturbed at our passage; and the moon's weak light casting shadows from the trees only one shade darker than the river. Even Roger, drugged and in pain, remarked how beautiful it was.

At last we reached Makuripai, where to our immense relief we found a long-boat with an outboard motor, sent up from Kamarang to bring us down. We roused the coxswain, asleep in the village, and at three in the morning set off again downstream, this time to the scream of an outboard motor at full throttle. For three hours and through several rainstorms we sped down the wide Kako river, then the even wider Mazaruni, slowing down only when forced to do so by the mist which lay over the water in patches at the approach of dawn.

Shortly after six in the morning we tied up the canoe at the foot of the steps leading to the Clinic at Kamarang. One last climb, with Roger a dead weight on our linked hands as Henrik and I carried him to the Clinic, and then he was lying at last on a bed, his sopping clothes stripped off him. Henrik examined him and declared that he was in good shape, considering.

Within the hour a plane arrived. Roger was carried off to Georgetown and hospital, accompanied by Henrik. Derek returned to Camp 1.

The next afternoon we received a radio message telling us that Roger had been successfully operated on, only 45 hours after he was first struck down.

And so the expedition came to an end. In Georgetown again we packed our specimens and equipment and shipped them by sea. Living plants, other than those left behind with

the Minister of Agriculture, were despatched by air to the Royal Botanic Gardens at Kew, where some of the orchids are already in flower. Preserved specimens have now been distributed to experts in the various groups, and we have little doubt that some of the species will prove to be of considerable scientific interest coming, as they do, from unexplored territory.

Was the expedition a success? We did not reach the summit of Roraima, our primary aim, but were frustrated in this not by our own inadequacies but for political reasons over which we had no control. Instead we pioneered a route to the north ridge of Roraima, physically far more demanding than the relatively easy climb to the summit by the regular trail in Venezuela.

The surveys carried out constitute original work, and we enjoyed the privilege of exploring unknown territory. Above all we returned with a great love for the forest and for the remarkable gentle people who inhabit its interior.

It is for others to judge our success as an expedition. In the minds of each of us who have seen the summit of the plateau and climbed the flanks of Roraima where none have been before, there are no doubts. When we left England it was to meet a legend. Now that we have returned from the 'Lost World' the legend has been displaced by a personal experience in which reality is itself very near to fantasy.

POSTSCRIPT

The 1971 British expedition to Roraima achieved:

1. The first exploration and ascent of the north ridge of Roraima
2. The first biological survey of the northern slopes and ridge of Roraima
3. The first demonstration of the feasibility and advantages of parachute techniques on a scientific expedition in Guyana
4. The first comprehensive aerial photographic record of Roraima, Kukenaam, and sister mesas
5. The first map to chart the northern sides of Roraima and Kukenaam.

The expedition did not achieve, for diplomatic reasons, the summit of Roraima. When an approach from the north was first considered it was fully realised that there was practically no hope of reaching the summit from Guyana, unless by some slim chance we were able to discover a point in the cliffs where an ascent could be attempted. The Guyanese section of the cliffs was thoroughly examined and it was concluded that nothing short of a major climbing operation would have any prospect of reaching the top.

However, Adrian Thompson, a well-known Guyanese explorer and an eminent botanist, with John Streetly and Bev Clark, both British Alpine and Himalayan climbers, decided to make a bid for the summit of Roraima from the north ridge, using our trail for the initial approach. The Mount Everest Foundation supported the attempt.

Between the highest point we achieved, 7,700 feet on top of the north ridge, and the summit, lies at least 1,200 feet of overhanging sandstone. After much effort and discomfort, Thompson's team managed to climb only 400 feet of the rock face before giving up in despair.

The north face of Roraima remains unconquered, and it seems that the summit of this strange plateau will remain inaccessible from the Guyanese side, 'except perhaps,' as Barrington-Brown said, 'by means of balloon'.

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Marlow Ropes Ltd.
Metal Box Co. Ltd.
Mitchell Cotts and Co. Ltd.
Moss Bros.
Optimus (London) Ltd.
Pains-Wessex Ltd.
Pearce Duff and Co. Ltd.
Plessey Co. Ltd.
Proctor and Gamble Ltd.
Racals
Rank Film Laboratories
Ronson Ltd.
Sellotape Products Ltd.
Slater (export/trading)
Smiths Industries Ltd.
Swelfoods
Taylor's Eye-Witness Co. Ltd.
Tilley Lamp Co. Ltd.
Transatlantic Plastics Ltd.
Unigate
Unilever Export Ltd.
Van den Berghs
Venus Esterbrook Ltd.
A. Wander
Watkins and Doncaster
Weetabix
Whitbread and Co. Ltd.
Wild Heerbrugg
Wilkinson Sword
World Air Charter
Wrigley Co. Ltd.
S. Young and Sons (Misterton) Ltd.

