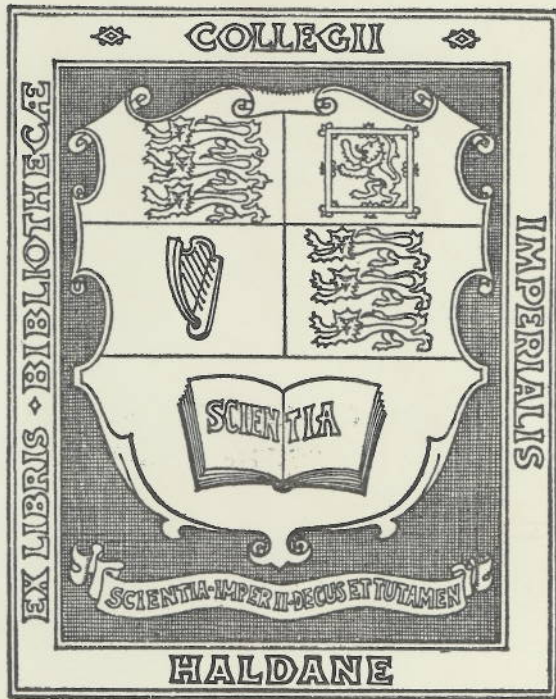


IMPERIAL COLLEGE
OF SCIENCE & TECHNOLOGY

SOUTHERN ETHIOPIA

1962

THE EXPLORATION BOARD



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ABSTRACT

IMPERIAL COLLEGE EXPLORATION BOARD

EXPEDITION TO SOUTHERN ETHIOPIA 1962

FINAL REPORT

May, 1965

ABSTRACT

Base camp was set up four kilometres south of Goba ($07^{\circ}01'N$, $39^{\circ}59'E$) at an altitude of 9,500 ft. The expedition party consisted of a postgraduate organic chemist, three zoologists, a metallurgist, a surveyor, a pedologist and a student interpreter from the University College of Addis Ababa. A scientific survey of an area of about eighty square miles was carried out, ranging from the cultivated plains north of Goba to the barren afro-alpine regions of the Saneti ridge. The highest point reached was 12,900 ft. The course of the River Micha (not named on the map) was plotted and the heights and positions of the peaks Anabura, Grati and Chorchora clarified.

Rainfall readings showed that August 1962 was a relatively wet August but, as expected, the work of the expedition was not hindered by the rains. An interesting phenomenon observed was that the way south-eastwards to the Dumal valley was almost always covered in a low bank of cloud. Rock-hewn dwellings in the Micha gorge, previously unrecorded, were mapped. A botanical collection of some seventy species of flowering plants provided no new finds but several extensions of range.

In addition to the field work at Goba, field trips were also undertaken to several other areas of interest. A trial trench was dug at Robae Cave near Ghinnir, the old trade centre of Bale. Zoological collecting at Dallo provided specimens of the bat, Rhinolophus hipposideros minimus, previously not recorded further south than Eritrea, and the black-backed jackal, Canis mesomelas schmidti, at its northernmost limit. Dallo was interesting because of the overlap between Ethiopian highland and East African forms. A summary of palaeomagnetic

results from samples collected in the Blue Nile Gorge concludes Part I of the report.

Part II of the report is concerned with a general description of the organisation and travel arrangements of the expedition. Appendix I gives a brief introduction to a promising archaeological area in Eritrea and Appendix II is a road report from Addis Ababa through Goba and Ghinnir to Magallo. Since there is no generally accepted system for the transliteration of Ethiopian names, alternative forms are given if there is any risk of confusion.

General Introduction	1
Statement of Intent	2
Acknowledgements	3
Appendix I: Brief pictures of the Conalto District, Eritrea	74
Appendix II: Road Report	77
References cited	80
1. August rainfall at base camp and at Goba	23/24
2. Daily rainfall for Goba	24
3. Maximum readings at base camp	25
4. Comparison of maximum and minimum temperatures at base camp and at Ghinnir	26
5. Road prices in Goba and Ghinnir	28
6. August surface temperatures	29/30
7. August minimum temperatures	32/33
8. August rainfall	33/34
9. Crops in the Niche Valley	32/35
10. Road through Sobas Gorge	37/38
11. Rock samples from the Blue Nile Gorge - dip and declination	44/45
12. Small exposures in the Blue Nile Gorge	45/46
13. The Conalto Fishery, Eritrea	78/79
List of plates	83
1. Expedition route in Ethiopia	87
2. Western Nile	88
3. Sobas and Niche Basins, Goba, Eritrea	89

CONTENTS

PART I: FIELD REPORT

	Page
Introduction	6
Field Area	11
Survey	17
Meteorology	19
Archaeology	26
Botany	34
Zoology	37
Rock Magnetism	44

PART II: GENERAL DESCRIPTION

Members of the Expedition	48
Outward Journey	49
Return Journey	51
Food	57
Medical Supplies	60
General Information	62
Discussion	64
Statement of Account	68
Acknowledgements	70
Appendix I: Rock pictures of the Cohaito Plateau, Eritrea	74
Appendix II: Road report	77
References cited	80

<u>TABLES</u>		
1.	August rainfall at base camp and at Goba	23/24
2.	Mean monthly rainfall for Goba	24
3.	Pressure readings at base camp	25
4.	Comparison of maximum and minimum temperatures at base camp and at Ghinnir	26
5.	Food prices in Goba and Ghinnir	60

<u>FIGURES</u>		
1.	August maximum temperatures	22/23
2.	August minimum temperatures	22/23
3.	August rainfall	23/24
4.	Caves in the Micha Valley	28/29
5.	Section through Robae Cave	31/32
6.	Rock samples from the Blue Nile Gorge - dip and declination	44/45
7.	Basalt exposures in the Blue Nile Gorge	45/46
8.	The Cohaito Plateau, Eritrea	74/75
	List of plates	83

<u>MAPS</u>		
1.	Expedition route in Ethiopia	87
2.	Western Bale	88
3.	Togona and Micha Basin, Goba, Bale	89

PART I

"One goes and goes and returns with himself; one lives
and lives and returns to earth."

Ethiopian proverb.

INTRODUCTION

Although the general background to Ethiopia is covered adequately in a number of texts (e.g. Villendorff, 1960) it is difficult to obtain accurate information about a specific area. Our initial literature survey uncovered numerous gaps and discrepancies, in part due to the heterogeneous nature of the country. The present account is restricted to one of the southern provinces and can necessarily convey only a very inadequate impression of even a small part of this intensely interesting country. It should be emphasized that Ethiopia is a highly dissected mountainous plateau (larger than France and Germany put together) it is no less fast to reach one of the more accessible areas in a limited time, yet hard to carry out scientific research there.

PART I

FIELD REPORT

In the past, travel in Ethiopia has been hindered by the suspicious and warlike character of the mountain peoples. This ancient Christian kingdom remained un conquered by Muslims in medieval times or by European colonialists in the nineteenth century. Popular articles inevitably refer to Ethiopia as a rock against which the waves of Islam have dashed themselves in vain endeavour. This independence led, not without parallel, to isolation. To quote from Gibbon: 'Encircled on all sides by the enemies of their religion, the Ethiopians slept near a thousand years, forgetful of the world by whom they were forgotten'.

The country is still little known to Europeans and the lesser known areas offer unusual scope for exploration and reconnaissance survey; few, if any, of the other countries of the dark continent offer comparable opportunities for original geographical research (Beek, 1956). Naturally, it took us no little discussion to decide

INTRODUCTION

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The country is still little known to Europeans and the lesser known areas offer unusual scope for exploration and reconnaissance survey; few, if any, of the other countries of the dark continent offer comparable opportunities for original geographical research (Brook, 1956). Naturally, it took us no little discussion to decide

on the exact area in Ethiopia to visit. Of the thirteen provinces and the federated territory of Eritrea, it was Bale province that intrigued us most, simply because we could find out so little about it in the literature. Formerly the westernmost sub-province of Harar, Bale became a full province in 1960, with its administrative headquarters at Goba. Its boundaries are now marked by the Webi Shebeli, the Ganale Doria and the Kenyan frontier.

At the turn of the last century, several hydrographic expeditions ventured into southern Abyssinia. In 1892-3 Bottego explored the lower part of the Welmal and followed the course of the Ganale Doria to its confluence with the Dawa Parma (Bottego, 1895). In 1897 the American, Donaldson Smith, in his travels from Somaliland to Lake Rudolf, visited the limestone caverns at Magallo and the Moslem shrine at Abu'l-Qasim, north of Ghinnir. In February 1901, the expedition of von Erlanger and Neumann followed the upper course of the Webi Shebeli and the sightings of their cartographer, Holtermüller, put Goba on the map for the first time (Sprigade, 1904). The route map of the expedition shows that they then passed through Ghinnir and along the Webi Mana valley (Erlanger, 1902). Goba itself was visited by Du Bourg de Bozas later in 1901. After a longer time span, the massive expedition of the Duke of Abruzzi reached Goba and Ghinnir in 1928 (Savoia-Aosta, 1932). This account gives a description of geological work along the Webi Shebeli by Stefanini. A geological map published after the Italian occupation (Dainelli, 1943) gives general coverage of Bale and is still the leading authority for much of Ethiopia. The Oligocene-Miocene lava sheets of the southern highlands are shown as laid down on sedimentary sandstones and limestones of the Cretaceous period of the Mesozoic era.

Our interest in Bale was stimulated by Sir Douglas Busk's statement that he could find no record of any European party ever penetrating the Batu mountain range in the west of the province (Busk, 1956 and 1957). In fact, Hodson appears to have crossed some part of the range in 1916 and Smeds ascended Mount Batu in 1954. Hodson (1927) describes the high plateau as being terribly cold and bleak. His journey was cut short by heavy rain and hailstorms. Professor Helmer Smeds was leader of the Finnish-Scandinavian geographical expedition to Ethiopia in 1953-4. The first account of his work appeared in 1955 and this reference is clearly cited in Scott's paper on the High Simieri (1958). At this time, Mount Batu (14,131ft. on the map) was considered to be the highest peak in the southern highlands. None of the hydrographic expeditions mentioned above penetrated the mountains and although the Italians may have explored the area during the occupation, there is no available record of their having done so. The Guida dell' Africa Orientale Italiana (1938) gives scant information on Bale.

Thus the virtually unknown Batu mountains (also variously referred to as the Bali, Mendebo, Arana, Goba or Aruanna mountains) seemed a challenging and exciting objective for a College expedition. However, whilst our plans were under way, we learnt of more recent journeys in the area. The opening of the airstrip at Goba had rendered the mountains more accessible and three independent parties had reached Mount Batu. In October 1957, Smeds returned to Goba and followed the course of the Shaya upstream to Amargara (13,050 ft.), from which he saw five higher peaks, one of these being the peak he ascended in 1954. Flooded rivers compelled his return to Goba. In January 1958, he travelled from Goba

to Masno across the high plateau in three days. He reported that there were two peaks called Batu, both named after a legendary chief of the highlands, and that the highest peak appeared to be a two-humped crest (14,600 ft.) due south of Batu Bulla (Smeds, 1959). He visited Goba for the fourth time in March 1958. The following month, Dr. H.F. Mooney, Forestry Adviser with the British Middle East Development Division, marched from Angasu to Rira. Shortage of fuel and supplies curtailed his journey.

In December 1958, Professor Dr. Josef Werdecker used Goba as a base for three treks into the mountains. On his first sortie, he climbed Mount Fasil and the three main peaks of the eastern range, Cire Bale, Sekuna and Gubbaduma. He then crossed the high plateau to Rira, after a detour to visit Chorchora, but did not climb Mount Batu owing to bad weather. From Rira he descended to the Welmal and travelled back to Goba via Adaba and Gurie. In January 1959 he climbed Batu in better conditions and estimated its height by aneroid barometer to be 14,300 ft. An impressive photograph of the summit is given in his account, which is concerned mostly with botanical observations (Werdecker, 1962). Finally, in December 1959, Dr. Mooney, at this time unaware of the travels of Smeds and Werdecker, carried out a botanical survey of the highlands above 10,000 ft. He gives the highest peak as Mount Dimtu (14,537 \pm 50 ft.), which was the peak recorded by Smeds. Dr. Mooney also ascended Mount Tigrita (14,104 ft.) which may be Smeds' Batu Bulla. The correct name for Mount Batu is stated to be Mount Saneti, Batu being the name of the locality, and the mountains as a whole are called the Araenna mountains by the local Galla (Mooney, 1963). It is incredible

to think that this, the second highest range in Ethiopia, was not properly described until as late as 1963. Although we received much helpful information from Dr. Mooney prior to departure we had not seen his compass sketch map of the Batu mountain group. Werdecker's work was not published until August 1962 and Smeds' accounts give no adequate route maps. We therefore had only the 1:500,000 maps to rely on.

Although we would not concur with Sir Douglas Busk's view that this coverage of the central high plateau had "cleaned the area up", our original idea had lost some of its novelty and we began to look for another objective. The Araenna mountains link up with the lower eastern range visited by Werdecker, forming a horse-shoe shaped barrier protecting the upper reaches of the Dumal. Interesting zoogeographical features are to be expected in the region as a result of the overlap between Ethiopian highland and East African types. Also the lower altitude would yield more productive zoological collections. As indicated on the best available maps (1:500,000; War Office, 1946 and 1949) the river has only western tributaries despite high ground to the east. One of these tributaries is marked as the Rira; it has now been shown (Mooney, 1963) that in fact the Rira flows south through Ordobba and at its nearest point is over twenty-five miles from the Dumal. Apart from a few contour lines, the only features shown in this region are three springs; one of these is marked as running uphill. The only expedition to have entered the Dumal valley seems to have been that of Du Bourg de Bozas in 1901 and his route from Goba to Masno (Masslo) was only provisionally noted. Obviously, very little was known about the valley and accordingly we decided to try and reach the upper Dumal

by crossing the 11,000 ft. pass south-east of Goba (map 2).

Since we intended to carry out an intensive scientific survey of a relatively small area our programme consisted of several projects. The most important facet of the expedition was a general ecological survey of the field area. One of the zoologists was also responsible for meteorological observations. The pedologist was to carry out a soil survey of the area and to help examine any mineral springs, whilst the surveyor was to make a field map by combination of plane table and prismatic compass. The expedition leader was concerned with collecting botanical specimens for Kew and noting features of archaeological interest. A metallurgist was included in the party as transport officer and the team was completed by the inclusion of a student interpreter from the University College of Addis Ababa. En route, we proposed to collect rock samples for the Rock Magnetism Group at Imperial College. We hoped to spend about seven weeks in Ethiopia, including five weeks in the field. The next section gives a general account of the field area and is followed by the individual scientific reports. Preliminary accounts of the work of the expedition have already appeared (Herbert, 1962 and 1963).

FIELD AREA

The main party arrived in Addis Ababa on July 25th, 1962, and was joined by Herbert on the 27th. With the invaluable assistance of members of staff at the University College, several field trips were carried out. A zoological and botanical collecting trip was made to

Mount Entoto and a zoological and geophysical collecting trip was made to the Blue Nile gorge, where orientated rock magnetic samples were taken from basalt layers of varying ages.

We arrived at Goba on the morning of Monday, July 30th, in a Douglas C-47 of Ethiopian Airlines, after a turbulent flight over Shoa and Arussi. It was difficult to reconcile our preconceived ideas of the wild Batu mountains with the line of forested hills that lay to the south and in fact at first we assumed that we had landed at Adaba, where the "Vomit-Comet" was scheduled to stop. Since the airstrip itself is at 9,100 ft., the highest in Africa, the impact of the foothills of the Batu range is somewhat diminished. We spent two hours explaining to the Director-General that our tight schedule in the capital had not allowed time for such mundane matters as obtaining travel permits from the Ministry of the Interior. We furthermore politely informed him that the first secretary of the Ethiopian Legation in London had stated in the "Daily Mail" that expeditions such as ours did not require permits nowadays. We were given permission to travel freely in the vicinity of Goba.

Whilst a temporary camp was being set up in the police compound, Herbert and Sowerbutts climbed Mount Fasil, the most prominent peak visible from Goba. The expedition was in a bad financial position and the hiring of mules was out of the question. However, we thought it might be possible to portage our food (130 lbs.) and equipment (780 lbs.) ourselves if we could find a suitable route at comparatively low altitude to the Dumal valley. From the top of Mount Fasil it was seen that a steep mountain wall, covered by a thick bank of cloud at 10,500 ft. would

hinder our progress (Plate II). Obviously, the pass was not unnegotiable but in view of the limited time at our disposal it was a formidable obstacle. Sharp hailstorms delayed the return of the two men and they spent an unpleasant night bivouacing on the mountainside.

The next day, Barrer and Hinks rode out on horseback with a guide to reconnoitre a more easterly route. They in turn reported that the way was steep and difficult and that bandits had been seen in the area. The general opinion of the expedition members now was that it would be better to work from a base camp near Goba rather than to attempt to reach the Dumal valley. Williams and Outram had meanwhile found eight mineral springs below Goftari and we decided to set up our base camp near there. This decision meant that the expedition lost much of its intended exploratory nature but was advantageous as regards the scientific collecting work. On the whole, our field area provided a good cross-section for a scientific survey and contained interesting comparative features that would have been lacking in solely urec or k'olla terrain.

Three days after arriving in Goba, we set off in the police Mercedes lorry. This transport was provided free and we were given an escort of a lieutenant, seven constables and two guides. After a long detour, via one or two t'ej bates, to reach the Italian-built bridge over the Togona, we climbed up into the old town. The track soon faded out and the vehicle lurched on across rough ground. Eventually we came to a clearing on the east bank of the Togona, at the point where it receives a small tributary, the Kafficha. Having exchanged greetings with the local chieftain, we set up the base camp at 9,500 ft. and dug trenches around the tents before the afternoon rains began.

During the next month, we carried out a scientific survey of an area of about eighty square miles, ranging from the cultivated plains north of Goba (8,700 ft.) to the barren afro-alpine regions of the Saneti ridge (12,900 ft.) The gorges of the Shaya, the Togona, and the Micha proved to be of particular interest. The Shaya is a small but powerful river that has cut a ravine in places at least two hundred feet deep but only fifteen feet wide. It is not possible to see the water as trees growing from the almost sheer rock face of one side touch the opposite bank. The Togona shows clear signs of glacial erosion.

