

RESULTS OF THE ARCHBOLD
EXPEDITIONS. NO. 68

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(AUSTRALIA) EXPEDITION

L. J. BRASS

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OF THE

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WITH NOTES ON THE MAMMALS OF CAPE YORK PENINSULA BY
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INTRODUCTION

THE EXPEDITION HERE SUMMARIZED extended to the Cape York Peninsula, in northeastern Australia, a program of biological explorations which began in New Guinea in 1933 and was continued there in 1936-1937 and 1938-1939 by expeditions of the American Museum of Natural History financed and led by Richard Archbold. General reports on the three New Guinea expeditions have been presented in the Bulletin series by Archbold and Rand (1935), Rand and Brass (1940), and Archbold, Rand, and Brass (1942).

The Cape York Expedition was primarily for the purpose of making collections and obtaining field data for an understanding of the problems of geographical distribution concerning New Guinea and Australia, with particular reference to mammals and plants. An invitation was extended to the Queensland Museum to attach to the party a staff member to make study collections of birds and to collect other zoological specimens for exhibition purposes. The expedition also presented an opportunity to assist, with materials from an area little known botanically, investigations of the Council for Scientific and Industrial Research of Australia into the pharmacology of the native flora. Soil samples were collected for antibiotics research in the laboratories of Chas. Pfizer and Company of New York.

As in the case of the two preceding Richard Archbold expeditions, the Arnold Arboretum of Harvard University made a financial contribution to the Cape York Expedition and received the botanical collections.

Preparations were made for six months of field work between the sixteenth parallel of latitude and the northern tip of the Peninsula. But owing to a waterfront strike, which delayed the delivery of equipment and supplies shipped from the United States, it became necessary to spend nearly six weeks in limited collecting in the vicinity of Cairns and to extend the expedition an extra month. Field work began February 28 and ended September 27, 1948.

The personnel of the expedition consisted of L. J. Brass, leader and botanist; George H. H. Tate, chief mammalogist; Hobart M. Van Deusen, mammalogist; Geoffrey M.

Tate, business manager and collector of invertebrates and cold-blooded vertebrates; and Donald P. Vernon, representing the Queensland Museum.

As cook for the party we had J. McLaughlin, who contributed a valuable store of local knowledge gained in years of residence on the Peninsula. Employed as field helpers throughout the trip were three aboriginal men, Willie Somerset, George Moreton, and Roy Stephen, from the Government Mission Station at Cowal Creek, on the far northern part of the Peninsula.

Before joining the expedition, and again after the field work of the expedition was completed, George Tate made an independent mammal reconnaissance survey for the American Museum of Natural History of parts of Queensland other than the Cape York Peninsula.

The botanical collections of the expedition have been determined only in part. Therefore, rather than omit mention in this report of certain plants characteristic of major vegetation types which were met with on the Peninsula, they are referred to by a generic name and a collection number, or in a few cases by a collection number alone. The Monocotyledoneae and the capsular Myrtaceae with the exception of *Metrosideros*, *Syncarpia*, *Tristania*, and *Xanthostemon* have been determined by Mr. S. T. Blake of the Queensland Herbarium. Mr. Lindsay S. Smith of the same institution has determined most of the other Dicotyledoneae for which binomials are given, the few exceptions being sight identifications made by me in the field. Mr. Edwin B. Bartram has identified the mosses. The botanical results of the expedition will be published in the Journal of the Arnold Arboretum.

ACKNOWLEDGMENTS

The cooperation and advice of all members of the party in planning and carrying out the expedition are gratefully acknowledged. If not always rewarded with commensurate results, their unremitting hard work in searching out the animals of the area showed that even the least encouraging localities scarcely

deserved the description "biological desert," which an esteemed predecessor felt should apply to some parts of the Peninsula (Wilkins, 1928, p. 61). The smooth efficiency of Geoffrey Tate in attending to outfitting and supplies was an important factor in the success of the expedition. We could not have had a more cooperative and pleasant associate than Donald Vernon.

The Federal Government of Australia and the State Government of Queensland readily granted permissions for our project. Equipment and supplies were admitted free of customs duty. The collecting permits granted by the Queensland authorities were virtually unrestricted, except as applied to national parks and there were no national parks in our area proper.

In New York, Mr. C. V. Kelway, then Australian Consul-General, and Mr. Edward Littlejohn, Vice-Consul, gave valuable aid in preliminary arrangements for the expedition. In Brisbane, Mr. W. L. Peck, American Consul, helped in many ways.

The Honorable E. M. Hanlon, Premier of Queensland, took a personal interest in our work, and we are grateful for his good offices on our behalf. It is pleasant to look back upon the unflinching cooperation received from public officials in Queensland. On departmental levels we wish to thank Mr. Arthur F. Bell, Under Secretary, Department of Agriculture and Stock, for general collecting permits and the assistance of his officers in the north; Mr. V. Grenning, Director, Sub-Department of Forestry, for permission to collect in state forests, timber reserves, and crown lands; Mr. J. R. Kemp, Chairman, and Mr. J. E. England, Secretary, Main Roads Commission, for background information and arranging for practical assistance on the Peninsula; Mr. C. O'Leary, Director of Native Affairs, for general information and arranging for our aboriginal helpers; and Mr. W. M. McLean, Chairman, and Mr. F. Matthews, Secretary, Land Administration Board, and Mr. J. A. Sewell, Director, Department of Local Government, for data invaluable in initial planning.