c. *Britain (Administrative and Service)*

Army
Army Parachute Association
Brazilian Embassy
Cambridge University O.T.C.
Foreign Office
G.O.C. Eastern Command
Guyana High Commission
Oxford University O.T.C.
Royal Engineers
Services Kinema Corporation
United States Embassy
Venezuelan Consulate
Venezuelan Embassy

d. *Britain (individuals)*

Peter Albu
Simon Albu
B. P. Austin
T. S. Blakeney
Major J. N. Blashford-Snell, M.B.E., R.E.
G. Boyce
Christopher P. T. Brown
J. H. Carter
Robert Chatterton
Dr. J. M. Cherrett
The late Dr. D. Clark
Adrian Cowell
John Cuthill
G. L. Davies
A. Denston
T. L. Donald
Lt. Anthony Evans
Dr. E. Frisby
Mrs. J. George
Nick Gifford
Dr. A. Goudie
Th. O'Grady
Miss A. G. C. Grandisson
Robin Hanbury-Tenison
Dennis Hart
Christopher Hawkesworth
Dr. J. Heard
John E. Hill
Prof. C. H. Holland
G. Holt
T. G. Howarth

G. Howes
Mr. Hyatt
Lt. Col. J. M. B. Isaac
Spencer Lane Jones
Donald Judd
Eddie King
Maj. Gen. H. A. Lascelles, C.B., C.B.E., D.S.O.
Colin D. Leighton
Mrs. R. H. Lowe-McConnell
Dennis Miller
Dr. P. Morris
Miss June Morton
Miss Carolyn J. Oxtom
Douglas Readings
Dr. John Richardson
Dr. Robbins
T. Robinson
George Sinclair
Prof. N. Singer
C. G. Smith
Dick Snailham
Muir Sturrock
Michael Styles
Dr. John Tampion
Miss Angela Teden
R. F. Tredwen
Mrs. Sylvia Vickers
A. Walker
Mrs. L. Walker
F. G. Warren
Mrs. D. P. Warren
Miss Barbara Wells
R. G. Webster
N. van Zwanenberg

e. *Britain (publicity)*

British Broadcasting Corporation
Independent Television
Newspapers: Cobham and Esher News
Daily Telegraph
News of the World
Oxford Mail
Sunday Times
Surrey Comet
Surrey Herald
The People
The Sun
The Times

f. *Guyana and Overseas*

Amerindians: Jonathan Chin
Robert Clement
Richard Francis
Irving George
Lincoln George
Milton Hunter
Isaac Jerry
Philip Steven
Sandy Williams
Wrenton Williams

Mrs. Sue Acton
Richard Alves
D. Ash
Barclays Bank D.C.O., Georgetown
Bookers Shipping Ltd., Georgetown
P. B. Bristow
British Embassy, Caracas
British Embassy, Rio de Janeiro
British High Commission, Georgetown
Mike Chan-a-Sue
Dr. Enid Dimbo
District Commissioner, Kamarang, Guyana
Sammy Edwards
'Floyd'
Arthur Goodland
George Grandsoult
Mr. Gravesande
Rod Grimes-Graeme
Guyana Aviation Corporation
Guyana Customs and Excise Department
Guyana Defence Force
Guyana Department of Geological Survey
Guyana Department of Lands and Mines
Guyana Ministry of Agriculture
Guyana Ministry of Home Affairs
Guyana Ministry of Information
Guyana Ministry of the Interior
Guyana Museum
Guyana Post Office
Guyana Zoo and Botanic Gardens
Michael and Rosemary Halsted, British Council
Mahamad Hanif
Oliver Hunter
The Indians at Amokokopai
The Indians at Malock
The Indians at Pipilipai
St. Joseph's Hospital, Georgetown
Mrs. Marie King

George Lee
James S. Lee
Bob Mackie
Mrs. Dina Mackie
Col. Martindale
Pat Mitchell
Capt. Derek Murphy
Mr. Nicholson
Neranjam Poonai
Police Commissioner of 'D' Division, Guyana
Col. Price
Juan Rivero
J. A. Sankey
Capt. Joe Singh
Adrian Thompson
U.S. Army Map Service, Washington
U.S. Government Printing Office, Washington
Venezuelan Consulate, Guyana
Venezuelan Ministry of the Interior, Caracas
Ivan Vyfhius
Miss Doris Wall
Tom Wilson
The late Asa Wright

g. *Others*

The late Sir Arthur Conan Doyle

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