The surface geology of the area consisted of two successive tertiary lava flows. The older basalt flow outcropped north of Goba whereas to the south this flow was covered by a layer of coarse volcanic ash that had been eroded before being covered by the younger basalt flow. The soils were in general poorly drained, heavy clay types derived from the recent basaltic lavas. They contained few insects but had a high proportion of organic matter. In and north of Goba a black clayey loam had developed; to the south was a brown sandy loam. Although the soils are potentially very fertile, no crops are grown on the mountain slopes due to cold and exposure. Cultivated areas are confined to the lower valleys and the plains. A general soil survey of the field area was undertaken using a hand auger. The morphology of the displayed profiles from four pits was described and twenty-five soil samples were taken for later analysis. Some work was done on rock decomposition products by panning techniques in order to determine the strata the river flowed through and to see if the slightly acidic spring water increased decomposition. A concentration of magnetite was found at certain points in the river due to weathering

and preferential deposition. No other mineral deposits were located - this was to be expected as the rock was basaltic not Pre-Cambrian. Mineral residues deposited by the springs were analysed using a B.D.H. spot test kit and water samples were collected. One of the springs was used as a watering-place by the Galla (Plate IV).

The town of Goba has a somewhat 'western' aspect. The houses, bars and restaurants are surrounded by corrals of rough-hewn timber and many of the inhabitants are horse breeders. There are even armed bandits in the hills. Goba has been described as an Amhara oasis in the Galla wilderness and indeed the heavily-worked irrigated fields around the town contrast strongly with the barren plains. The recent influx of Amhara officials has increased the cost of living but food is still cheap by European standards. Surplus produce is brought in from surrounding districts and sold at the markets held several times a week (new town market, Plate III). Besides being a centre of trade and administration, Goba is the chief garrison town of Bale and nearly a thousand policemen are stationed at the police training camp. Their ochre uniform, with bush hat, white anklets, and black shoes, soon became very familiar to us as we were greeted by innumerable handshakes whenever we passed through the camp. The mounted officers usually just waved. Once a month there is a rattling of chains in the town as the seventy major criminals detained in the doubly fenced prison are taken down to the river to bathe. As part of their penal servitude, the prisoners have to work for any tax-payer who so wishes. In return for this labour, the tax-payer pays a small fee to the prison authorities.

The mountain Galla were at first less friendly than the Gobans but after they had become accustomed to our strange appearance, they proved very hospitable. They are superficially Moslems but have many pagan beliefs. They have not been greatly influenced by the agricultural practices of the Amhara and prefer to herd cattle, sheep and goats in clearings of pasture meadow in the forest cover. Their typical family compound consists of two or three dome-shaped huts surrounded by a fence of thorn branches. The huts have daub and wattle walls up to six feet high and are usually divided into two compartments by a screen. At night the animals are kept in the half nearer the door; in the inner half are beds of skins supported by leather thongs and an open wood fire that is kept continuously smouldering. The wooden framework of the roof has a pleasant shiny appearance due to its covering of smoke deposits. The only light in the hut is from the embers. It is the custom to offer milk to travellers from a gourd; the milk was refreshing but often covered with a layer of scum. We found a form of porridge served with clarified butter to be very filling. The Galla showed great resistance to cold and fatigue and travelled barefoot, clad only in a rough blanket and carrying a long spear. The nurse at the mission clinic told us that she had once broken two needles trying to sew up a cut in a herdsman's sole.

The Ethiopians traditionally distinguish four climatic zones. Our base camp was situated in the daga or cool zone (7,000 - 9,000 ft.), whilst the Batu highlands lie in the urec or mountain zone (above 10,000 ft.). In order to extend our studies in Bale province, Barrer

and Hinks made a short visit to Dallo (Masno) in the low lying k'olla or hot zone to carry out zoological collecting in a more tropical environment. Also Herbert, Hamilton and Teklemichael visited Ghinnir in the woyna daga or temperate zone (5,000 - 7,000 ft.).

By the end of August, heavier rainfall indicated that the onset of the Rains was imminent. As the Dakotas sometimes cannot land for several weeks in the wet season we abandoned camp and returned in the police lorry to Goba, where we again set up a temporary camp at the police post. After two nights there we flew back to Addis Ababa via Adaba, making a collection of assorted fleas en route. During the next four days the pedologist collected more rock specimens from recent excavations and we began to make arrangements for the homeward journey. The missionary at Goba, Mr. R. Jarman, has since informed us that after a few heavy showers the weather became fine and frosty and the main rainy season did not in fact materialise.

SURVEY

Existing maps of Bale are useful as a guide but are inaccurate in detail. Professor Smeds (1959) says of the Batu highlands: 'It can be said without exaggeration that the mountain sought for is located in another place, bears another name and is situated at a different height from that indicated on the map'. It was therefore an important task of the expedition to prepare an outline map of the field area, as a basis for the other studies.

Palazzolo, the cartographer of the Duke of the Abruzzi's expedition, produced nine route maps along the Webi Shebeli on a scale of 1:250,000 (Savoia-Aosta, 1932). In 1939 the Institute Geografico Militare published the first general maps of Bale and in 1940 a 1:400,000 map (Dalle) and a 1:1000,000 map (Lago Margherita) were issued. These Italian maps formed the basis of the East African 1:500,000 maps of Dalle and Ghinnir (War Office, 1946 and 1949, NB 37-2 and NB 37-3). The Lake Margherita map (NB 37 4-GSGS), reproduced in 1946 in the World 1:1000,000 series, shows 500 m. contours and gives a general impression of the terrain. Recently, as mentioned in the introduction, Dr. H.F. Mooney has carried out a compass survey of the central Araenna mountains (Mooney, 1963).

The reconnaissance map (Map 3) prepared by the expedition surveyor, R.M. Hamilton, covered an area of about eighty square miles. A combination of plane table and prismatic compass was used. Heights were determined by corrected aneroid barometer, one aneroid being read frequently at the base camp. Goba meteorological station was taken as 9,100 ft. The scale was determined by controlled pacing on a baseline. Place names were ascertained verbally from at least two independent Galla sources.

The most prominent landmark of the area was Mt. Fasil (11,400 ft.), climbed by Werdecker in 1958. Grati (12,600 ft.), Goftari (11,050 ft.), Anabura (11,900 ft.) and the Micha river do not appear to have been recorded before. The hamlet of Agora, mentioned by Werdecker (1962) is the settlement marked south of Goftari on Map 3. Werdecker calls

Chorchora (12,100 ft.) Ittittu, as marked on the map, but this name does not appear to be in local use. A general view of the Togona-Micha basin is shown in Plate V, looking across towards Mt. Fasil from the summit of Mt. Grati. Plate VI shows the view in the opposite direction towards several unnamed peaks, behind which lies Mt. Batu. The scenery of the area was not spectacular but the mountains did have a certain grim fascination of their own. Travel was easy as the undergrowth was light and the return trip to Grati from the base camp could be made comfortably in about six hours.

At present, aerial coverage of Bale is limited to a series of 1:20,000 sheets held by the Imperial Highway Authority. These cover the area westwards of a longitudinal line through Goba. A combined American-Ethiopian project is planned to give extensive aerial coverage of all of Ethiopia on scales of 1:25,000 and 1:50,000 with electronically controlled horizontal and vertical positioning. A hundred technicians are being employed to set up ground radio stations and operate helicopters to supply stations in remote areas (Ethiopian Geographical Journal, 1963). Whether this project will be able to penetrate the cloud cover of the highlands remains to be seen.

METEOROLOGY

(I. Outram)

Introduction

The pressure and wind system affecting Ethiopia is one of great complexity, especially in view of the low pressure area of the Nile valley. The abrupt escarpment of the mountain massif, mean height

7,000-8,000 ft., rising almost perpendicularly from the torrid plains, interferes with wind movements of the Indian Monsoon area, which is reflected in an astonishing contrast of climate within a few miles. R. Mountford Deeley (1935) says: "The question of rainfall in tropical Africa is so bound up with the Indian Monsoon conditions, and we have so little knowledge of the effect of high-latitude pressures upon the Monsoon, that it is unsafe to theorise upon past and present rainfall conditions in the African lake district." In view of this climatic complexity, it is advisable to give the reader some idea of general climatic conditions prevailing over the whole of Ethiopia before dealing specifically with the southern highlands.

The four main climatic zones mentioned in the section on our field area are correlated to altitude and vegetation types and have a profound effect on the Ethiopian peoples. The bulk of the population is concentrated on the cooler, central plateau (daga and woyna daga). The highland dwellers are much more mentally alert than their nomadic cousins of the lowlands (k'olla). Their environment is comparatively healthy, the main malarial areas being concentrated in the torrid plains. The temperate climate of the plateau has enabled the eucalyptus, introduced some hundred years ago, to become established and it now forms the basis of peasant economy, its wood providing abundant fuel and building material. Coffee also grows wild in great profusion in this climate. It forms the backbone of the Ethiopian economy; it is their main export and has enabled them to build up considerable foreign reserves. The peoples of the lowlands

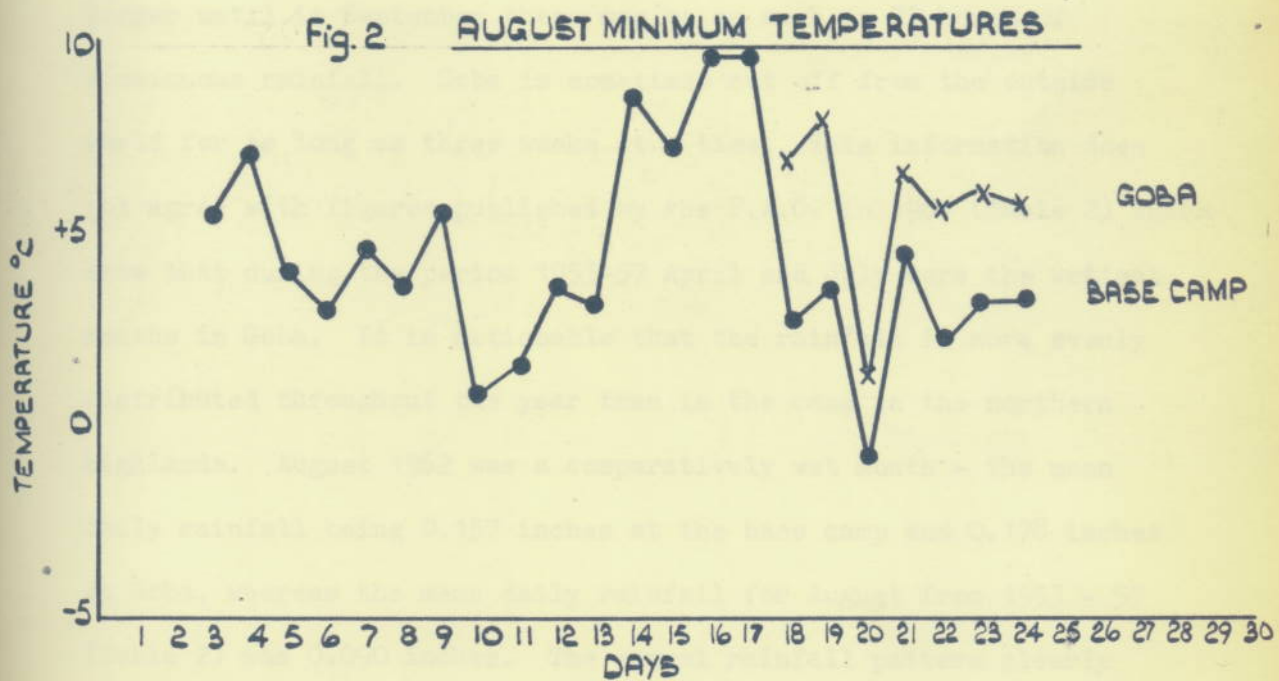
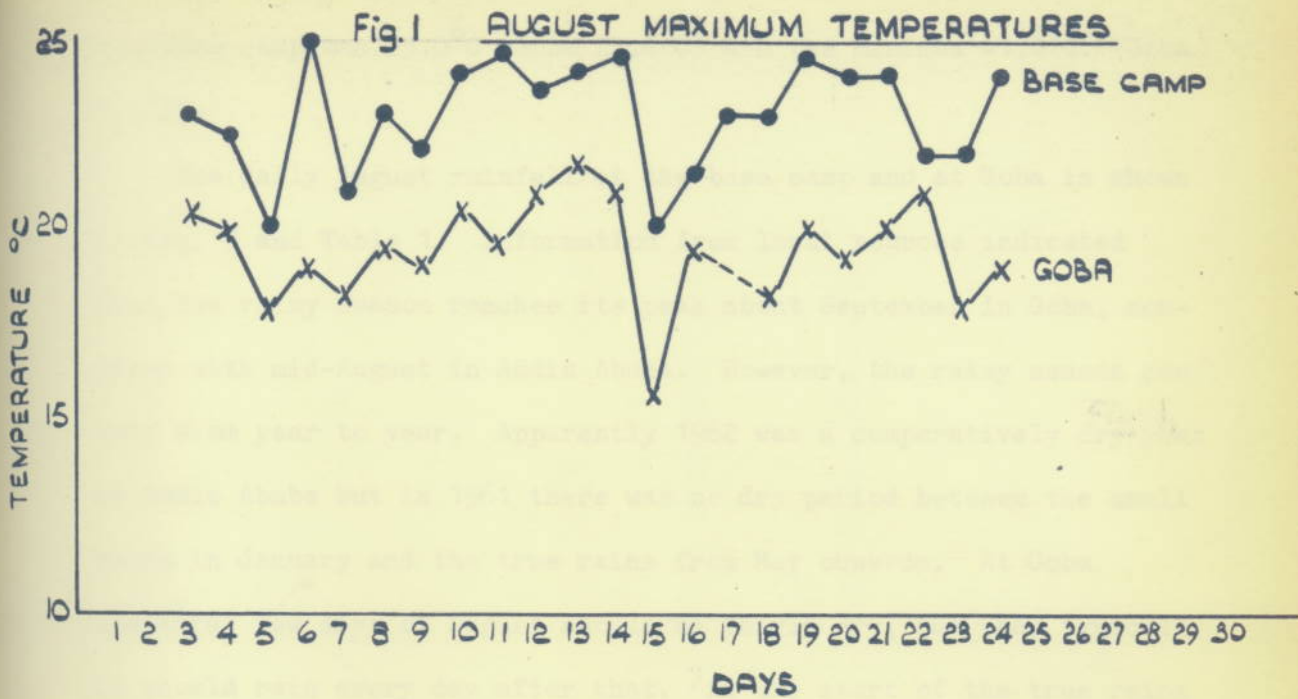
are nomadic tribesmen, with small flocks of sheep, goats, cattle and camels. The only crops they grow are tiny patches of a hardy variety of millet, which needs very little attention. Their environment is reflected in their hardness and cruelty and even today they carry out raids on the more placid highlanders in exceptionally hot and dry summers.

There are four seasons in the highlands. The rainy Keremt lasts from the middle or end of June to September. The Hagay or Bega is the dry season. The harvest season, Metseur, follows the heavy rains, and the sowing period, Tseday, is from March to June. The small rains usually occur between March and May. On the other hand, the coastal lowlands have a Mediterranean period of rains, mainly in December and January. Thus whilst the lowlands bordering the Red Sea are having their driest period, the plateau (only ten minutes flying time away) is experiencing torrential summer rains. This results in the winter migration of shepherds from the highlands to the lowlands. The ample rainfall is a direct result of the mountain massif on the Indian Monsoon and produces an agreeable and healthy climate on the plateau, despite the proximity of Ethiopia to the Equator ($4-18^{\circ}\text{N}$). The annual rainfall at Massawa on the Red Sea coast is 7 inches; Asmara in the North has 10 inches; Harar in the East has 35 inches; Addis Ababa in the central plateau 50 inches; Gore in the more tropical South West 80 inches. On the Danakil plain there is virtually no rain at all. These figures compare with 24 inches for London. In the highlands the temperature is very even throughout the year. Asmara has a maximum recorded temperature of 30°C

and a minimum of 3°C . At Addis Ababa the hottest month, May, has an average temperature of 18°C . and the coolest month, December, 14°C . In the lowlands the temperature is less agreeable, the mean average temperature at Massawa being 31°C . with a maximum of 46°C . and a minimum of 19°C . And the Danakil coast is reputed to be one of the hottest places in the world.

Readings

Rudimentary weather records were kept at the base camp from 3rd August to 25th August. The instruments used were a rain gauge, two maximum and minimum thermometers, an aneroid barometer, and an improvised wet bulb thermometer. Unfortunately the latter did not function properly and relative humidity records were not obtained. The rain gauge was set up well away from trees, and the other instruments were enclosed in a screen made out of tea chests and branches. Results obtained at the base camp (9,500 ft.) were compared, where possible, with the official records of the meteorological station maintained at Goba by the Civil Aviation Department (9,100 ft.). The only records available were the daily readings for August; the monthly records are sent to the central office in Addis Ababa. The readings taken at the Goba office were daily maximum temperatures, as they had only started taking the minimum temperatures on 18th August, and rainfall (in millimetres). In Figs. 1 and 2 the temperature readings at the two stations are compared. The mean maximum daily temperature at the base camp was 23.0°C . (Goba 19.4°C .) and the mean



minimum was 4.3°C . (Goba 5.6°C). The maximum temperature recorded at the base camp was 25.0°C (Goba 21.6°C) and the minimum -1.0°C . (Goba 1.0°C).