To the late Mr. C. T. White, Government Botanist of Queensland, we owe a special debt of gratitude for sound advice in framing our itinerary and the benefit of specialized

and general information which he alone could supply.

Mr. George Mack, Director, Queensland Museum, received us most cordially, assisted in preliminary arrangements, and kindly placed the facilities of his institution at our disposal.

We owe thanks to many friends in Cairns for their hospitality and generous aid in our work. In particular we take pleasure in acknowledging indebtedness to the very active North Queensland Naturalists' Club for the use of building space for work and storage, and gifts of specimens. We also wish to thank its then president, Mr. S. E. Stephens, and members J. George Brooks, Gordon Stephens, Alfred Read, and Thomas Webb for arranging special field excursions for our benefit. Dr. H. Flecker, founder of the Club, was most cooperative. We are much indebted to Mr. R. D. Gallop, Divisional Engineer, Main Roads Commission, for aid in various ways and helpful suggestions based on his wide experience of the country. The Cairns branch of Burns, Philp and Co., Ltd., managed by Mr. C. W. Dupain, functioned efficiently as our paid agents.

Valuable assistance and advice in the furtherance of our aims were given by Mr. Gilbert Bates, Director of the Northern Sugar Experiment Station, at Gordonvale. For hospitality in providing bases for field work near Cairns we are deeply grateful to Messrs. Harold Lane and James Cobb of Mossman, Mr. and Mrs. George Veivers of Speewah, Mr. and Mrs. P. Hanna of Julatten, Messrs. G. and T. Giddens of Bellenden Ker, and Mr. and Mrs. Robert Hunter of Barron Waters. The fortitude and fine companionship of William Kerns, Jr., and Sven Nielsen, on an ascent of Mt. Bellenden Ker, will always be remembered by George Tate and myself.

It is with feelings of particular inadequacy that I attempt to express our appreciation of the gracious and ever-ready hospitality, keen interest, and splendid cooperation of the people of the outer communities of the Peninsula.

At Cooktown we had the helpful interest of two local naturalists: Mr. Carlton Olive and the distinguished comparative anatomist, Dr. H. L. Kesteven. Mr. J. A. Roberts was of great assistance at Shipton's Flat. Some of us

were the guests of Mr. and Mrs. G. A. Seagren, on the Endeavour River. Through the cooperation of Mr. William Gladwell of Queensland Government Railways, and Mr. Norman Watkin, transport arrangements were simplified and collections enriched.

Our operations in the Coen area were facilitated by Mr. H. J. Thompson, who helped greatly in providing base facilities and local truck and pack-horse transport. Mr. Maurice Shephard was a fruitful source of information and advice. To assistance in the hunt from Mr. Joseph Fisher we owed important accessions to the mammal collections. And as men who came hungering for fresh food, the good things we had from Mrs. May M. Armbrust's oasal vegetable garden will long be a grateful memory.

At the mining settlement of Wenlock, where every member of the small community took active part in making our visit both pleasant and profitable, we had special cause to be grateful to Mr. and Mrs. W. J. Fisher, Mr. and Mrs. George Nankervis, Mr. Norman Fisher, Mr. and Mrs. Arthur Ulett, Mr. Sam Zammit, and, for very efficient transport arrangements, Mr. Hugh D. Fisher.

Information provided by Mr. H. E. Johnston of Lockhart River Mission helped materially in the formulation of working plans. Others in the Lloyd Bay area to whom we owe a special debt of gratitude, for hospitality and assistance, are Mr. and Mrs. Bert Connell and the late Mr. Leo Ferris of Iron Range; Mr. E. R. Pinwell of the Main Roads Commission; and Mr. Jack Gordon, Mr. and Mrs. Douglas Fisher and Barrie Fisher of Portland Roads.

Our work on the tip of the Peninsula was carried out in close association with Mr. C. T. Holland of Lockerbie Station, who kindly made advance preparations for our base camp, undertook all transport, and with his sons, Dick, Tom, and Stan, gave enthusiastic and knowledgeable aid in actual collecting.

Finally I wish to record our appreciation of favors granted by Mr. Percy Jensen, Protector of Islanders, and of extensive background data supplied by Mr. J. G. Loney, Representative of the Department of Local Government, both of Thursday Island.

ORGANIZATION

The area with which we were primarily concerned is very sparsely populated by cattle ranchers and miners. It has few roads and these, due to bog and especially the flooding of unbridged rivers and the damage done to river crossings by flood waters, for the most part are impassable for vehicles in the wet season and for a month or so after the rains. The seasons had therefore to be taken into account in drawing up a working plan which would involve a considerable amount of inland travel.

A selection of general localities to be investigated was made in advance on the basis of information gained through correspondence and to some extent from the meager literature available on the parts of the Peninsula we wished to examine. This selection was checked and confirmed, sites for base camps were chosen, and preliminary on-the-spot arrangements were made by the writer on an aerial and ground reconnaissance prior to the beginning of field work.

We depended upon means of transport that were available locally, using boats between various points along the coast, and motor trucks and pack-horses (and occasionally resorting to backpacking) inland. The service provided by small vessels plying along the coast of the Peninsula was infrequent and unreliable, owing in part to a shortage of vessels and in part to the effects of labor trouble at ports farther south. Most of our motor transport was by war surplus, four-wheel-drive trucks owned individually by residents of the areas visited. We had little difficulty in securing such transport, since one truck or a truck and trailer carrying up to about $1\frac{1}{2}$ tons was adequate for our needs. A larger or heavier party, moving as one unit, could not have made satisfactory arrangements for local motor transport on most parts of the Peninsula. We could have used one or two jeeps to advantage for collecting operations out of base camps. Instead, we resorted to bicycles where roads and trails were good enough. Horses for riding and packing were not available in most of the localities where they could have been used.

The expedition took place at a time when

post-war shortages of materials were still being felt in Australia, and the operation of economic controls kept off the market items of expedition supply which would ordinarily have been available. All equipment, and practically all supplies except foodstuffs and oil products, were therefore shipped from New York via the Panama Canal three months before the planned starting date for work in the field. Certain items of food were rationed in Australia, but the quantities allowed were quite enough for our needs, as

were supplies of rationed gasoline which were made available to us on special permit.

As our main supply base we chose Cairns, a deep-water port with established communications with the northern Peninsula by sea and a weekly air service to Thursday Island via Cooktown, Coen, and Iron Range. Provisions and pre-packed replenishments of collecting supplies were shipped from Cairns periodically by our agents, who received collections which we sent by sea and air for storage until the end of the expedition.

GENERAL REMARKS ON THE AREA

THE CAPE YORK PENINSULA has a length of about 490 miles, a breadth of 370 miles at the base, and an area of roughly 95,000 square miles. A glance at the map will show its tapered jut extending farthest north of any part of Australia, and separated from the New Guinea mainland by only 95 miles of water in the island-studded Torres Strait. It will be noticed, too, that the Great Dividing Range, the dominant orographical feature of eastern Australia, forms a continuous though not always prominent backbone to the Peninsula, lying much closer to the east coast than to the west, and decreasing generally in altitude from south to north. This range, it may be noted here, is largely of granite. Several shorter mountain ranges lie parallel to the Great Divide and mainly on its eastern side, and many short lateral ranges branch from the Great Divide, mostly on its western flank. On closer study, however, it is apparent that even the modern large-scale maps such as the Queensland Four-Mile Series of 1939-1947, the Queensland Two-Mile Series of 1945-1948, and in large part the incomplete series of Queensland Four-Mile Strategic Maps of 1943-1944 are based on insufficient survey data and therefore leave much to be desired in detail and reliability. The Queensland Military Surveys One-Inch Maps of 1942-1946, with detail from air photographs, are of a high order of accuracy, but the total area coverage of the sheets so far published is small.

A serious shortcoming of all the maps, other than the few large-scale military sheets, is the paucity of altitude data they supply for hill and mountain features. Such data are especially sparse in positions back from the coast, where hachured "caterpillars" indicate the location, or the approximate location, of mountain ranges, but general elevations or spot heights seldom are given. This situation points up the fact that, prior to the military surveys of World War II, the map makers had available to them little precise topographical information on the Peninsula other than that of the Admiralty Charts, which naturally are limited to coastal and near-coastal features useful as landmarks for navigators of ships.

The two series of military maps are of special interest to the biologist in that they present a classification of the vegetation in terms of cover for military vehicles, such as "low scrub," "camouflage cover," and "full cover." The reliability of the interpretation of the vegetation from air photographs varies on different sheets of the maps. Various types of forest on the Peninsula provide full military cover, but we found from ground observations that in areas in which rain forest occurred the "full cover" of the maps usually could be taken to indicate fairly closely the distribution of the rain-forest type of vegetation.

DISCOVERY AND HISTORY

The first landing by white men on the Australian mainland of which authentic written record has come to light took place on the Cape York Peninsula. This was in 1623, when the Dutch yachts "Pera" and "Aernem," commanded by Jan Carstenszoon, sailed along almost the entire west coast and made numerous landings in search of trade and lands to colonize. Carstenszoon's diary was frank in disappointment with what he found. "The land between 13° and 17°8' is a dry and barren tract, without any fruit trees or anything that man could make use of. It is low and flat, without mountains or heights, overgrown in many places with scrub and stunted timber, with little fresh water. . . ." And, "in our judgement this is the driest and barrenest region that could be found in the world." The natives, "pitch black, thin in body, and stark naked," were "utter barbarians," always hostile and, moreover, resistant to capture by the boats' crews for a reward of 10 reals of eight per live body brought on board the flagship "Pera" (Jack, 1921).

Carstenszoon was preceded in discovery of the west coast of the Peninsula by Willem Janszoon in the "Duyfken" in 1606, who apparently made no landing, and was followed by other Dutch voyagers in the next 130 years. They did not know that in 1606 the Portuguese navigator Louis Vaes de Torres had demonstrated the insularity of New Guinea by sailing through the strait that now

bears his name. Approaching from the west and believing New Guinea and Australia to be a continuous land mass, the early Dutch never saw the mountainous and much more attractive east coast of the Peninsula.

First on the east coast, in the historical record, was Captain James Cook in the barque "Endeavour" in 1770. Following the coast from the south, Cook landed briefly in Trinity Bay, near where the city of Cairns now stands. Off Cape Tribulation his ship struck on a coral reef, and in badly crippled condition it was taken into the mouth of the Endeavour River and careened for repairs. Seven weeks elapsed before the "Endeavour" was ready to sail again, during which time friendly relations were established with the "Indians," and the naturalists Banks and Solander made collections, including important gatherings of plants. Cook's only other landing on the Peninsula was at Lookout Point. Rounding Cape York, which he named, Cook hoisted the English colors on Possession Island and there took formal possession of all the eastern coast of "New Holland" in the name of King George III.