The daily August rainfall at the base camp and at Goba is shown in Fig. 3 and Table 1. Information from local sources indicated that the rainy season reaches its peak about September in Goba, compared with mid-August in Addis Ababa. However, the rainy season can vary from year to year. Apparently 1962 was a comparatively dry year in Addis Ababa but in 1961 there was no dry period between the small rains in January and the true rains from May onwards. At Goba the first few days of August should be fairly dry, and then typically it should rain every day after that. At the start of the true rains at Goba the "showers" occur during the late afternoon but as the month progresses the "showers" start earlier in the day and last longer until in September there may be as much as 72 hours of continuous rainfall. Goba is sometimes cut off from the outside world for as long as three weeks at a time. This information does not agree with figures published by the F.A.O. in 1961 (Table 2) which show that during the period 1953-57 April and July were the wettest months in Goba. It is noticeable that the rainfall is more evenly distributed throughout the year than is the case in the northern highlands. August 1962 was a comparatively wet month - the mean daily rainfall being 0.157 inches at the base camp and 0.178 inches at Goba, whereas the mean daily rainfall for August from 1953 - 57 (Table 2) was 0.090 inches. The annual rainfall pattern clearly

FIG. 3. AUGUST RAINFALL

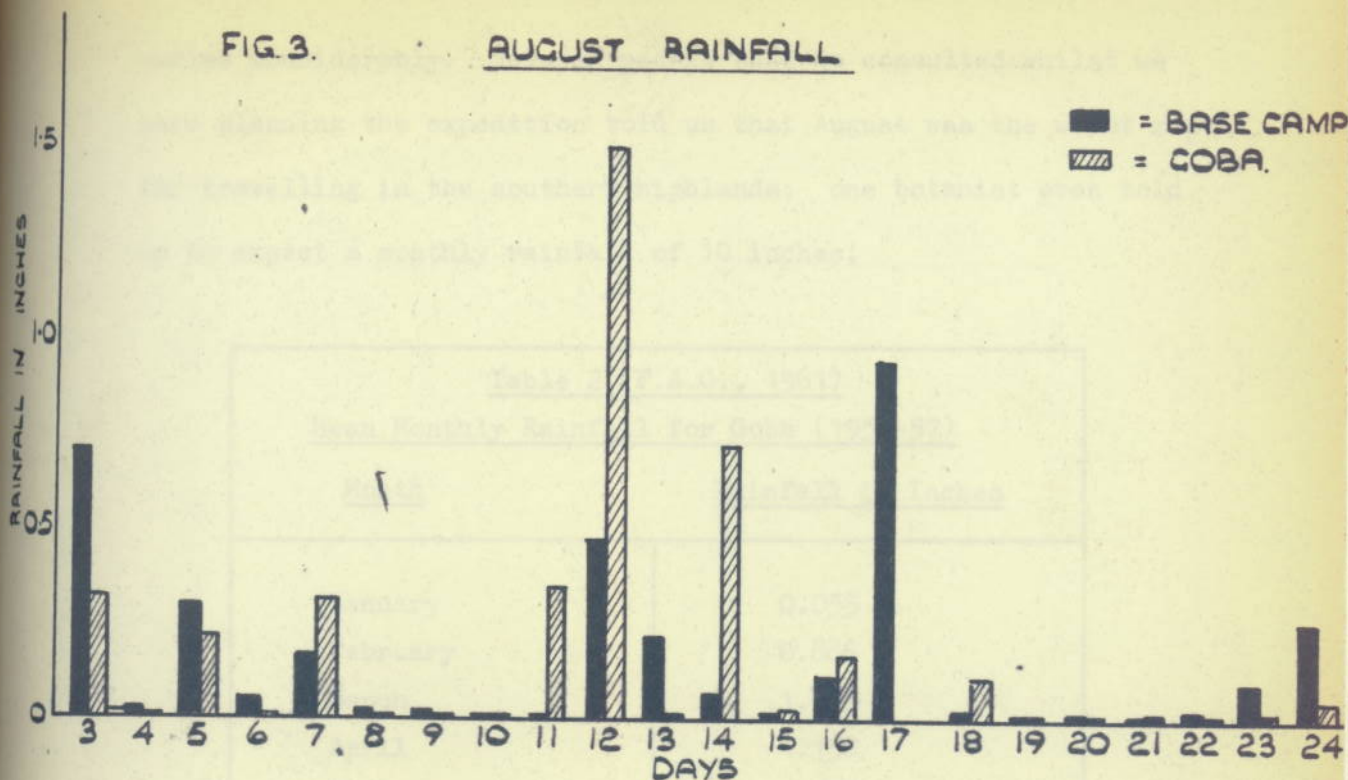


TABLE I
AUGUST RAINFALL IN INCHES

DATE	BASE CAMP (9,500')	GOBA (9,100')
3.8.62	0.700	0.314
4.8.62	0.010	0.000
5.8.62	0.295	0.205
6.8.62	0.055	0.000
7.8.62	0.170	0.318
8.8.62	0.025	0.000
9.8.62	0.010	0.000
10.8.62	0.000	0.000
11.8.62	0.000	0.346
12.8.62	0.470	0.492
13.8.62	0.210	0.000
14.8.62	0.070	0.704
15.8.62	0.010	0.023
16.8.62	0.115	0.173
17.8.62	0.935	-
18.8.62	0.005	0.110
19.8.62	0.000	0.000
20.8.62	0.000	0.000
21.8.62	0.000	0.000
22.8.62	0.020	0.000
23.8.62	0.100	0.000
24.8.62	0.250	0.053
TOTAL	3.450 in 22 days	3.738 in 21 days
NUMBER OF RAINLESS DAYS - 5		

varies considerably. Several people that we consulted whilst we were planning the expedition told us that August was the worst month for travelling in the southern highlands; one botanist even told us to expect a monthly rainfall of 10 inches!

<u>Table 2 (F.A.O., 1961)</u>	
<u>Mean Monthly Rainfall for Goba (1953-57)</u>	
<u>Month</u>	<u>Rainfall in Inches</u>
January	0.055
February	0.886
March	1.905
April	4.158
May	3.158
June	2.055
July	4.007
August	3.513
September	3.275
October	2.500
November	0.547
December	0.098
Total	24.157

The accuracy of the barometric readings cannot be vouched for as simultaneous pressure, air temperature and wind measurements should be taken and we did not possess a whirling thermometer or an anemometer. However, for what they are worth, the pressure readings are given below (Table 3).

Date	Pressure (mm.Hg)
3.8.62	537.370
4.8.	547.776
5.8.	546.100
6.8.	544.830
7.8.	544.499
8.8.	543.864
9.8.	543.331
10.8.	543.229
11.8.	543.569
12.8.	543.966
13.8.	543.560
14.8.	543.864
15.8.	543.560
16.8.	543.864
17.8.	544.068
18.8.	545.464
19.8.	544.830
20.8.	543.874
21.8.	543.874
22.8.	544.464
23.8.	544.830
24.8.	544.195
25.8.	544.830

Daily maximum and minimum temperatures were also measured at Ghinnir for a week and compared with the readings at base camp (Table 4). The drop in altitude (3000 ft.) caused a rise in mean maximum temperature of 4.7°C and in mean minimum temperature of 7.5°C . Rainfall for the week at base camp was 1.135 inches whereas there was hardly any rain at Ghinnir, five days being completely dry.

Table 4

Comparison of Temperatures at Base Camp and at Ghinnir
Daily Temperature Readings in °C

<u>Base Camp (9,500 ft.)</u>			<u>Ghinnir (6,500 ft.)</u>	
Date	Max.	Min.	Max.	Min.
14.8.62	24.5	8.5	29.0	13.5
15.8.	20.0	7.0	29.0	14.0
16.8.	21.5	9.5	24.0	14.0
17.8.	23.0	9.5	26.5	13.0
18.8.	23.0	2.5	27.0	13.0
19.8.	24.5	3.5	29.5	12.5
20.8.	24.0	-1.0	18.5	11.5
Mean	22.9	5.6	27.6	13.1

ARCHAEOLOGY

(E.J. Herbert)

Goba

Arab slavery expeditions in the period A.D. 1100-1200 developed into conquest and by 1285 Bale was established as a Moslem state (Trimmingham, 1952). Amhara influence in the province was first felt during the reign of Amda Syon I, 1314-44 when Bale was forced to pay tribute to the king. Further Amhara expansion in the reign of Zar'a Yakob (1434-68) led to the annexation of Bale. However, the Moslems recaptured the province during the reign of Lebna Dengel (1508-40) when

an Ethiopian army led by the governor of Bale was defeated in 1527 by fanatical Somali troops under the leadership of Imam Ahmad ibn Ibrahim al Ghazi (Gran). This period was also a time of upheaval for the pagan Galla, who uprooted by the expanding Afar and Somali tribes, began to migrate into the highlands. Taking advantage of the vacuum left by the exhausting conflict between Christians and Moslems, the Galla overran a third of the Empire, including Bale, from about 1531-1533. The incursions of Galawdewos in 1545, after his defeat of the Wajir Abbas, established a token Amhara administration in Bale, but further waves of nomadic tribesmen in 1545-47 reasserted Galla superiority in the area. Bale remained a Galla stronghold for four centuries and although Sarsa-Dengel (1563-97) partially subdued the Southern provinces, it was not until the campaigns of the great Menelik II in 1890-93 that Bale was fully re-occupied (Doresse, 1959).

Very little archaeological work has been reported from Bale and almost nothing is known of the people who lived there before 1100. Dr. Brumpt, the naturalist of the Du Bourg de Bozas trans-Africa expedition in 1901, brought back some stone implements found on open-station sites in the area, including a neolithic tranchet from Goba. These implements were later described by Kelley and Breuil (1936). Apart from this French account, we could find no other archaeological records relating to Bale and it was therefore of importance to note any features of interest, such as earthworks and caves, in the field area.

Many Christian rock-hewn churches have been reported from northern Ethiopia (Buxton, 1949) but none have been described from the Southern provinces, although F. Graziosi has recently been examining some natural caves near Harar. The discovery of some thirty-five rock-hewn shelters in the Micha gorge by the expedition was therefore of considerable interest. Unfortunately, the caves had little or no floor deposit and no dating was possible. Local tradition asserts that the shelters had some religious significance in ancient times. Some of the shelters were well hidden and were found only with difficulty; it seems possible that they served as hiding places for Christians fleeing from the Moslem invaders. In this connection, it was noted that a farmer ploughing on Safagara hill (map 3), where there are earthworks, had uncovered some charcoal and pottery, and a Bible that quickly decayed on exposure to light. This evidence confirms the local belief that Safagara was the site of a Captic refuge village destroyed by Gran in the sixteenth century. The wide plains north of Goba offer no cover for refugees and the Micha gorge would provide suitable protection without venturing into the desolate mountain tracts. During the 1961 expedition to Turkey, Herbert, Hamilton and G. Hadin carried out some mapping work at Göreme in central Anatolia, where a similar situation arose in which Christians fleeing from the Moslems excavated rock-hewn shelters in the volcanic ash.

Several natural shelters were found in the Togona valley but these were of little interest. One cave, near the bridge by the new school, had suffered a roof collapse about twenty years ago and contained many

animals' bones, probably dragged in by hyaenas. A large natural cave was also found near the Ghiorghis bridge but it was wet and unlikely to have been inhabited. The location of each of the rock-hewn groups of caves is shown in Fig. 4 and a brief description is given below.

Group 1: Two scooped-out hollows and four caves, two of which are connected, on the east bank of the Micha (not west bank as marked in Fig. 4) about six feet above present river level. Pick marks on the walls corresponded with marks on quarried rock above the caves and the caves seem to have been recently excavated or enlarged.

Group 2: Four large shelters on the east bank near ford and mineral spring. Now used as cattle stables. The shelters were enlarged by the Italians but the original excavations were apparently much older. On the opposite bank is a tunnel called Abo (Father) Cave, cut into a layer of weathered volcanic ash.

Group 3: One natural cave and one man-made tunnel, 25 ft. long, near top of cliff on west bank. Dirt floor with recent pottery and bone.

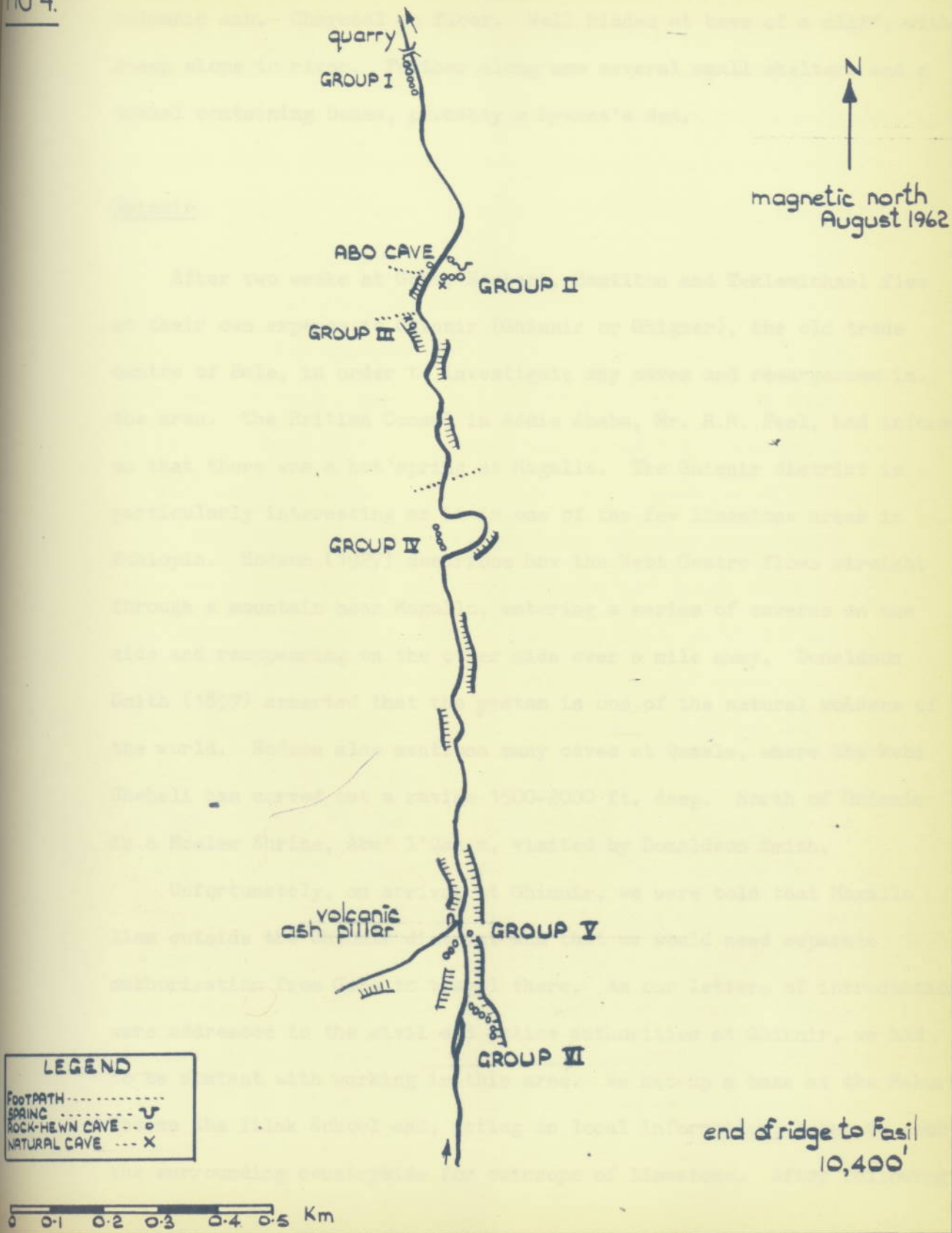
Group 4: A series of shelters on U-bend of river. Cells, pillars and chambers with shelves and ledges cut into the walls. Sterile dust floor (1").

Group 5: Three small shelters, twenty feet above the water level, well hidden at the bottom of gorge. Roofs blackened by soot deposits. Rock engravings, mostly imperfect circles and ovals. Organic matter on floor. On opposite bank are several partially hewn hollows.

Group 6: A group of five cells connected by a tunnel at the rear. This is the most interesting system. Steps and handholds are cut into the

SKETCH MAP OF CAVES IN THE MICHA VALLEY

FIG 4.



volcanic ash. Charcoal on floor. Well hidden at base of a cliff, with steep slope to river. Further along are several small shelters and a tunnel containing bones, probably a hyaena's den.