Notable exploration and charting of the coasts of the Peninsula were achieved by the following: Matthew Flinders in the "Investigator" (Robert Brown, botanist) in 1802; Phillip Parker King in the "Mermaid" and later the "Bathurst" (Allan Cunningham, botanist) during 1819-1821; E. P. Blackwood commanding the "Fly" (J. Beete Jukes and John Macgillivray, naturalists) and the tender "Bramble" in 1843-1846; and Owen Stanley with the "Rattlesnake" (John Macgillivray and Assistant Surgeon Thomas Huxley, naturalists) and the "Bramble" in 1848-1849.

Exploration of the interior began in 1848 with a disastrous expedition led by Edmund Kennedy, which landed at Rockingham Bay late in May with the intention of overlanding to the northern tip of the Peninsula. Kennedy had with him William Carron, botanist, Thomas Wall, general naturalist, nine other white men, and a black boy named Jackey-Jackey. With 28 horses and three carts, 100 sheep for food, and heavy loads of stores, the ill-fated party of 13 struggled inland over the crest of the Great Dividing Range and then towards Cape York. The impracticability of

the carts becoming apparent, rather late it seems, they were left behind and the stores packed on the horses. Harassed by hostile natives and unable to draw much sustenance from the country, the expedition reached the mouth of the Pascoe River in November. A meeting with the survey vessel "Bramble" in Princess Charlotte Bay had failed to materialize. They were perilously short of food and had already been reduced to killing all but nine of their failing horses for meat. Leaving the main party at the Pascoe in charge of Carron, Kennedy set out with Jackey-Jackey and three of the white men in an attempt to reach Port Albany, near Cape York, where a relief ship would surely be waiting. Only Jackey-Jackey succeeded in getting through. Kennedy was speared to death by blacks, as no doubt were his white companions, left on the way to protect one man already wounded and unable to travel. Of the group left at the Pascoe, only Carron and one other survived. The rest, beleaguered by blacks, died of starvation before a rescue schooner, guided by Jackey-Jackey, reached their camp. The leader's journal, and all the biological collections except some packets of seeds, were lost.

Kennedy's expedition followed by three years an expedition of Ludwig Leichhardt (including in personnel John Gilbert, naturalist) which touched the central and western base of the Peninsula at the Mitchell River and reported good grazing country on its route from the south. Pastoral occupation followed and before the mid-1860's extended to Carpentaria Downs, on the Einasleigh River, almost as far north as the south end of the Peninsula.

Meanwhile the Torres Strait had become important as a throughway for sea traffic with settlements on the lower east coast of Australia. Ships frequently were wrecked in the strait and on the treacherous course between the upper east coast and the Great Barrier Reef. A garrisoned post therefore was established on the mainland in Port Albany for control of Torres Strait, and as an entrepôt for trade, coaling station, and harbor of refuge for mariners in distress. This first settlement on the Peninsula was founded in 1863 by John Jardine, as Resident, and named Somerset.

The difficulties of travel in the unexplored interior were further emphasized by the experiences of Jardine's sons, Frank and Alick, who made an epic droving trip with cattle to found a herd for the supply of fresh beef for Somerset. With about 250 head of cattle and a team of 42 riding and pack horses, the young Jardines started from Carpentaria Downs in October, 1864. Included in the party of 10 were A. J. Richardson, a government surveyor, and four black boys. Within a month an accidental grass fire destroyed a large part of their stores and gear. There were frequent brushes with the natives, about 50 of whom were shot on the journey. To add to their troubles, the wet season set in about the end of December. Much of the ground became soft and boggy. Saddles and stores rotted from constant wet. All but 12 of the horses died from eating poisonous plants and exhaustion from floundering through bog. In the middle of March the surviving cattle (fewer than 200) were delivered at Somerset. For two months the men had walked barefooted and practically naked, subsisting towards the end on jerked beef and water and such scanty fare as could be picked up in the bush.

Organized search on the Peninsula for minerals began, with government assistance, in 1872, with an expedition led by William Hann and including Norman Taylor, geologist, and Thomas Tate, botanist. The area traversed took in headwaters of the Mitchell River, and the Princess Charlotte Bay basin as far north as the Stewart River. Alluvial gold, afterwards proved fabulously rich, was discovered on the Palmer River, and large tracts of good pastoral land were made known.

The second successful traverse of the Peninsula from end to end was made in 1879-1880 by R. Logan Jack, Queensland Government Geologist, accompanied by several practical miners. The results of this party's mineral search were not sensational. In later years, however, Jack produced a valuable historical and geographical study of the Peninsula, "Northmost Australia," which proved most useful in planning the Archbold Expedition and has been drawn upon freely for these paragraphs.

Rapid progress in exploring and opening up the country followed the discovery of gold.

Cooktown, in the mouth of the Endeavour River where Captain Cook repaired his ship, was founded in 1873 to supply the Palmer, and in three years no fewer than 15,000 white and 20,000 Chinese diggers had rushed to this field. By 1880 Cairns and Port Douglas had been opened as ports; important tin and silver-lead deposits had been discovered in the hinterland of these places; and the planting of sugar-cane had begun on rich lands of the coast as far north as Cairns.

These developments, or those that have been lasting and progressive, affected mainly the coastal and near-coastal southeastern parts of the Peninsula for which Cairns has become the modern deep-water port and railway terminal. With a decline in mining, the economy of this area today is predominantly agricultural and lumbering.

Within five years of its discovery, the rich Palmer goldfield began to peter out, and Cooktown to lose importance. Numerous other discoveries of gold, and of tin, were made in widespread prospecting activities in the mountainous eastern half of the Peninsula and many of them far to the north of Cooktown. Goldfields were opened at Coen in 1876, on the Batavia River in 1892, and during the next four years on islands of Torres Strait. None of the mineral discoveries came anywhere near the Palmer in importance. They seldom involved more than a few hundred men for a few years before they were worked out or found no longer payable. The heyday of mining on the Peninsula was brief and ended before the turn of the century.

But associated with mining activities were developments in cattle grazing far exceeding them in area spread and permanency. The cattle industry, practicing open-range methods under a low-rental system of Crown Lands tenancy, employs only a small number of men. It has been backward in improvements to increase the natural carrying capacity of the very large tracts of land held under individual or company leasehold. But with large markets in the Cairns area and closely settled parts south of the Peninsula, it has survived as the sustaining industry on the Gulf of Carpentaria watershed and a good part of the Pacific slopes.

Men in boats have also played an important part in exploiting the natural resources

of the Peninsula: getting sandalwood on all the coasts, and taking pearl-shell and pearls, trochus shell, and bêche-de-mer from Torres Strait and the lagoon waters between the east coast and the Great Barrier Reef. Thursday Island early became the chief center for marine industries in Torres Strait and neighboring seas, and in 1879 the government establishment of Somerset was moved there. Soon afterward, this outpost of growing importance was linked with southern cities by a telegraph line which passed through the interior of the Peninsula almost to Cape York, and thence under water and over islands to its termination.

The Cape York Telegraph Line, with operating and maintenance stations every 60 to 80 miles, was completed in 1886, a year that may perhaps be taken to mark the end of an era on the Peninsula. Corners of the great triangle of territory remained unknown, and much of it was only sketchily mapped. Worthwhile grazing lands still awaited occupation by cattlemen. Hardy prospectors, than whom there can be no more admirable breed of men, were combing the country, and many mineral discoveries remained, and no doubt still remain, to be made. But the period of preliminary exploration was at an end. The last major expedition of geographic note had, in fact, as its objective the choice of a route for the telegraph line in 1883. The "line" was solid evidence of an occupation planned to be permanent. All that remained to be done was holding and development.

Development north of the Cairns area was at a low ebb and the upper Peninsula definitely a part of the "empty north," when the Second World War brought about the establishment of a chain of military airfields along the east coast for use by the American and Australian forces. To the newcomers of this second great influx of population the Peninsula must have seemed empty indeed, for with the threat of Japanese invasion most of the more northern white population was evacuated, and such industry as there was came practically to a standstill, except for cattle raising.

By 1948 the air bases had been closed and for the most part demolished, and the Peninsula was in the process of post-war readjustment. Of a total white population of about

1200 north of the sixteenth parallel, Cooktown and Thursday Island each claimed 300, and the communities of Laura, Coen, and Wenlock about 100 between them. A few farmers grew peanuts and maize near Cooktown and tobacco at Laura, while the other white inhabitants lived thinly scattered on cattle stations, at small gold and tin mines, the telegraph stations, and at missions on the coasts.

Few of the 2000 to 3000 mainland aborigines followed to the full their old ways of life, entirely dependent upon hunting and gathering. Some hundreds of them worked for white men on the cattle stations, others on boats and at various wage-earning jobs. But for the most part the aborigines were on large reserves, especially on the west coast, free to roam but in contact with missions where efforts were being made in agricultural re-education. Cattle at the missions helped with the meat supply. Flour, tea, sugar, tobacco, and clothing could be earned, or in the case of men who had gone out to work, paid for with savings withheld under a system of government protection which applied to all employed aborigines.

An adverse post-war condition, proclaimed by the "old hands," was the reluctance of young people to give up the amenities of the more settled areas, from Cairns southward, for opportunity in the far north. On the opposite side of war's influences was the institution of a regular commercial air service through the Peninsula from Cairns, taking advantage of runways left by the military airmen and greatly improving previous contacts with the outside social and business world.

Basically, however, the Peninsula remained dependent for transport on infrequent, and in our experience erratic, boat services, and a system of primitive unformed bush roads open for wheeled traffic only in the dry season. Inland communities such as Coen and Wenlock, for example, were thus obliged to lay in bulk food stocks in November or early December to last through May. The all-weather military roads built in the northern parts of the Peninsula were local and coastal and of small benefit to a functioning white population located principally inland.

On the Pacific coast, Somerset was entirely abandoned, and the only established habitations on 480 miles of littoral between Cooktown and Cape York were at Lockhart River Mission and Portland Roads, with fewer than a dozen white people all told. Along the west coast, which Jan Carstenszoon thought so little of in 1623, were several mission stations for its relatively numerous native population, and behind this coast were the most important cattle properties on the Peninsula. Torres Strait had a few white residents at Red Island Point and the Cape York Telegraph Station.