Ghinnir

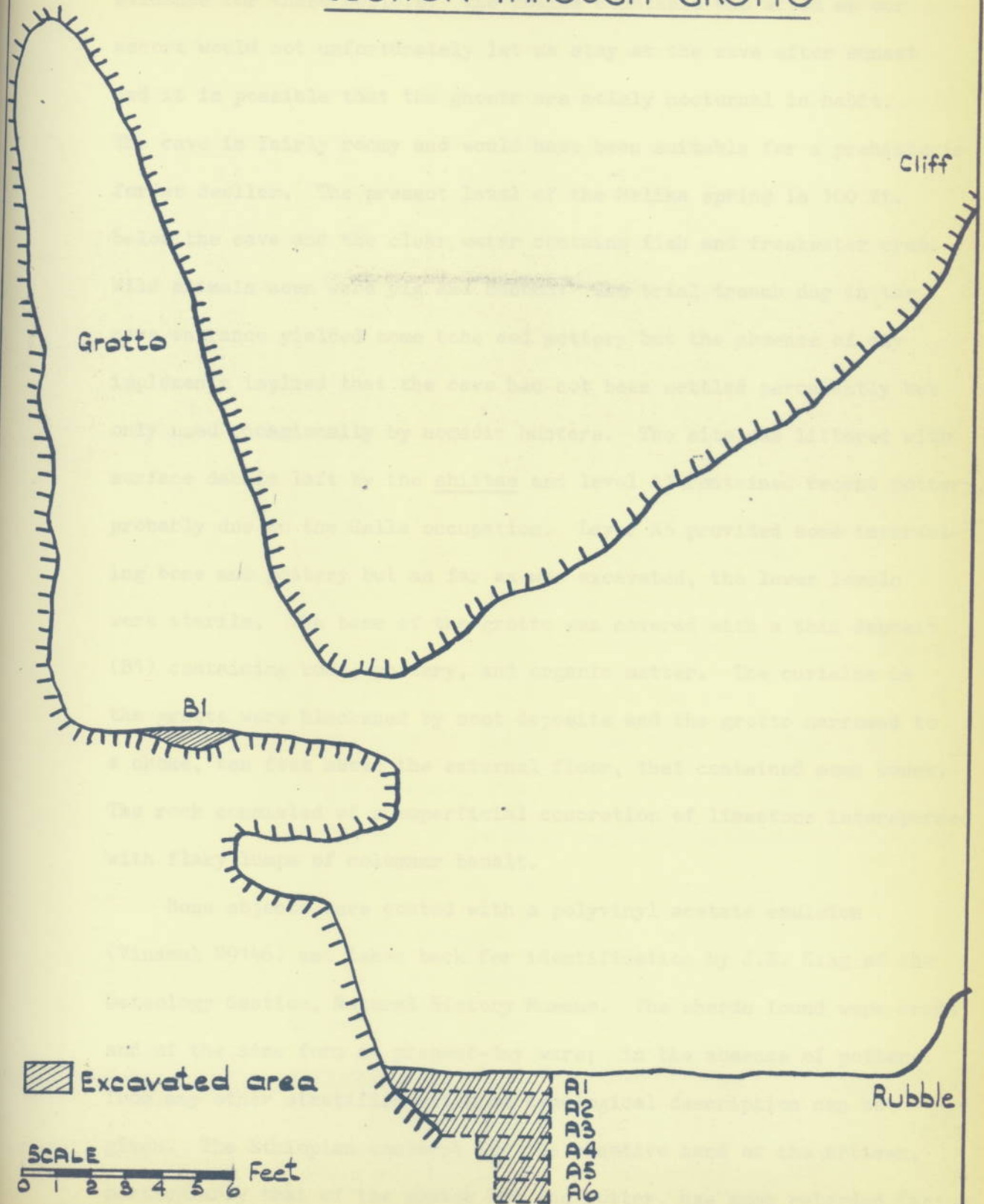
After two weeks at Goba, Herbert, Hamilton and Teklemichael flew at their own expense to Ghinnir (Ghinnir or Ghigner), the old trade centre of Bale, in order to investigate any caves and resurgences in the area. The British Consul in Addis Ababa, Mr. R.M. Peel, had informed us that there was a hot spring at Magallo. The Ghinnir district is particularly interesting as it is one of the few limestone areas in Ethiopia. Hodson (1927) describes how the Webi Gestro flows straight through a mountain near Magallo, entering a series of caverns on one side and reappearing on the other side over a mile away. Donaldson Smith (1897) asserted that the system is one of the natural wonders of the world. Hodson also mentions many caves at Qamale, where the Webi Shebeli has carved out a ravine 1500-2000 ft. deep. North of Ghinnir is a Moslem Shrine, Abu' l'Qasim, visited by Donaldson Smith.

Unfortunately, on arrival at Ghinnir, we were told that Magallo lies outside the Ghinnir district and that we would need separate authorisation from Goba to travel there. As our letters of introduction were addressed to the civil and police authorities at Ghinnir, we had to be content with working in this area. We set up a base at the Mekuria Tesema Aba Yilak School and, acting on local information, began to comb the surrounding countryside for outcrops of limestone. After following

several false trails, including examination of a spring that was only physiologically hot, we located a suitable cave. This was situated near the Melika spring in the Berberi lowland area and was reached by a woodcutter's path branching off eastwards from the main track to Al Kayre (El Kere), about two miles from Ghinnir just before the track descends the escarpment. The police had found this cave four months earlier and had captured nine bandits there; five of the band were still at large. The cave was situated at 5,600 ft. in thorn scrub and was difficult to find. Once we had blazed a direct route to the cave, it took us about 75 minutes march from Ghinnir to reach it. According to the farmer on whose property it lies, the cave is called Robae Cave after a previous owner of the land. An alternative explanation given by a policeman at Ghinnir prison is that Robae was a shifta who used the cave as a hideout. Formerly there existed a village on the plateau above the cave but the site is now overgrown. The cave was used by refugees during the Italian occupation and is now periodically used as a shelter by the local Galla in the rains ('Robae' can mean 'rain'). It is of no spelaeological interest.

In view of the inaccessibility of the cave and the fact that no professional archaeologist was working in this region, it seemed worthwhile to dig a small trench under the overhang (Fig. 5). This would still leave a large area of undisturbed material. Besides Robae Cave, there were four other small caves in the cliff, which measured over 210 ft. at its base. Local tradition asserts that the ghosts of the dead villagers, guarded by a devil and a big snake, live in the cave. However, careful examination of the cave yielded no

FIG. 5 ROBÆE CAVE, GHINNIR
SECTION THROUGH GROTTO



evidence for these beliefs. The police constable who acted as our escort would not unfortunately let us stay at the cave after sunset and it is possible that the ghosts are solely nocturnal in habit. The cave is fairly roomy and would have been suitable for a prehistoric forest dweller. The present level of the Melika spring is 100 ft. below the cave and the clear water contains fish and freshwater crab. Wild animals seen were pig and baboon. The trial trench dug in the cave entrance yielded some bone and pottery but the absence of any implements implied that the cave had not been settled permanently but only used occasionally by nomadic hunters. The site was littered with surface debris left by the shiftas and level A1 contained recent pottery, probably due to the Galla occupation. Layer A3 provided some interesting bone and pottery but as far as was excavated, the lower levels were sterile. The base of the grotto was covered with a thin deposit (B1) containing bone, pottery, and organic matter. The curtains in the grotto were blackened by soot deposits and the grotto narrowed to a choke, ten feet above the external floor, that contained some bones. The rock consisted of a superficial concretion of limestone interspersed with flaky lumps of columnar basalt.

Bone objects were coated with a polyvinyl acetate emulsion (Vinamul N9146) and taken back for identification by J.E. King of the Osteology Section, Natural History Museum. The sherds found were crude and of the same form as present-day ware; in the absence of pottery from any other stratified sites no typological description can be given. The Ethiopian contempt for the creative hand of the artisan, particularly that of the weaver and the potter, has much retarded the

development of local crafts. In conclusion, it can be said that the cave offered evidence of fairly recent nomadic occupation but no permanent settlement. The floor was excavated to 'natural' at the base of the grotto but the outside trench showed the deposits to be of considerable depth and only $3\frac{1}{2}$ ft. was removed. I should like to thank Dr. E. Anati for a very helpful discussion on the recording of cave drawings at the Institute of Archaeology before the expedition left.

Description of Layers

Trench A (4' x 4')

Surface: poles, charcoal, cattle and chicken bones.

A1: grey, 0-6". Basalt chips; sherd, hand-made gritty brown ware, roughly burnished on outside; charcoal.

A2: grey, 6-12". Wood, charcoal, nut shells.

A3: brown, 12-18". Basalt chips; base sherd from a bowl, coarse-grained, grit core, dark bulb-brown ware, irregularly fired in an oxidising atmosphere, roughly burnished; wood; charcoal; scapula and radius of hydrax (Procavia sp? shoana); gnawed ulna and femur fragments and juvenile tibia of ox (Bos sp).

A4: brown, 18-24". Sterile.

A5: dark brown, 26-34". Sterile.

A6: dark brown, 34-40". Sterile, basalt chips.

Trench B (2' x 2')

Surface: wood, charcoal, bones of ox, remains of crab, beetle,
and butterfly.

B1: grey, 0-5". Sherd of crude brown ware with gritty
core, roughly burnished; fragment of baboon tibia
(Papio sp? hamadryas).

Note: on Mount Entoto near Addis Ababa, several obsidian flakes were
found; apparently these are still used as razor-blades.

BOTANY

(E.J. Herbert)

At the request of the Director of the Royal Botanic Gardens,
Kew, a collection of flowering plants was made in our field area.
Some seventy species, many of them of typically temperate genera,
were collected and a partial list of determinations is given below.
The Kew workers state that the collection is a useful contribution
to their knowledge of the flora of Ethiopia. It did not provide
anything spectacular in the way of new botanical finds; surprisingly
the endemism does not seem to be very high and extensions of range
rather than outright new discoveries are likely to be the main result
from collections made there. The reader is referred to three recent
publications (Smeds, 1959; Werdecker, 1962; Mooney, 1963) for a
more authoritative botanical description of the area than can be
given here. The present collection is useful as no previous party

had collected in the 'wet' season. A copy of the list of determinations has been sent to Professor G. Cufodontis at Vienna.

Determinations (H 985/63)

June, 1964

- 6 Swertia sp.
- 7 Trifolium burchellianum Ser. ssp. johnstonii (Oliv.) Cufod.
- 12 Hypericum peplidifolium A. Rich.
- 13 Lobelia scebelii Chiov.
- 14 Craterostigma pumilus Hochst.
- 15 Cyanotis barbata D. Don.
- 16 Crepis rueppellii Sch. Bip.
- 18 Anagallis serpens Hochst. ex DC. ssp. serpens
- 19 ?Cynoglossum cf. C. coeruleum Hochst. ex DC.
- 20 Geranium arabicum Forsk.
- 21 Cerastium octandrum T.C.E. Fries et Weimarck
- 23 Lotus goetzei Harms
- 24 Delphinium wellbyi Hemsl.
- 27 Swertia schimperii Grisel.
- 29 Duplicate of 19.
- 30 Hebenstretia dentata L.
- 31 Epilobium stereophyllum Fresen var. stereophyllum
- 36 Duplicate of 16.
- 37 Duplicate of 15.
- 38 Cynoglossum? densifoliatum Chiov. or? coeruleum Hochst. ex DC.
- 41 Duplicate of 19.
- 42 Trifolium simense Fresen.
- 44 Convolvulus kilimandshari Engl.

- 45 Verbascum ternacha Hochst. ex A. Rich.
- 48 Duplicate of 23.
- 49 Solanum migrum L., sensu lato
- 56 Cerastium octandrum Hochst. ex A. Rich.
- 57 Duplicate of 18.
- 58 Romulea campanuloides Harms.
- 59 Trifolium burchellianum Ser. ssp. johnstonii (Oliv.) Cufod.
var. oblongum Gillett.
- 65 Swertia lugardae Bullock
- 66 Hebenstretia dentate L. galled
- 67 Viola abyssimia Streud. ex Oliv. x V. eminii Engl. in part
almost pure V. abyssimia
- 69 Petamenes latifolius N.E. Br.
- 75 Satyrium crassicaule Rendle
- 78 Trifolium calocephalum Fresen.
- 80 Silene sp. nr. macrosolen Streud. ex. A. Rich.
- 81 Juniperus procera Hochst. ex Endl.
- 82 Epilobium hirsutum L.
- 84 BCRAGINACEAE sp.
- 86 Anagallis arvensis L. ssp. arvensis.

Of particular interest was no. 24, Delphinium wellbyi Hemsl.
Plant material (1.17kg.) of this species, collected just before
flowering, was treated with boiling water at the base camp. The
aqueous extract was basified later in the laboratory and extracted
with chloroform. The plant material was further extracted with 2½%

acetic acid, basified, and extracted with chloroform. The two organic extracts were combined, dried over sodium sulphate, and evaporated. The crude basic fraction (3.5g, 0.3%) was shown to contain seven alkaloids by thin-layer chromatography on alumina G. Chloroform was used as the developing solvent and the spots were visualised by the modified Dragendorff reagent. The same seven alkaloids were present in the seeds of the delphinium. None of the alkaloids had the same R_f values as the alkaloids from the British hybrid D. elatum L., or as lycoctonine, obtained by hydrolysis of methyl-lycaconitine, found in British, Canadian and Russian species. This finding is of interest in that it supports the idea that the structures of the complex delphinium alkaloids could be used as the basis for a chemical taxonomy of this genus. Examination of various delphinium species has already established that the alkaloids contain the same carbon skeleton but that the peripheral groups vary. The biogenesis of delpheline in D. elatum is currently being studied at Imperial College.

ZOOLOGY

a) P.M. Barrer

Collections were made from two areas - Goba (07°01'N, 39°59'E, 9,500ft.) and Dallo (06°21'N, 39°47'E, 7,000ft.). These two areas, although not far apart (approx. 50 miles) represented two very different habitats. (See pages on Goba and Dallo). Unfortunately, in the short time available, 3 weeks at Goba and one week at Dallo, it was not

possible to make a representative collection from the two areas. The specimens taken during that period were however of some interest.

Goba

MAMMALIA

Insectivores Two species of Crocidura were taken, one fairly small, and another considerably larger. It has not been possible to identify these to species level in the present state of shrew taxonomy.

Primates Both the Abyssinian guereza, Colobus polykomos abyssinicus and a baboon were common in the foothills. No baboons were actually identified from this area, but they may well have been Papio doguera.

Carnivores The spotted hyena Crocuta crocuta could be heard at night, but was very shy and probably not common in the area. The serval, Leptailurus serval could be found at this altitude as well as a smaller cat, probably Felis lybica ocreata, surprisingly close to the town.

Rodents The white-footed mouse, Rattus (Fraomys) albipes, and the brush-furred mouse Lophuromys flavopunctatus were commonly caught in box traps at 9,000ft. in the foothills. A very small and dainty Mus sp. was taken in and around the native houses. The mole rat Tachyoryctes splendens was common in the more open areas, together with an actively burrowing species superficially similar

to the prairie dog in habits, and probably Arvicanthis abyssinicus. Traces of porcupines were found in caves. Thus in Goba the mammalian fauna was fairly sparse. Surprisingly no bats were seen, and only rarely any antelope. The relatively small number of species, all of a hardy nature, suggests the importance of altitude in faunal colonisation after the last ice age.

ARTHROPODA

Insecta A collection of Coccids was made from the Goba area. The African Coccids are not well known, the area best studied being that of South Africa. Five species were taken here, of which two species of Sclopetaspis are probably new. The only other species, probably from the genus Coccus but showing a number of characters in the males midway between Coccus and Pulvinaria is of considerable interest. This may eventually prove to be a new genus. Also one species of Spilococcus and one of Euripersia were taken. As yet it has not been possible to identify any of the specimens to species level. They are at present in the care of Dr. K. Boratynsk of the Imperial College Zoology Department.

Spiders A collection of spiders was made both from Goba and from Dallo. These were presented to the British Museum (Natural History) and are at present in the hands of Mr. Clark of the Arachnid Department. They have not as yet been identified.

PULMONATES

These did not appear to be common, but a number of specimens of Vitrinid pulmonates were found in both areas. This is an interesting family of snails, their thin shells partly covered by the mantle and probably somewhere along the line of evolution to the Limacid slugs.

Dallo

MAMMALIA

Bats A specimen of Rhinolophus hophosideros minimus a subspecies of the European Lesser Horseshoe Bat, was caught in flight around the native houses. This was an interesting capture as the subspecies is mainly a Mediterranean and Middle East one which has not been recorded further south than Eritrea. It has certainly not been listed for Kenya.

Primates Papio doguera, the anubis baboon mentioned in the list from Goba, was common in this area. It is an East and Tropical African species and is quite distinct from the sacred or hamadryas baboon and the gelada baboon, both of Ethiopia. Specimens of the Abyssinian ljuereza and also the green guerion Cercopithecus aethiops hilgert were also common.

Carnivores A specimen of the spotted hyena, Crocuta crocuta was obtained, together with two black-backed jackals (Canis mesomelas schmidti) which must have been from very near the northern limit

of distribution of this species, typically an East African animal.

Artiodactyla A skin of Gnetheis Dik-dik, Rhynchotragus guentheri was given to us. Apparently this animal was not common locally. Traces of wild pig were also found in the area.

Rodentia A single specimen of the same Mus species mentioned in the list from Goba was found, together with what were probably Rattus (Mastomys) natalensis and Rattus (Praomys) albipes. A species of porcupine was also observed.

The Mammalian collection as a whole is of interest in demonstrating that the region of south Ethiopia is one where typically Ethiopian highland forms, such as the white-footed mouse, the brush-furred mouse, the guereza as well as more northern species such as the lesser horseshoe bat, meet typically East African forms such as the anubis baboon, the spotted hyena and the blackbacked jackal. The collection is lodged at the British Museum (Natural History).

Thanks are due to:

Dr. H. Gorvett - Department of Zoology, Imperial College.

Dr. K. Boratynsk " " " " " "

Dr. G.E. Corbet - Mammal Section, British Museum (Nat. Hist.)

Mr. R.W. Hayman " " " " " "

Mr. Clark - Arachnid Section, British Museum (Nat. Hist.)

ZOOLOGY

b) C.F. Hinks

Reptiles

While no special effort was made to collect snakes and lizards, whenever specimens were found whilst collecting insects, they were captured if possible and preserved in alcohol.

Surprisingly the reptile fauna in both Goba and Dallo was quite sparse; for snakes this was particularly true, none were found at Goba and to the knowledge of the natives they did not seem to live there. Two small specimens were found during our week's visit to Dallo, while held to be venomous by the local inhabitants I have been unable to find any evidence of venom conducting fangs or poison glands.

Of the lizards collected, agamids were taken at Goba, and skinks, lacertids and chameleons at both Goba and Dallo.

Amphibia

Frogs and toads were particularly abundant at Goba; the high rainfall supports them not only in the streams and marshes but also in almost any pockets of water and in the trees; tree frogs are common and at least 6 species were collected. Both these and the reptiles have yet to be identified.

Coleoptera

Most effort was directed towards a collection of beetles, principally for comparison with the collection of Hugh Scott, from his

1927 and 1949 expeditions. In both he collected from the mountain tops in Southern Ethiopia, and in his report published in the Transactions of the Linnean Society (Scott, 1952) he noted the paucity of species but was able to show their relationship to the N. temperate and S. African faunas. As his collecting was confined to altitudes above 10,000ft. and nothing was known of the beetle fauna below this, it was hoped that the collection made would provide some additional information as to the geographical distribution and relationships in this unique part of Africa.

4 weeks were spent in collecting around Goba, 9,500ft. and 1 week at Dallo, 7,000ft. In addition a day's excursion from Addis Ababa afforded a small collection from the Blue Nile gorge at about 7,000ft. It is unfortunate that the latter region could have such little attention, for the beetles collected differed markedly from those of the other 2 areas. This may have been due to the chalk substrate; for it was here that the only scorpion that we collected in Ethiopia were found. Also we collected some Paussids in one of the numerous ant nests to be found beneath the loose stones. Heavily armoured burrowing Cassids and weevils were also plentiful.