PREVIOUS BIOLOGICAL WORK

A detailed review of the collections that have come from the Peninsula has not been published, and it is not proposed to attempt it here. The biological searchings begun in 1770 by Joseph Banks and D. C. Solander, of the "Endeavour," have progressed by fits and starts and still have a long way to go before any major group of life forms, excepting, perhaps, the birds, can be considered adequately known for more than limited areas. A disproportionately large part of the collecting, both zoological and botanical, has been done and is continuing, with rich results, in the mountainous and largely rain-forested southeastern corner of the Peninsula, within 40 or 60 miles of Cairns.

In our particular area, north of the sixteenth parallel, the northern tip of the Peninsula and the district about Cooktown have received most attention. The great expanse of territory lying between these two points of easy access has attracted few collectors, and not until rather recent years has work of consequence been done away from the coasts.

The name Cape York has been used loosely in the past and by some applied to the whole of the Peninsula. It seems probable, however, that many of the early collections labeled "Cape York" came from the northern tip of the Peninsula and not far from Somerset, which is only 6 miles southeast of Cape York proper. The earliest biological collections made thereabouts appear to have been those of Jukes and Macgillivray of the survey ship "Fly" and her tender, the "Bramble." In 1844 and again in 1845, Jukes and Macgillivray visited Evans Bay (Jukes, 1847, p. 139),

about 4 miles towards Cape York from where Somerset was later established, and most likely they took advantage of surveying operations to extend their investigations to the mainland and island shores of Port Albany in 1845. [Port Albany, so named by Lieutenant C. B. Yule of the "Bramble" in 1845 (Macgillivray, 1852, p. 132, wrongly giving the year as 1846) and known today as Albany Pass or Albany Passage, is a narrow strait with Albany Island on the east side and the mainland and Somerset on the other.] Later, as naturalist of the "Rattlesnake," Macgillivray revisited Evans Bay and the vicinity of Cape York in 1848 and 1849, and in the former year collected at "Port Albany" and on Albany Island (Macgillivray, *op. cit.*). Port Albany became a calling place and anchorage for vessels before the establishment of Somerset as a government station. From 1865 until his death in 1919 Frank Jardine (see p. 147) lived at Somerset, engaged in cattle ranching, pearling, and later also in coconut planting. The hospitable Jardine house was a frequent place of call for visitors, scientific and otherwise. Jardine himself did some botanical and zoological collecting, and through his interest the field work of others was forwarded in the area.

Passing mention has been made of a number of the earliest collectors in connection with the geographical explorations which gave them their opportunities. Later activities have been chiefly in zoological fields, in which most collectors have not confined themselves to any particular group. Important work in special fields includes that of Kendal Broadbent (mammals and birds from about Somerset in 1884); A. S. Meek (birds and Lepidoptera from Bloomfield River and Cedar Bay for the Tring Museum in 1893); H. C. Robinson (mammals from the Cooktown area in 1899); H. G. Barnard (birds from the tip of the Peninsula for H. L. White in 1910-1911); Robin Kemp (birds and mammals from near Cape York in 1912); W. R. McLennan (the largest collections of birds, Cape York to Coen between 1910 and 1922); F. P. Dodd (insects); P. J. Darlington, Jr. (insects and mammals from Coen and Rocky Scrub, Harvard Australian Expedition, 1932); Donald F. Thomson (birds from Stewart River, Lloyd Bay, and the west

coast between 1928 and 1933); and Miss Gabriele Neuhäuser (mammals for the Richard Archbold collection, inland localities north to Cape York in 1938).

Among the more important contributors to botanical knowledge north of the sixteenth parallel, in addition to the earliest collectors mentioned elsewhere, were Ferdinand von Mueller, Walter Hill, and Daemel ("Cape York" and other coastal localities); W. Poland (Cooktown area and Bloomfield River); and more recently S. T. Blake (collections for the Queensland Herbarium from Coen, Cooktown, and southern inland localities in 1941 and 1943); H. Flecker (Iron Range and Portland Roads, for the North Queensland Herbarium, Cairns, in 1944); and F. W. Whitehouse (large "sampling" collections over much of the area, for the Queensland Herbarium in 1942).

The largest scientific party to visit the northern parts of the Peninsula prior to our expedition in 1948 was a British Museum expedition led by Sir G. Hubert Wilkins, which worked principally in the Temple Bay area in 1923. The prime interests of the Wilkins Expedition were zoological, especially birds and mammals. A few plants were collected by J. E. Young (Wilkins, 1928).

CLIMATE

The Cape York Peninsula lies between the tenth and eighteenth parallels of south latitude and thus is well within the tropics. Over all but a small area in the southeastern corner, the year is divided into pronounced wet and dry seasons. Generally the climate is one of ample summer rains from the northwest monsoon, January through March, and winter drought during the period of the southeast trade winds, about June through October. Local thunderstorms, beginning in October or November, bring varying amounts of rain before the onset of the wet season proper. Spells of showery weather, and also thunderstorms, may be expected in the month or two following the big rains.

Rainfall is heaviest along the east coast, where mountains rise close to the sea, and the higher the mountains the heavier the rainfall. There is also a regional increase in rainfall on the far northern and northwestern parts of the Peninsula. The relatively high rainfall of

the mountainous east coast is due in part to precipitation during the trade-wind season, especially where the mountains lie very close to the coast and across the direction of the trade winds. A small amount of winter rain falls in even the driest parts, usually in June, and in light showers, but occasionally in quantities sufficient to be useful to graziers.

Average annual rainfall varies from 30 to 35 inches in the southwestern parts of the Gulf of Carpentaria watershed, to nearly 70 inches at Cape York, about 90 inches at Cairns, and 178 inches at Deeral at the eastern base of the high Bellenden Ker Range, 22 miles south of Cairns. Deeral has the highest recorded average rainfall in Australia.