It is difficult to compare quantitatively the numbers of species from the three regions due to the disparity in the time spent collecting in them but one would certainly have the impression that there were far more at the lower levels of the Blue Nile gorge than at either Goba or Dallo. While more species were collected at Goba far more time was spent there and undoubtedly the collection made towards the end of the dry season at Dallo was hardly representative.

What was immediately noticeable was the difference in size between species in the same family from Goba, as compared with Dallo; those from the latter were in all cases larger. Coccinelidae, Carabidae, Curculionidae Chryromelidae, Staphylinidae, Cantharidae Tenebrionidae Bupresidae and Scarabaeidae were common to both. The Carabids found at Goba were all small and comprised but few species, many more were found at Dallo and large specimens of the genus Anthia were plentiful beneath rocks along the river bank. In general, it may be said that those specimens collected from the sub-tropical region of Dallo were typical of the South African fauna whilst those from Goba more closely resembled the temperate European fauna.

ROCK MAGNETISM

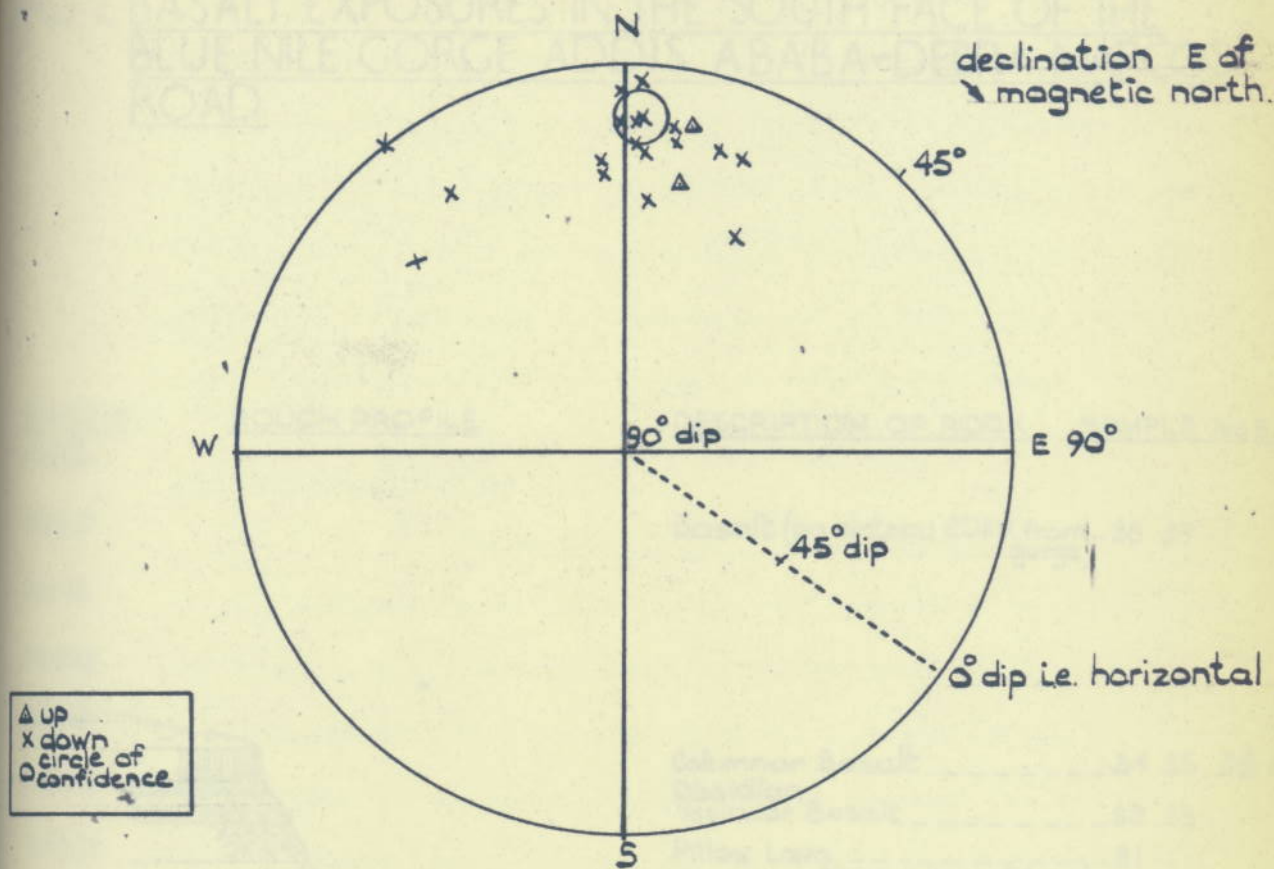
(R.L. Grasty)

The direction of the weak natural magnetism "fossilized" in ancient rocks tells geophysicists something about the past history of the Earth's magnetic field and also indicates past movements of land masses on the Earth's surface. The methods employing rock magnetism are a means of correlation and depend only on the need to demonstrate magnetic stability and to show that magnetic directions are characteristic of a particular age of formation. Palaeomagnetic results have been used to support hypotheses regarding possible polar migration and continental drift.

Although rock magnetism results have been recorded from the Aden and Kenya volcanics, no rock specimens have been examined from the intermediate series in Ethiopia. Accordingly, in order to aid the Rock Magnetism Group at Imperial College to carry out preliminary investigation of this gap, the expedition collected rock specimens in Ethiopia. Twenty-one rock samples were collected from basalt exposures in the south face of the Blue Nile gorge on the Addis Ababa-Debra Marcos road (Fig. 7). The dip and declination results are expressed in Fig. 6. The average direction of the samples was found to be 3°E , 14°D (down) with a circle of confidence of 7° . The theoretical dipole field at this point is 19°D . This thus indicates a displacement northwards of $5 \pm 7^{\circ}$ for Africa since the basalts were laid down i.e. there has been no significant movement within the limits experimentally measurable. The eastwards movement implies that Africa has twisted anticlockwise (i.e. top to left in Fig. 6) by 3° but as the error is 7° , this value is again not significant. Assuming that the average direction of magnetic north has been along the axis of rotation of the Earth, Africa has not drifted with respect to the axis of rotation of the Earth by any significant amount. Various rock samples collected by the expedition from other sites in Ethiopia were unsatisfactory for determining a pole position for Africa in tertiary times as they had scattered directions.

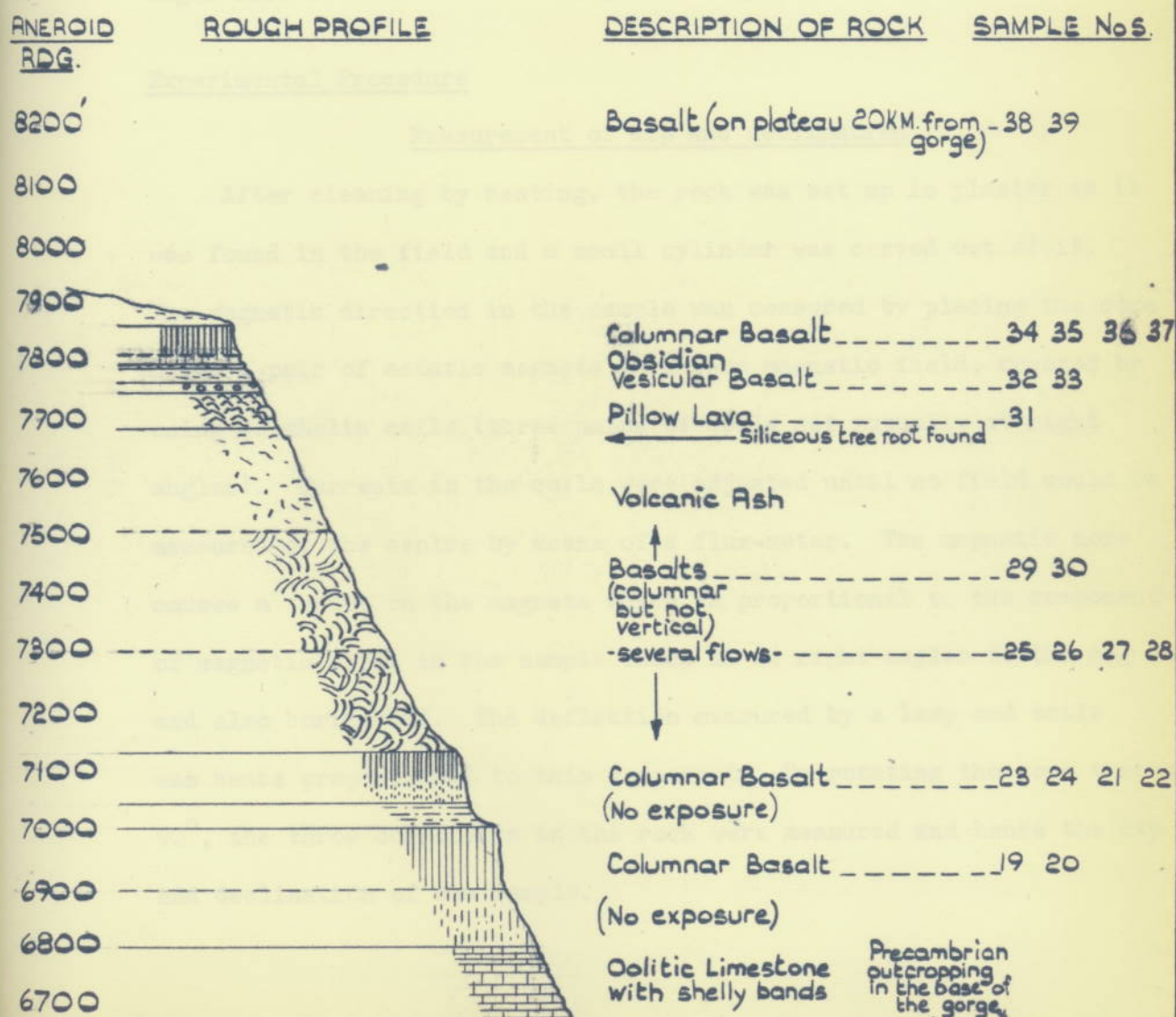
The age of the specimens from the Blue Nile gorge was determined by potassium-argon dating to be 48 ± 14 million years; it was not possible to distinguish between the ages of the successive flows.

FIG. 6. ROCK SAMPLES FROM THE BLUE NILE GORGE
DIP AND DECLINATION



No.	Altitude	Dip	EMN	No.	Altitude	Dip	EMN
19	6950'	36°D	28°E	29	7500'	14°D	10°E
20	6950'	15°D	9°E	30	7500'	19°D	326°E
21	7100'	27°U	12°E	31	7700'	4°D	3°E
22	7100'	14°U	12°E	32	7750'	13°D	2°E
23	7100'	6°D	0°E	33	7750'	12°D	0°E
24	7100'	32°D	6°E	34	7850'	13°D	3°E
25	7300'	17°D	22°E	35	7850'	25°D	356°E
26	7300'	17°D	-18°E	36	7850'	20°D	4°E
27	7300'	18°D	3°E	37	7850'	22°D	356°E
28	7300'	25°D	313°E	38	8200'	0°D	322°E

FIG. 7. BASALT EXPOSURES IN THE SOUTH FACE OF THE BLUE NILE GORGE ADDIS ABABA-DEBRA MARCOS ROAD.



Orientated rock samples for the Imperial College rock magnetism group.

This method of dating depends on the fact that there is a known ratio of radioactive K^{40} to the stable isotope K^{39} in all rocks. The K^{40} decays in two ways: to Ca^{40} , and to A^{40} by K-electron capture. These decay constants are known and hence if the amount of argon trapped in a rock and the potassium content of the rock can be measured, the length of the decay period can be calculated. In the case of basalts, the decay begins when the lava was extruded and solidified. The percentage of potassium in basalts is low and hence the amount of argon liberated is small and requires very careful measurement.

Experimental Procedure

Measurement of dip and declination

After cleaning by heating, the rock was set up in plaster as it was found in the field and a small cylinder was carved out of it. The magnetic direction in the sample was measured by placing the core under a pair of astatic magnets in a zero magnetic field, created by using Helmholtz coils (three pairs of coils set mutually at right angles). Currents in the coils were adjusted until no field could be measured at the centre by means of a flux-meter. The magnetic core causes a torque on the magnets which is proportional to the component of magnetic field in the sample which is at right angles to the magnets and also horizontal. The deflection measured by a lamp and scale was hence proportional to this component. By rotating the core through 90° , the three components in the rock were measured and hence the dip and declination of the sample.

Potassium-argon dating

The rock was broken into small chips and a portion (ca. 5g.) was used for the argon measurement. The rock was placed in a water-cooled chamber in a molybdenum crucible. The gases in the rock were liberated by induced radiofrequency heating to fusion. Water vapour and carbon dioxide were condensed using a liquid nitrogen U-tube. Nitrogen was removed by adsorption on a red-hot titanium sponge. Hydrogen and argon were adsorbed on charcoal at liquid nitrogen temperature and as the hydrogen has a much higher vapour pressure it was pumped off, leaving the inert gas.

A known volume of argon enriched with A^{38} was added to the radiogenic argon and the gas mixture was let through a slow leak into the mass spectrometer which was kept evacuated. The gas leaked out exponentially and the peak heights dropped in the same way when the magnetic field scanned the mass ranges A^{36} , A^{38} and A^{40} . The peak heights for the different isotopes were measured and punched out on computer tape to a set programme, together with the potassium data. The age of the rock together with the atmospheric contamination was given by the computer. The potassium was measured by powdering the rock and dissolving a portion (ca. 0.5g.) in hydrofluoric acid. The heavy metals were precipitated out and the solution fed to a flame photometer, giving the percentage of potassium by comparison with a standard. The dating was performed by Dr. J.A. Miller, who first used this method for dating the Deccan Traps of India, at Cambridge.

MEMBERS OF THE EXPEDITION

2. J. Forester, B.Sc., A.R.C.S., age 21. Devonport, Dorset, and organic chemist. Ph.D. at Imperial College in 1964 and now at University of West Indies in Jamaica.

3. Innes, Robert A.R.C.S., age 21. Sheffield. Geologist and meteorologist. Now working for I.C. at Nalwood Park.

P A R T I I

4. A. Williams, B.Sc., A.R.C.S., age 21. Cambridge Wells. Transport officer and meteorologist.

GENERAL DESCRIPTION

2.5. Hurst, age 20. Bristol. Zoologist. Now working for I.C. in Zoology Department, Imperial College.

2.6. Hamilton, age 23. Devonport. Mathematic and physicist. After a period in British Columbia, now working in New Zealand on the Maniapouri Hydro-electric project.

2.7. Hinko, age 23. Devonport. Zoologist. Now working for I.C. in Zoology Department, Imperial College.

2.8. G. Howarth, age 20. Flaxstead, near St. Albans. Zoologist. Now taking degree in Geology at Leicester.

2.9. Tachemichael, age 21. Addis Ababa and University College of Addis Ababa. Interpreter and biologist.

MEMBERS OF THE EXPEDITION

E.J. Herbert, B.Sc., A.R.C.S., age 21. Coventry. Leader and organic chemist. Ph.D. at Imperial College in 1964 and now at University of West Indies in Jamaica.

I. Cutram, B.Sc., A.R.C.S., age 21. Sheffield. Zoologist and meteorologist. Now working for Ph.D. at Silwood Park.

A.R. Williams, B.Sc., A.R.S.M., age 21. Tunbridge Wells. Transport officer and metallurgist. Now in Nigeria.

P.M. Barrer, age 20. Bromley. Zoologist. Now working for Ph.D. in Zoology Department, Imperial College.

R.M. Hamilton, age 23. Sevenoaks. Mechanic and surveyor. After a period in British Columbia, now working in New Zealand on the Manipori Hydro-electric project.

C.F. Hinks, age 23. Penzance. Zoologist. Now working for Ph.D. in Zoology Department, Imperial College.

W.T.C. Sowerbutts, age 20. Flamstead, near St. Albans. Pedologist. Now taking degree in Geology at Leicester.

N. Teklemichael, age 21. Asmara and University College of Addis Ababa. Interpreter and biologist.

OUTWARD JOURNEY

(F.M. Barrer)

The expedition left London on June 25th, 1962, after a press reception organised by Burberrys Limited of the Haymarket. Our vehicle, a 30 cwt. ex-army Bedford truck (Plate I), took us somewhat less than sedately to Dover, where we caught the midnight car-ferry to Ostend. Apart from minor short-cuts, we followed the A.A. recommended route along the E5 through Belgium, Germany, Austria, Yugoslavia, Bulgaria, and Turkey. This is the most direct route to the Near East but not the most interesting. A puncture occurred on the Austro/Jugoslav frontier, the first in a series of mishaps that was to bring the truck home crippled.

The first thousand miles were over asphalt roads and it was not until Bulgaria that we encountered a bad stretch of unmetalled, pot-holed road shortly before the Turkish frontier. We stopped in Istanbul long enough to see one of the most infamous streets in eastern Europe and then crossed the Bosphorus into Asia. As we climbed into the Taurus mountains the scenery changed from the arid summer aspect of the Anatolian Plateau to the pleasing greenery of coniferous forests and mountain pastures.

Back again on the plains, the desert began to take real form, with little but vast areas of hard-baked clay and small xerophytic plants sheltering from the glare of the sun in the shadow of rocks and boulders. In northern Syria, we were fortunate to be stopped by a police check; otherwise we would not have found out until much later

that we were on the wrong road to Damascus. We made good time through Syria into Jordan, the breeze of motion being far more comfortable than the still heat. The Desert Highway after Amman led through some remarkably rugged and impressive scenery to the Rift Valley and the Gulf of Akaba. We drove on past a collection of houses, expecting to see the large port of Akaba in the distance at any moment. We came to the phosphate docks; beyond this was only desert. Here was Akaba! The 3,150 mile journey had taken us ten and a half days.

In Akaba our troubles began in earnest. The only reasonable camping site was somewhat closer to the Saudi Arabian border than was desirable - when Saudi Arabian troops advanced and occupied 200 yards of Jordanian territory on the pretext of helping the Jordanians against the Israelis, the border became even closer. An average of only one cargo boat a day came in and few of them had the facilities or the desire to carry passengers. The Port Pilot, Captain Brown, was most unfriendly and abruptly informed us that he could not help us in any way. The daily pantomime of gaining access to the docks began to resemble a repetitive nightmare. A separate series of written permissions from various officials and agents was needed for each ship that came in. Sometimes it was necessary to evade the Dock Police and to slip on to the docks in order to see one of the shipping agents and get his written permission to ask permission to get on to the docks. The farce culminated in near-arrest of the transport officer for having too many passes and a justifiable argument with the Port Director.

After a frustrating wait of twelve days, a Dutch ship 'M.S. Silindoeng' docked. Her Captain was willing to take passengers. The sea passage via Jeddah took six days and we arrived in Djibouti on July 23rd. We caught the next passenger train to Addis Ababa along the line constructed with French capital early this century. The line totals 487 miles in length and runs across the Somali and Danakil Deserts, rising from sea level at Djibouti to 7,880 ft. in Addis Ababa (Map 1). As the train gained altitude, the sparse scrub with its characteristically African flat-topped acacias gave way to a denser undergrowth predominated by prickly pear and thorn bush. As we approached the Ethiopian capital the coolness, the rain, and the lush green grass made it difficult to believe we were less than 500 miles from the equator.

RETURN JOURNEY

We returned from Goba on Monday 27th August and began to make arrangements for the homeward journey.

The Forship Travel Agency knew of no ship leaving for Akaba until September 19th. There was, however, a French passenger ship due to leave Djibouti on September 2nd for Port Said. As no reservations in the third or fourth class could be made from Addis Ababa we decided to travel to Djibouti on the next train and try to make a booking at the port. After an uncomfortable night in a third class carriage we reached Dire Dawa and caught the evening

connection to Djibouti. The morning of September 1st saw us travelling through the barren brown scenery of French Somaliland. We arrived at the colonial port of Djibouti in a dust-storm. Having made enquiries at four ships in dock without success, we visited two shipping offices. Compagnie des Messageries Maritimes were able to offer only three third class and four tourist class places on 'La Bourdonnais' due in the next day. This was the sailing we had heard about in Addis Ababa. In order to get back to London in time for the start of the Autumn term, we reluctantly accepted this offer; it was more expensive than we could afford and we had hoped to travel deck class. Our baggage had arrived by freight train and we spent the night in the wagon in which it had arrived. After the coolness of the mountains, the hot and humid atmosphere of Djibouti seemed oppressive and we sweated continuously. We embarked on 'La Bourdonnais' next morning, portaging all our equipment ourselves (1,500 lbs.) and causing much jeering from the Somali porters. We had been told by the shipping agent that there would be no extra charge for baggage but towards the end of our five day stay on the ship, the chief steward demanded four pounds as registration fee for our eleven crates of equipment. After some discussion the fee was paid, since it seemed rather silly to allow the crates to sail to and fro between Marseilles and Mauritius for the next year or so. We arrived at Port Said late on September 6th and disembarked, the transport officer providing light entertainment by falling into the Suez Canal from the lighter carrying the equipment ashore.

After some tedious customs formalities we were allowed into the town, pushing a handcart loaded with our personal luggage. We slept on a convenient roundabout in the town centre, to the bewilderment of the Director of Tourism. The next day we embarked on the Greek ship 'C.S. Achilleus' bound for Beirut, again having trouble with the ship's officers over our heavy equipment and specimens and having to pay a further freight charge.

As soon as the ship docked at the Lebanese capital, three members of the expedition left by 'bus for Damascus, leaving the others to clear the crates through the customs. From Damascus they took a service taxi to Amman where they spent the night on a veranda and next day (September 9th) caught the 'bus to Akaba. They arrived back in Beirut early on September 13th with the truck, having been delayed by two punctures, visa trouble, and the necessity of renewing a full passport. The truck had been hired out in Jordan as a private arrangement to Mr. A.B. Reeves of Brown Engineers International Limited. It was used as a water carrier during construction work on a hotel site near the Israeli frontier until the authorities found out and tried to impose a fine on Mr. Reeves. The matter was cleared up when we returned to claim the vehicle and showed that it had not been sold. As the air filter was unaccountably removed considerable wear had occurred in the desert and the cost of repairs and increased oil consumption ate heavily into our net profit. A new tyre was bought in Amman and during the process of wheel changing, the thread was stripped off a wheel bolt.

At dusk on September 13th, after a frustrating delay due to a camera being stolen, we continued on the long way home. Small fires dotted the countryside along the coastal road to the frontier post of Arida, where we were told three of our Syrian visas had expired one transit ago. Fortunately we were able to buy new visas on the spot. We drove on well into the night and after a brief sleep on a stony beach motored on. The desert gave way to irrigated land which led in turn to the green forests of the mountain pass to Kassab, the Syro/Turkish frontier post. Turkish officials checked the engine and chassis number and disinfected the wheels. The performance of the Bedford on the steep road to Antakya was not good and ominous noises from the engine forced us to stop in Iskenderum to have a big end bearing remetalled. By midday on September 15th, the repairs had been completed and we camped that night in the Taurus Mountains, at the same place as on the outward journey. The next day we covered 460 miles in seventeen hours, stopping to collect more rock samples from a basalt layer near a Turkish castle. The sparking plugs had to be cleaned at frequent intervals.

We crossed the Bosphorus early on September 17th and found that it took twenty-four hours to obtain a visa from the Yugoslav Embassy in Istanbul so we decided to obtain our visas more expensively but more quickly at the border. We took the short route to Ipsala via Tekirdag, saving 95 miles on the Edirne route, but travelling over a rough unmetalled road in hot weather. This section was covered at too high a speed and at 9 p.m. the truck lurched to a halt shortly

after reaching Greece. We left a shredded back tyre by the roadside. At 11 p.m. another puncture caused camp for the night. Next morning the puncture was repaired, the tyre blown up, and we set off gently. Twelve miles before Comotini our spare tyre burst. Williams and Barrer hitch-hiked to the town to try and buy another tyre, whilst the others waited by the roadside. The vehicle was in an obstructive position and a rear lamp was hung on the offside at night to warn oncoming traffic.

Late next day the 'new' tyre and inner tube arrived and once more we were on the move. As darkness fell, the bumping of the rear offside wheel announced another puncture, this time probably due to a patch perishing from the heat. Our technique for mending punctures had now been brought down to a fine art. The rim was partially removed by backing the truck over the wheel, with a fifteen stone zoologist jumping up and down on the opposite side. Much banging with a mallet and prodding with levers completed the removal of the rim, a spare inner tube was inserted, and the wheel was replaced in record time. We were by now resigned to our fate and realised the Greek Gods were not with us.

After Thessalonika, it was found that a vulcanised patch on the same offending tyre had become badly torn and it seemed hardly possible that we would reach the next town to effect repairs. A proposal to abandon all the heavy crates, which were causing serious overloading on the rear tyres, was narrowly defeated. A thirty kilometre stretch of bad road lay ahead between the Yugoslav frontier

and Tito Veles. To our relief this section was covered without incident. Next day dawned wet and cloudy and having redistributed the weight in the back of the truck, we felt safer about the worn patch. In fact the weather remained cold for the rest of the journey home and the tyre held all the way. As the canvas on the truck was badly ripped it was, however, uncomfortable sitting in the back exposed to the wind and rain. In Belgrade we were fined five shillings for having only one headlamp working. Along the road to Zagreb and thence to Maribor we were stopped by the police several times for standing up in the back of the vehicle.

On September 22nd we crossed into Austria and gained a blissful night's sleep in a hay-barn. The next day being Sunday, we took things quietly, our only mishaps being driving on the wrong side of the road in Munich and later damaging two Volkswagens in a shunting accident, for which the expedition was fined eight shillings and elevenpence. Returning from the police station the Bedford ran out of petrol at the exact place of the accident. We pushed the truck across the road, got out one of the spare cans of petrol, and departed in haste. Early on September 25th we reached Ostend, where an architect treated us to a free lunch at the Ostend Palace Hotel. This gesture was much appreciated; since Port Said we had spent little more than five pounds from the expedition funds on food for seven people for nineteen days. We had lived mostly on the remains of our dehydrated food; we had had no alternative but to supplement this by fruit and sweet-corn borrowed from suitable fields.

The Channel crossing was uneventful. Bedford 1646 MM was the first vehicle to leave the Belgian car-ferry 'Artevelde'. As she accelerated up the gangway on to English soil, a dense cloud of oil fumes hovered in her wake. Four weeks later she was sold as scrap for eight pounds.

FOOD

About 500 lbs. of food, including 145 lbs. of dehydrated provisions, were taken on the expedition. Owing to the generosity of food firms in England the cost of this was only £46.14.4. Food bought locally en route amounted to £51.7.10d. and thus the total cost of food for 571 man days was £98.2.2d. or less than four shillings per man per day. However, on 'La Bourdonnais' and 'Silindoeng' (an extra 70 man days) our meagre diet was alleviated by some really excellent meals, the cost of which was included in the passage fare. On the homeward journey expedition funds were insufficient to provide adequate meals and any food bought locally had to be paid for by the individual concerned. A list of food taken is given below; in addition, the report of the second Reading University expedition to Ethiopia gives some useful food notes (Thomas, 1964).

Dehydrated Field Provisions

				<u>Notes</u>
Dried peas	2 bags	12 lbs.	Springlow	
Instant pie filling	28 pkts.	28 lbs.	Springlow	
Dinah Soup Mix	28 pkts.	28 lbs.	Springlow	
Mixed vegetables	3 bags	12 lbs.	Springlow	Tasteless
Diced potato	1 sack	40 lbs.	Springlow	
Dried meat	14 pkts.	7 lbs.	Irish Sugar Co.	Insufficient
Dried egg powder	1 bag	18 lbs.		Expensive

Tinned Food

Fruit salad	12 tins	23 lbs.	Batchelors
Spaghetti in sauce	48 tins	84 lbs.	Springlow
Corned beef	16 tins	12 lbs.	Fray Bentos

Beverages

Milk powder	36 tins	=216 pts.	Cow & Gate	V. useful
Tea	15 tins	15 lbs.	Liptons	Essential
Instant coffee	27 tins	3 lbs.	Nescafe	
Horlicks	24 tins		Horlicks	oo much
Tango fruit juice	144 tins		Beecham	

Emergency Field Rations

Horlicks tablets	18 pkts.	1 lb.	Horlicks	
Glucodin	24 tins	24 lbs.	Glaxo	Filler only
Kendal mint cake	144 bars		Romney	
Ascorbic acid tablets		7 tins	Vitamins Ltd.	Vitamin C
Befortiss complex	7 boxes		Vitamins Ltd.	Vitamin B
Sultanas	1 box			
Barley sugar		2 lbs.	J. Pascall Ltd.	

Sundries

	Quantity	Weight	Brand	Notes
Marmalade	1 jar	2 lbs.	Chivers	
Jam	1 jar	2 lbs.	Chivers	
Marmite	7 tins	2 lbs.	Marmite	
Salt	8 tins	12 lbs.	Cerebos	V. useful
Biscuits	3 tins		Carr	Expensive
Ryvita	24 tins	24 lbs.	Ryvita	
Ctameal blocks	16 tins	10 lbs.		Delicious
Sugar	70 tins	70 lbs.	Tate & Lyle	V. useful
Margarine	54 tins	27 lbs.	Van den Berghs	V. useful
Oxo cubes	1 gross		Oxo	

Food at Goba was very cheap. Meat and fruit were readily available at the markets. Our month's stay cost us 14s. 3d. for local food; this included a chicken two or three times a week. Table 5 compares food costs in Goba and Ghinnir - five cents are taken as three halfpence.

MEDICAL FINDINGS

Members of the expedition were vaccinated against smallpox, cholera, typhoid, tetanus, typhus, and yellow fever. With the exception of yellow fever vaccination, only national health charges should be payable if arrangements are made with a general practitioner. Vaccination against yellow fever can be performed at Yellow Fever Clinic No. 3, 33 Great Brunswick Street.

Table 5
Food Prices in Goba and Ghinnir

<u>Item</u>	<u>Goba</u>	<u>Ghinnir</u>
Sheep	6s.	-
Chicken	9d.	-
Sugar (Kilo)	1s.10d.	1s.2d.
Omlette	4½d.	-
T'ej	3½d.	3d.
Birth	3½d.	3d.
T'alla	2d.	1½d.
Injera	2d.	¾d.
Corn cob	1d.	1½d.
Banana	½d.	¼d.
Milk (Pint)	free	4d.
Egg	¼d.	-
Orange	-	¾d.
Water (Pint)	free	1½d.
Firewood (Bundle)	free	1s.5d.
Cigarettes (20)	5d.	7d.

MEDICAL SUPPLIES

Members of the expedition were vaccinated against smallpox, cholera, tetanus, the paratyphoids, typhoid, typhus and yellow fever. With the exception of yellow fever vaccination, only national health charges should be payable if arrangements are made with a general practitioner. Vaccination against yellow fever can be performed at Yellow Fever Clinic no. 3, 53 Great Cumberland Place,

London W.1. It is also advisable to have a dental examination before an expedition such as this. The medical supplies listed below were donated by Boots Pure Drug Company; in addition two First Aid kits (A) were carried. It should be remembered that the primary use of the medical kit will probably be in treating minor ailments of the local people and at least one member of the expedition should have taken a course in First Aid. J. Outram acted as our medical officer in the field. One essential item is an anti-dysentery drug such as enterocivioform or thalazole; temporary stomach upsets and diarrhoea appear to be unavoidable but they should not be allowed to worsen. Supressants for maleria were carried but not used. Clear running water was readily available at the base camp and Halazone tablets were used only in water obtained in the warmer countries on the journey.

Furamide	...	6 x 15
Chloroquine phosphate tablets	...	2 x 100
Aspirin tablets	...	3 x 100
Codeine tablets	...	1 x 100
Medicated talc	...	4 x 6oz.
Halazone tablets	...	5 x 100
Sulphathiazole	...	15g. bottle
Penicillin ointment	...	2 tubes
Viso eye drops	...	3
Strepsils	...	2

Kodacolor, Kodachrome II, Plus-X, Panatomic-X and Tri-X films were used by the expedition. All processing costs were paid by the individual members. A selection of colour transparencies taken on the expedition is held by the Secretary of the Imperial College Exploration Board.

GENERAL INFORMATION

Journey

We encountered little language difficulty on the journey and could usually find someone who spoke English. German, and to a lesser extent, French, was useful. It was necessary to keep a careful check on exchange rates offered. We obtained the maximum amount of foreign currency in London, as with the exception of Lebanese pounds, there is a more favourable exchange rate here. In particular, Ethiopia, Turkey, and Yugoslavia have mediocre exchange rates within their borders. Before entering Bulgaria we stocked up with food and petrol to avoid changing much money. Our American dollars proved readily exchangeable in the Near East and commanded good rates. The price of petrol in each country was studied and the tanks and cans were filled as economically as possible. Our accommodation expenses for the whole trip were seven shillings and sixpence for camping site fees in Bulgaria and five pounds for several nights' stay in the Y.M.C.A. hostel at Beirut (unavoidable). Our other sleeping places ranged from a Sinalco bottling factory in

Amman (hic) to an autobahn bridge in Belgium. We did not camp at official sites in Yugoslavia.

Customs

Despite the fact that during the ten thousand mile journey we crossed twenty-six frontiers, we had little customs trouble. The general attitude of customs officials was to show amusement rather than suspicion. An exception was Bulgaria, where officials wanted to look inside our carefully nailed-down crates. We refused and brewed a cup of tea in the road. After a few insults from both sides we left the country with our crates of equipment intact. On the return journey we found it advisable not to stress the presence of our geological and biological specimens. We managed to avoid payment of any customs fees in Ethiopia and were able, by judicious swapping of crates, to bring out all our specimens safely.

Firms

The expedition was very fortunate in that eleven bodies loaned scientific or camping equipment, twenty-four firms supplied equipment free or at reduced rate, and that twenty-four firms supplied food free or at reduced cost. Without this help our deficit would have been much greater and our scientific work less effective. A further fifty-five firms written to were not prepared to help, there being a considerable amount of competition from other student expeditions that year. We also typed a further fifty letters to various bodies and

individuals asking for advice on conditions in Ethiopia or on scientific points. We found that some British experts who had visited Ethiopia tended to generalise, which can be very misleading in the case of a country as diverse as Ethiopia. Due to there being a Supplies Officer for the combined 1962 Imperial College expeditions much of the work of ordering food supplies was taken off our hands.

DISCUSSION

(E.J. Herbert)

Finance

The reason for the deficit of the expedition was that we underestimated the cost of the return Red Sea passage by £442. Our estimate of £170 was based on the fare of £50 for a tourist class passage from Trieste to Djibouti. By travelling overland to Akaba and travelling deck class we hoped to obtain single passages of the order of £15 each. In fact the fare was £42 each, although an initial figure of £17 without food was quoted to Barrer and Williams by the Aral Shipping Company; this was later apparently retracted. We had to ship down the Red Sea as the desert route through the Sudan (Wadi Halfa - Atbara - Kassala) was out of the question with the solitary vehicle at our disposal. We were unable to reserve third or fourth class berths directly with any of the shipping companies on the Red Sea run and so we inquired at various travel agencies. Dean and Dawson Ltd. were inefficient, to say the least, in finding even tourist class passages for the expedition from Mediterranean ports

to Massawa in Eritrea or Djibouti in French Somaliland. We received only one reasonable offer - from the Yugoslav Steamship Company for six berths on a cargo boat 'S.S. Pirot' sailing from Trieste to Djibouti. However, there was no ship of this company returning from Djibouti at a suitable date and we decided that it would be quicker and cheaper to travel overland to Akaba and ship from there. The Jordanian Embassy officials in London assured us that it would be easy to book passages at the busy port of Akaba, the only sea outlet of Jordan. By a majority of four to three, we decided to drive to Akaba and cancel our option on the 'S.S. Pirot'. As events turned out, we were the first passengers to travel down the Red Sea from Akaba since the new port had been constructed two years ago and the port authorities had to draw up new passenger regulations. After a wait of twelve days at Djibouti, the Dutch ship 'M.S. Silindoeng' docked. The fares were expensive but at least the captain was willing to take us. We arrived at Djibouti on the same date as 'S.S. Pirot'; it would in fact have been cheaper if we had caught the Yugoslav ship. On the return journey the only suitable passage that would get us back before the beginning of term was on 'La Bourdonnais' of Compagnie des Messageries Maritimes. The head of the passenger department in the Company office at Djibouti refused to discuss any form of reduction and any remaining hopes we had of breaking even on the expedition vanished. We would advise any further expedition to ship direct from Marseilles or some other Mediterranean port.