The amount of annual rainfall for any locality is variable within rather wide limits. Another aspect of variability is the time of onset and ending of the wet-season rains, which might start as early as the beginning of December and end as late as the last of April. The limited area of highest rainfall alone is secure from occasional abnormally dry spells or seasons which might locally, and in relative terms, be called droughts. Seasons of exceptionally heavy rains and high floods usually are due to tropical cyclonic storms. These cyclones or hurricanes are a regular feature of the wet season over all of the Peninsula and generally are more beneficial in the rains they bring than damaging by wind and water. But at intervals of years exceptionally severe cyclones strike the area, generally on the southeast coast, with damage in local disaster proportions. As in Florida in the United States, the residents of northeast Queensland are accustomed to these violences of the elements and take them more or less as a matter of course. Cyclonic downpours of 20 inches or more in 24 hours are not rare on the southeast coast of the Peninsula, and falls of over 30 inches have been recorded. As an extreme example of the boosting of annual rainfall by cyclonic storms, Nimmo (1948) records for Deeral 108.02 inches in March, 1945, and a total of 287.18 inches for the year.

Temperatures are high where not modified by altitude. The average annual mean is over 80° F. at Cape York. At Cairns (Gentili, 1947), average mean is 76.5° F. with January (82.2° F.) the hottest month and July

(69.9° F.) the coolest.

Average annual rainfall is theoretically equal to or in excess of average potential evaporation-transpiration losses in a belt about 25 to 50 miles wide extending north along the east coast to the Pascoe River and taking in all the Peninsula north of a line drawn approximately southwest from the Pascoe to the mouth of the Edward River on the Gulf of Carpentaria coast. The dry edge of this belt corresponds with the 50-inch isohyet, and perennial streams, except for a few fed by springs, are found only within this area (Nimmo, *ibid.*). This is a generalization which can also be applied to the distribution of rain forest as a climax type of vegetation, although in actual fact few rivers between the Cairns-Cooktown high rainfall area and the extreme north of the Peninsula maintain a permanent flow from source to sea, and climax rain forest is confined to a few especially favorable areas within the belt above defined.

SOILS

In a preliminary classification and mapping of the major soil groups of Australia, Prescott (1931) classes the soils of the whole of the Cape York Peninsula as podsoles, with the exception of an area in the vicinity of Cairns and including the Atherton Tableland, in which both red loams and podsoles occur. Lateritic formations are considered important zonal features over a very large area which roughly corresponds with the Gulf of Carpentaria watershed as far north as about latitude 12° 05' S. and includes all of the Peninsula northward from there.

The red loams recognized by Prescott are developed under rain forest. We noted deep red soils, which may or may not be comparable with these red loams, in the rain-forested tracts of the Mt. Finnegan and Iron Range areas, farther north on the Peninsula.

Leached, gray, podsollic soils were present throughout the working area of the expedition. "Sour flats" of gray soil, boggy when saturated by wet-season rains and setting hard in the dry season, were frequent in the valleys and hollows of hilly and ridgy terrain. Wide expanses of this and somewhat similar types of soil are called "spewy country" from the character of the saturated subsurface soil

when the grassy crust is broken through in the wet season.

Laterite was also found, at least locally, in all the territory covered by the expedition. It occurred either as pebbles lying on the surface or buried in the soil or, particularly in the more northern parts of the Peninsula, in the form of massive beds. "Pebbly ridges" or "ironstone ridges" commonly alternated with sour flats in areas of low relief. These lateritic ridges do not ordinarily become boggy in the wet season. The roads of the country follow them whenever possible, and they are favored sites for airdromes. The consolidated laterite beds are often referred to locally as "a sort of conglomerate rock." They may have little or no soil cover. But more often they are masked by accumulations of soil except where exposed by the cutting action of streams or on the eroded edges of tableland formations. Extensive outcrops of such laterite occurred at Lockerbie and Newcastle Bay and between Mein and the Archer River.

Gentle ridges of deep, loose, sandy loam, probably of diverse origin, occurred here and there in inland localities from Laura northward to near Cape York. The sand-ridge soils vary in color from generally grayish or slightly reddish in the climatically wetter areas to deeply reddish in the drier areas. The greatest development of inland sand ridges encountered was along the telegraph line between Laura and the Morehead River, where the soils were of the "red" type. Lemon-leaf tobacco is grown very successfully on the sand-ridge soils of Laura. The sand ridges are of special value to the cattleman in that, if burned after the early thunderstorms, the deep-rooted grasses soon produce fresh green feed. If burned soon after the wet season the sand-ridge grasses maintain some growth throughout the dry months.