Field Work

In Ethiopia, the expedition spent four weeks in the field at Goba and a further week engaged in field trips from Addis Ababa. The total length of the venture was three months. This compares favourably with the Cambridge 1953 Lake Tana expedition, which spent two weeks near Gorgora and eleven weeks travelling, and the Reading expedition in 1962 which spent four weeks in Ethiopia and nine weeks on the journey. There are no other Ethiopian reports (August 1964) in the R.G.S. Library (the 1957 Cambridge expedition report seems to be on permanent loan to Nottingham). One reconnaissance expedition got as far as Aswan, and the 1963 Cambridge Eritrean expedition suffered financially, owing to the loss of both their vehicles. It appears that as far as Ethiopian expeditions are concerned, the human factors (Kirwan, 1964) e.g. beneficial experience to expedition members, have to be given undue weight as compared with scientific results.

I would agree entirely with Brook (1956) that: 'to plan a field project in Ethiopia, objectives should be formulated in general rather than specific terms. Often field conditions will make changes necessary in methods of procedure, choice of study area, and even in the research project itself . . . often governmental 'red tape' in getting permission to travel in certain parts of the country, difficulties and expenses of transportation, and a multitude of other factors make necessary changes in plan'. Even though we did not get as far as we had hoped, our results are useful, I think, because of the general lack of information on Bale. No other student expedition

has visited this area; the second Reading expedition in 1964 tried to reach Goba by the track from Shashamanna but had to turn back at 11,500 ft. due to a miscalculation of petrol (Thomas, 1964). The three professional parties that have reached Batu all carried out a preliminary trip to ascertain conditions before making their main journey into the mountains, as detailed in the introduction. We had no forehand knowledge of the route to the Dumal valley.

It is unlikely that any of us will visit Ethiopia again, which is rather sad as we uncovered more questions than we answered. The most promising area was Magallo, where the Webi Gestro flows through a mountain for over a mile; the limestone caves there would provide interesting mapping work. There is also a reliable report of a hot spring at Magallo, yet the site is far away from the Rist Valley. The view from the escarpment south of Ghinnir is impressive, with unmapped residual plateaux rising from the wide valley floor; the long track to Al Kayre beckons invitingly. At Dallo the governor had told the zoologists of a poisonous snake with legs, known only locally, and of a cave one-and-a-half days' journey to the north in which animals and birds had been carved from the rock. And of course, there is the Dumal valley, still virtually unexplored. From the air we caught tantalising glimpses of grey peaks towering above the heavily forested upper valley.

STATEMENT OF ACCOUNT

INCOME

<u>Donations</u>	£
William Johnston Yapp Charitable Trust	115. 0. 0.
British Petroleum Company Limited	100. 0. 0.
Royal Geographical Society	75. 0. 0.
Vauxhall Motor Company	21.18. 3.
<u>Imperial College Grants</u>	
Exploration Board	300. 0. 0.
Rock Magnetism Group	100. 0. 0.
Supplementary grant from Exploration Board	50. 0. 0.
<u>Personal Contributions</u>	
E.J. Herbert	120. 0. 0.
W.T. Sowerbutts	100. 0. 0.*
Five other members	300. 0. 0.
<u>Other Income</u>	
From hire of vehicle in Jordan	14. 1. 0.
Equipment and camera insurance (paid by members)	20. 7. 1.
Vaccination expenses (paid by members)	10.16. 0.
Sundries account	2. 8. 0.
Miscellaneous sales	28.12. 4.
B.B.C. broadcasts	10.10. 3.
TOTAL INCOME	<u><u>£1368.12.11.</u></u>

* This item includes a £40 travelling grant from the Goldsmiths Company.

EXPENDITURE

	£
Petrol, oil & paraffin costs on overland journey	146. 0. 2.
Return Channel crossing	38. 6. 8.
A.A. fees and third party vehicle insurance	6.10. 0.
Red Sea passage Akaba to Djibouti	254.12. 0.
Red Sea passage Djibouti to Port Said	288. 0. 0.
Sea passage Port Said to Beirut	53. 9. 8.
Single air fare London to Addis Ababa	127. 7. 6.
Return rail costs Djibouti to Addis Ababa	83. 0. 6.
Return air fare Addis Ababa to Goba	94.14. 0.
S.S. Pirot charges	20. 0. 0.
Vehicle repairs	44. 5. 6.
Record photography costs	56. 2.10.
Visas and identity cards	43. 4. 1.
Food	98. 2. 2.
Medical supplies and scientific equipment	23. 6. 1.
Camera and personal equipment insurance	20. 7. 1.
Vaccination expenses	10.16. 6.
Postage and stationery	6.16. 6.
Bank charges etc.	5.12.10.
Accommodation expenses	5. 7. 6.
Miscellaneous	27.18. 7.
	<hr/>
TOTAL EXPENDITURE	£1453.19. 8.
	<hr/> <hr/>
Less income	£1368.12.11.
Debit	£ 85. 6. 9.
	<hr/> <hr/>

We ran out of expedition funds at Beirut and travelled to Ostend on personal loans by members of the expedition. A loan of £30 was sent by the Exploration Board to Ostend to pay for the Channel

crossing. The Board very generously agreed to help meet the deficit by means of a grant of £43.17.8d. The members of the expedition remain out of pocket by the following amounts:

	£
E.J. Herbert	31.18. 6.
R.M. Hamilton	3. 1. 7.
P.M. Barrer	1.18. 0.
C.F. Hinks	1.15. 0.
J. Outram	1.10. 0.
W.T.C. Sowerbutts	1. 6. 0.
A.R. Williams (transport officer)	0. 0. 0.
	<hr/>
	£41. 9. 1.
Board grant	£43.17. 8.
	<hr/>
	£85. 6. 9.
	<hr/> <hr/>

Insurance

Insurance of expedition personnel against accident and medical expenses, and insurance of scientific equipment, was paid for by the Imperial College Exploration Board, as was the cost of preparing the reports. Our accident in Germany cost the insurance company with which Hamilton was insured about £120.

ACKNOWLEDGEMENTS

The expedition would not have been possible without the financial help of the following bodies. For their assistance we are extremely grateful.

The Imperial College Exploration Board
The Royal Geographical Society
The William Johnston Yapp Charitable Trust
The Rock Magnetism Group, Imperial College
The British Petroleum Company Limited
Vauxhall Motors Limited

The following bodies loaned scientific or camping equipment to the expedition.

The Imperial College Exploration Board
The Royal Geographical Society
The Royal Botanic Gardens, Kew
The British Museum (Natural History)
Imperial College Zoology Department
Imperial College Mining Department
Imperial College Metallurgy Department
Negretti and Zambra Limited
Analytical Measurements Limited
Soil Mechanics Limited
Imperial College Youth Hostels Group

The following firms generously supplied goods free, or, in a few cases, at reduced rate to the expedition.

Allen and Hanburys Limited
Beecham Group Limited
Bennetts Cameras Limited
Thomas Black and Sons (Greenock) Limited
Boots Pure Drug Company Limited
British/American Tobacco Company Limited
British Drug Houses Limited
British Nylon Spinners Limited
British Visqueen Limited (I.C.I.)
Burberrys Limited
Cellular Clothing Company Limited
Edward Elwell Limited
The Ever Ready Company (Great Britain) Limited
Gallaher Limited
Thomas Hedley and Company Limited
Johnsons of Hendon Limited
Kodak Limited
Metal Box Company Limited
Munsell Color Company Limited

Pfizer Limited
Tern-Consulate Limited
John Waddington Limited
Winsor and Newton Limited
X-lon Products Limited

The following firms generously supplied food, free or at reduced rate, to the expedition.

The Australian Dried Fruits Board
Bachelors Foods Limited
Carr and Company Limited
Cerebos Limited
Chivers and Sons Limited
Felton and Crepin Limited
Glaxo Laboratories Limited
Horlicks Limited
Huntley and Palmers Limited
Irish Sugar Company Limited
Landauer and Company Limited
Liptons (Overseas) Limited
Marmite Limited
Nestles Company Limited
Oxo Limited
James Pascall Limited
George Romney Limited
Ryvita Company Limited
Tate and Lyle Limited
Thames Rice Milling Company Limited
Unicream Limited
Van den Berghs and Jurgens Limited
Vitamins Limited

We are grateful to the following gentlemen for relevant advice and assistance.

F.W.G. Annas, Esq., Accountant, Imperial College.

Professor P.M.S. Blackett, F.R.S., Physics Department, Imperial College.

Professor H.R. Hewer, O.B.E., Zoology Department, Imperial College.

Professor H.H. Read, F.R.S., Geology Department Imperial College.

Assistant Professor A. Stephenson, C.B.E., Chairman, Imperial College Exploration Board.

S. Stera, Esq., Finance Office, Imperial College.

P.F. Taylor, Esq., Imperial College Exploration Board.

J.F. Perkins, Esq., Deputy Keeper of Entomology, British Museum (Natural History).

A.J. Thomasson, Esq., Rothamsted Experimental Station.

O.H. Myers, Esq., Archaeologist, Berkhamsted.

R.M. Peel, Esq., M.B.E., Her Majesty's Consul, Addis Ababa.

J.T. Macfarlane, Esq., Acting President, University College of Addis Ababa.

Dr. H.F. Mooney, O.B.E., Forestry Advisor, British-Middle East Development Division.

Dr. M. Prosser, Biology Department, University College of Addis Ababa.

Professor A.S. Rogers, Geology Department, University College of Addis Ababa.

R. Jarman, Esq., Sudan Interior Mission, Goba.

Captain Telahun Belaineh, Police Post, Goba.

Ato Ayellew Degu, Teacher, State School, Goba.

Kanyazmach Wole Teferi, Governor, Dallo.

Lieutenant-Colonel Berhane Zeleke, Police Post, Ghinnir.

Ato Neraiu Teklemichael, Interpreter to the expedition.

D. Brenner, Esq., University of Heidelberg, Germany.

B. Christiaens, Esq., Architect, Ostend.

W.B. Reeves, Esq., Brown Engineers International Limited, Jordan.

C.J. Leaver, Esq., Supplies Officer, 1962 Expeditions.

APPENDIX I:
ROCK PICTURES OF THE COHAITO PLATEAU, ERITREA

(E.J. Herbert)

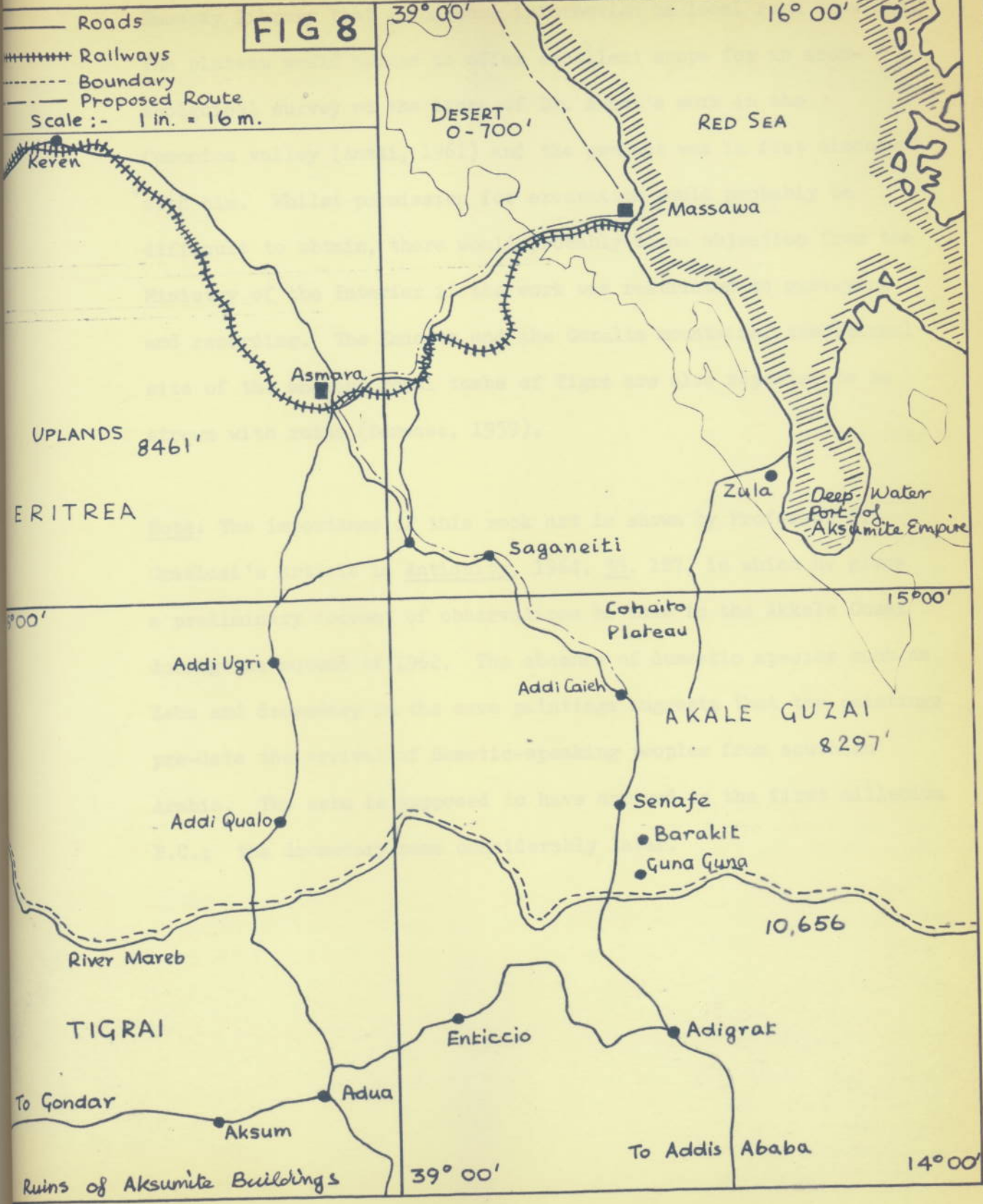
Initial plans concerning the expedition were made in November 1961. It was at first intended to visit the Cohaito plateau in the Akele Guzai (Acchele Guzai) district of Eritrea, where prehistoric rock pictures had been found. It seemed likely that an archaeological survey of the plateau would yield interesting results. However, after a literature search, the leader of the expedition at this stage, C.J. Talbot, found that the geology of this area was unlikely to be suitable for his mapping work and he decided to map a volcanic ring complex 80 miles WNW of Port Sudan. Accordingly, it was proposed that the expedition should split into two groups, one working in the Sudan and one in Eritrea. Unfortunately, the geological team had to withdraw from the expedition in February 1962 due to transport difficulties involved in reaching their proposed desert base. Three zoologists were included in the party to fill the gap and it was decided to attempt to reach the Dimal valley, because of its greater potentiality for zoogeographical work. Two members of the expedition still favoured working on the more arid Cohaito plateau but in the general interests of the expedition they accepted this change of area.

Since I did some reading on the Eritrean site I give here a summary of its possibilities. The key reference is a typescript in the Department of Ethnography at the British Museum by Mrs. S. Drew, wife of the former Governor of Eritrea, the late Brigadier-General Drew

(Drew, 1954). She describes many sites on the plateau, especially near the eastern escarpment where there is a sheer drop of about 4,500 ft. The drawings are mostly in places where there is a good level outcrop and a magnificent view. Her documentation is supplemented by watercolour copies. Mrs. Drew (8 Winterbrook Close, Wallingford, Berkshire) says that she only touched the fringe of the area and that there were bound to be many more undiscovered sites. Furthermore, she did not think there would be any shiftas in this area. Mrs. Drew (1951) also describes two Eritrean rock sculptures probably of Coptic origin but these appear to be fairly recent. On the plateau, she found paintings of animals, schematic carvings, and Ge'ez inscriptions. Littmann (1913) gives a sketch map of the southwestern part of the plateau on a scale of 500 metres to the inch, showing Absumite ruins on the ancient trade route across the plateau from Zula (Adulis) to Aksum. Ricci (1957) describes some stylised animal pictures and rock inscriptions, mostly in southern Arabian characters.

F. Anfray (Institut Ethiopien d'Archeologie, B.P. 19071 Addis Ababa) states that the Cohaito ruins are approached by a motorable track branching off from the Asmara-Addis Ababa road between the 120 and 121 kilometre posts, 11 miles from Addi Caich. The general location is given in Fig. 8. Dr. Franchini, of the Italian Embassy at Asmara, is the local authority on the area and he has published an account of some rock paintings and ancient architectonic remains on the plateau (Franchini, 1963). There is also a book in the British

FIG 8



——— Roads
 - - - - - Railways
 - - - - - Boundary
 - · - · - Proposed Route
 Scale :- 1 in. = 16 m.

Keren
 Asmara
 UPLANDS 8461'
 ERITREA
 15° 00'
 Addi Ugri
 Addi Caieh
 Saganeiti
 Cohaito Plateau
 AKALE GUZAI 8297'
 Senafe
 Barakit
 Guna Guna
 10,656
 River Mareb
 TIGRAI
 To Gondar
 Aksum
 Ruins of Aksumite Buildings
 39° 00'
 DESERT 0-700'
 RED SEA
 Massawa
 Zula
 Deep Water Port of Aksumite Empire
 16° 00'
 Adigrat
 To Addis Ababa
 14° 00'

Embassy library that gives some information on local rock drawings. The plateau would appear to offer excellent scope for an archaeological survey on the lines of Dr. Anati's work in the Camonica valley (Anati, 1961) and the project was in fact discussed with him. Whilst permission for excavation would probably be difficult to obtain, there would probably be no objection from the Ministry of the Interior if the work was restricted to surveying and recording. The Enderta and the Garalta mountains, traditional site of the ancient royal tombs of Tigre are also reported to be strewn with ruins (Doresse, 1959).

Note: The importance of this rock art is shown by Professor P. Graziosi's article in Antiquity, 1964, 38, 187, in which he gives a preliminary account of observations he made in the Akkele Guzai during the autumn of 1962. The absence of domestic species such as Zebu and dromedary in the cave paintings suggests that the paintings pre-date the arrival of Semetic-speaking peoples from southern Arabia. The sebu is supposed to have arrived in the first millenium B.C.; the dromedary came considerably later.

APPENDIX II: ROAD REPORT

(R.M. Peel)

Reproduced by permission of the Consular Section,
British Embassy, Addis Ababa.

ADDIS ABABA - SHASHAMANNA - GOBA - GHINNIR - MAGALLO. March 1959

<u>Place</u>	<u>Altitude (feet)</u>	<u>Miles Between Points</u>	<u>Running Time Between Points</u>	<u>Remarks</u>
ADDIS ABABA	8000	-	-	
SHASHAMANNA	6400	155	4.15	All weather good.
COFOLE	7400	24	1.45	Track runs through forest over black cotton soil. Turn left at Cofole village for Core.
CORE	9000	14	1.30	Track climbs gently over black cotton soil or red Murram. No foundation, difficult and perhaps impassable during heavy rains.
WEBI SHEBELI	8300	40	2.15	River about 150ft. wide (March) depth 3ft. hard shingle bottom. Impassable from June to Nov.
ADABA	8400	8	0.40	Market village. Population about 1500. Turn left in centre of village for Goba track.
SUDAN Interior Mission station	8400	2	0.10	School. Dressing station Good water in stream.
	8800	8	0.40	Track begins to climb over shoulder of Salmana range.
	9900	4	0.30	Track climbs through cedar forest. Track four yards wide, stony surface, foundations of old Italian road.

<u>Place</u>	<u>Altitude (feet)</u>	<u>Miles Between Points</u>	<u>Running Time Between Points</u>	<u>Remarks</u>
Summit	12000	7	1.50	Road foundation still evident but in bad condition.
	10300	8	1.10	Road descends to high upland valley. Bleak and windy.
GURIE (DEHNSO)	10300	9	1.30	Track very bad over black cotton soil. Cultivated areas begin.
Twin Fords over (SCICJA) Shaya river	9000	12	1.40	Hard pebble bottom. 3 ft. depth of water. Impassable June to Oct.
Track Junction	8500	2	0.10	Turn right for Goba which is six miles on. Straight on for Ghinnir.
Collection of huts (Sinana)	7000	26	2.00	Track very bad across black cotton soil badly eroded. Track occasionally disappears but general direction is E.
GORC (Ghinnir diversion)	5400	11	0.15	Track descends into dense thorn bush over black cotton soil.
Junction	5000	1	0.10	Turn left over bed of Abbe river for Ghinnir straight on for Magallo.
Crossing	5200	7	1.00	Very difficult ford over large boulders 3ft. water
	6400	4	0.30	Track reaches top of web escarpment.
	5300	9	1.00	Track runs through dense thorn bush.

<u>Place</u>	<u>Altitude (feet)</u>	<u>Miles Between Points</u>	<u>Running Time Between Points</u>	<u>Remarks</u>
	4600	4	0.30	Track drops into valley of dense thorn.
	4400	2	0.20	Track runs NW along floor of valley. Old Italian foundation of stones now evident.
Summit	6400	3	0.50	Arduous climb to top of Ghinnir escarpment. Road surface stony but in fairly good condition. 3-4 yards wide. Some dangerous hair-ins with 1500ft. sheer drop off road.
GHINNIR	6400 (Magallo diversion)	4	0.30	Ghinner. Market centre; police; airport.
GORO	5400	-	-	
ABBE crossing	5000	10	0.50	Easy ford stony bottom 2ft. water.
ABBE crossing	4800	10	0.50	Dry in March. Road runs through dense thorn bush occasionally over old Italian foundations. General direction SE.
ABBE crossing	4400	5	0.30	Dry in March.
Track Junction	4400	1	0.10	Turn left for Magallo.
Track Junction	4400	1000 yds.	-	Turn left for Magallo. Old Italian track begins. General direction is now SE.
MAGALLO	5300	7	1.00	Small market centre. Police post.

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Note: references marked with an asterisk (*) are cited indirectly. All other references are available in the libraries of the R.G.S., Mew, the Institute of Archaeology, the Geological Museum, or the Science Museum.

LIST OF PLATES

- I. The expedition vehicle, R.M. Hamilton at the wheel, in Turkey on the homeward journey.
 - II. View from Mount Fasil across the Awash valley to Cire Bale in the eastern range. On the extreme right is the pass to the Dumal valley, covered in dense cloud.
 - III. The new market place at Goba, showing characteristic Ethiopian shamma. Eucalyptus globulus in background.
 - IV. Galla herdsmen at one of the mineral springs below Goftari.
 - V. General view of Togona-Micha basin from Mount Grati, Looking across scrub and juniper parkland to Mount Fasil (11,400 ft., 100°) and the Micha ridge.
 - VI. View towards Batu from Mount Grati. Unnamed peak on horizon, bearing 261°. Erica arborea in foreground.
-



PLATE I



PLATE II



PLATE III



PLATE IV

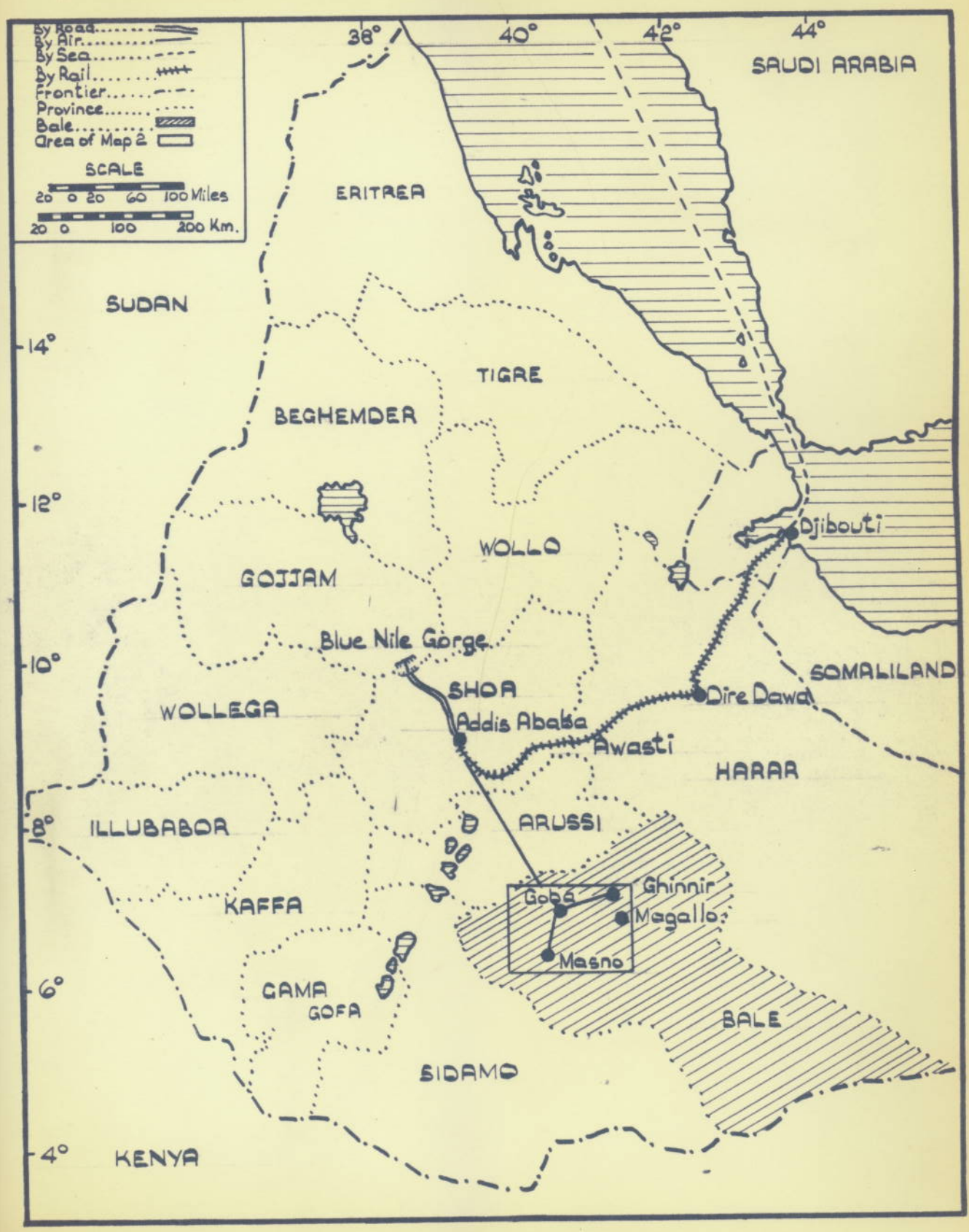


PLATE V

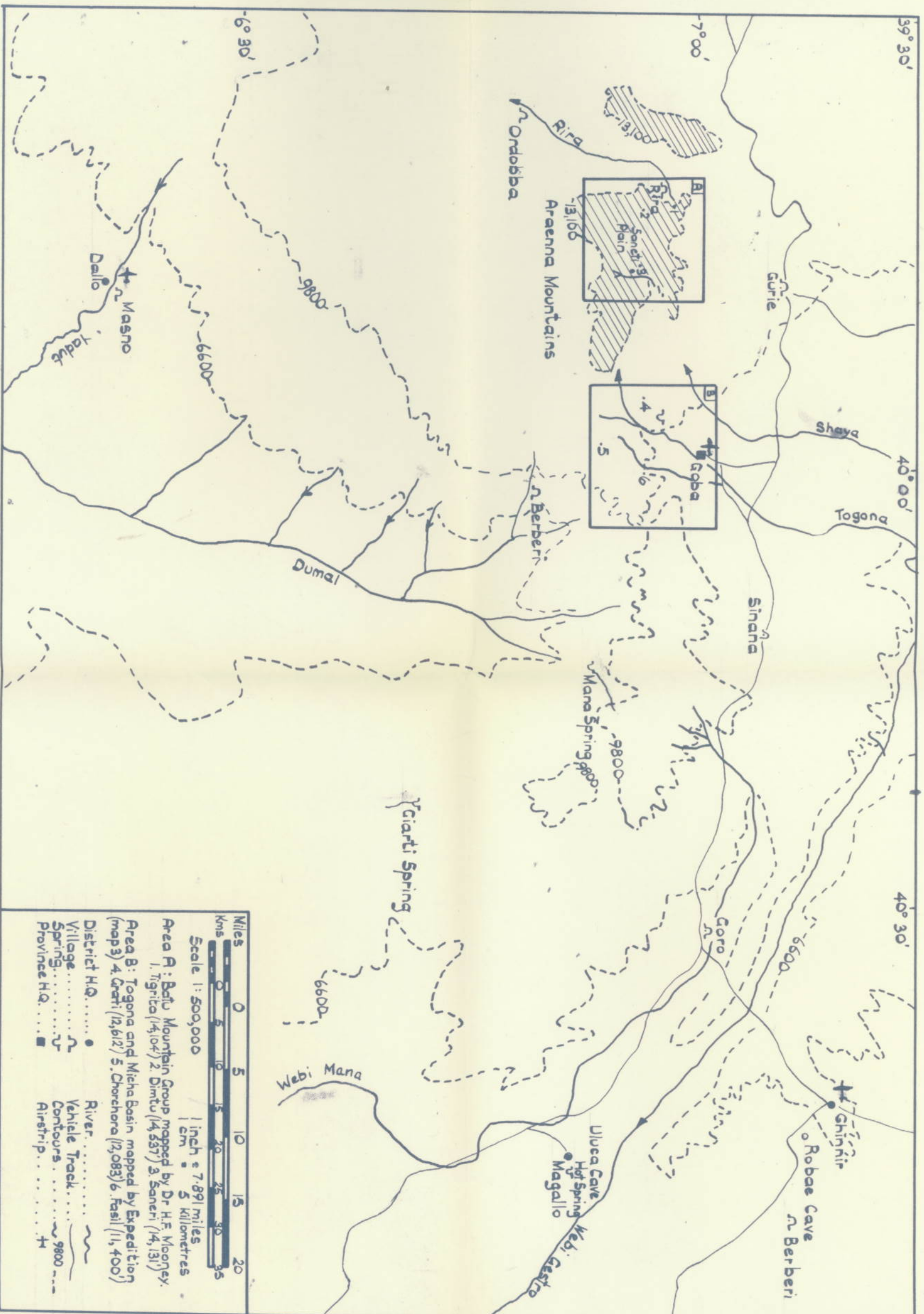


PLATE VI

MAP I. EXPEDITION ROUTE IN ETHIOPIA



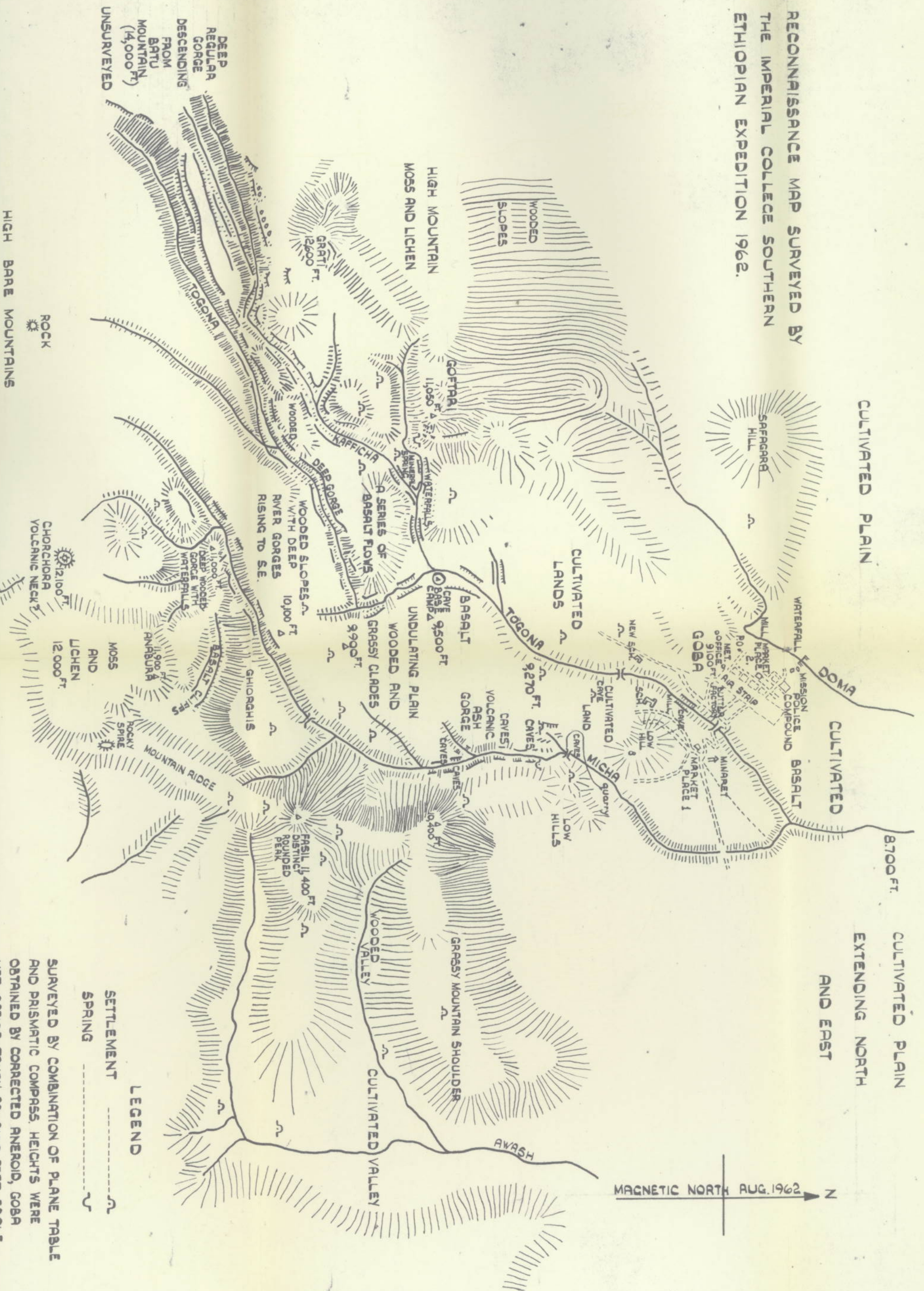
MAP 2. WESTERN BALE



Miles 0 5 10 15 20
Kms 0 5 10 15 20 25 30 35
 Scale 1: 500,000
 1 inch = 7.891 miles
 1 cm = 5 Kilometres
Area A: Batlu Mountain Group mapped by Dr. H.F. Mooney.
 1. Tigrita (14,104') 2. Dintu (14,537') 3. Saneri (14,131')
Area B: Togona and Mocha Basin mapped by Expedition
 (maps 3) 4. Gura (12,612') 5. Chorchora (12,083') 6. Fasil (11,400')
District H.Q. ●
Village
Spring
Province H.Q. ■
River
Vehicle Track
Contours
Airstrip

MAP 3. TOGONA AND MICHA BASIN, GOBA, BALE, ETHIOPIA.

RECONNAISSANCE MAP SURVEYED BY
THE IMPERIAL COLLEGE SOUTHERN
ETHIOPIAN EXPEDITION 1962.



CULTIVATED PLAIN

CULTIVATED

8,700 FT.

CULTIVATED PLAIN
EXTENDING NORTH
AND EAST

MAGNETIC NORTH AUG. 1962

LEGEND

- SETTLEMENT
- SPRING

SURVEYED BY COMBINATION OF PLANE TABLE
AND PRISMATIC COMPASS. HEIGHTS WERE
OBTAINED BY CORRECTED ANEROID, GOBA
MET OFFICE TAKEN AS 9100 FEET SCALE

HIGH BARE MOUNTAINS