Coastal dunes of shifting sand, or sand stabilized by scrub, are a conspicuous feature of the eastern littoral at intervals between Cooktown and Somerset. The most extensive dune formations observed were, from south to north: (1) at the base of Cape Bedford, (2) a stretch of about 20 miles between the McIvor and Starcke rivers, (3) southern parts of Temple Bay, and (4) most of the coast from Olive River in Temple Bay to the mouth of the Escape River. A smaller dune area was

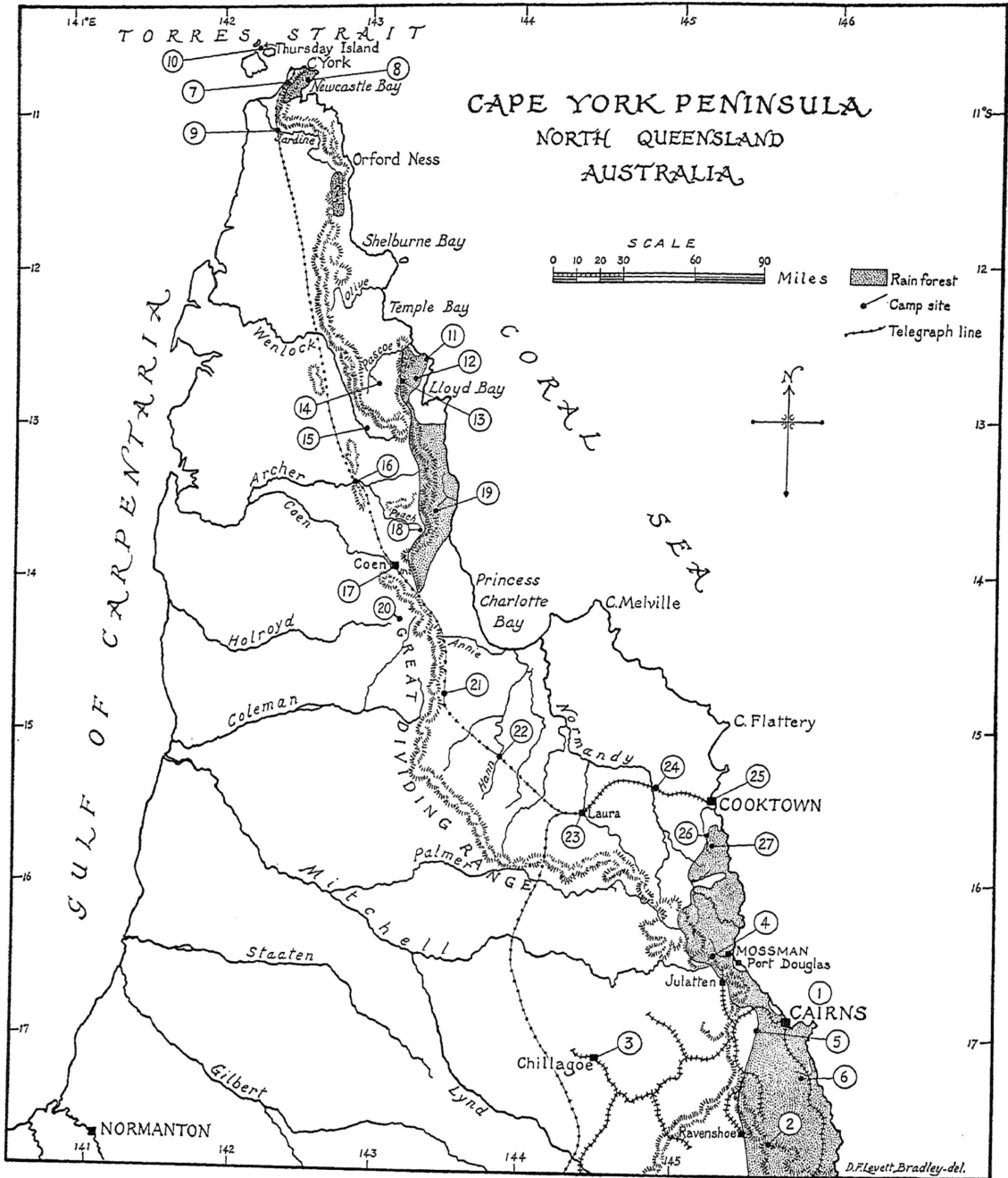


FIG. 1. Map showing camps and collecting stations of the Archbold Cape York Expedition and principal areas of rain forest. 1, Cairns; 2, Walter Hill Range; 3, Chillagoe; 4, Mossman River Gorge; 5, Speewah; 6, Junction Creek, Russell River (and Mt. Bellenden Ker); 7, Lockerbie; 8, Naru Point, Newcastle Bay; 9, Jardine River Crossing; 10, Thursday Island; 11, Portland Roads; 12, Iron Range; 13, Tozer Gap (and Tozer Range); 14, Brown's Creek, Pascoe River; 15, Wenlock; 16, Archer River Crossing; 17, Coen; 18, Bonanza Creek, upper Peach River; 19, Leo Creek, upper Nesbit River; 20, Ebagoola; 21, Musgrave; 22, Hann River Crossing; 23, Laura; 24, Alderbury; 25, Cooktown; 26, Helenvale (also Black Mountain and Annan River); 26, Shipton's Flat (also upper Parrot Creek and Mt. Finnegan).

worked by the expedition in Newcastle Bay.

Patches of heavy blackish, brownish, or yellowish soils were present in most of the localities we visited from near Cooktown to near Cape York. Surrounded by the predominantly sandy, permeable soils, the "black soil flats" (as they were called, without regard for soil color) were usually quite small in area. They carried as vegetation distinctive types of open forest or sometimes treeless grassland. The soil surface was uneven, with grassy hummocks and bare depressions in which water lay in the wet season and large cracks caused by soil shrinkage appeared in the dry season. From their uneven surface, the black soil flats were also called "melon-hole flats." "Gilgai country" was another name. One small patch of blackish soil, about 15 miles south of Cooktown, was on basalt. Other occurrences were on granite. The largest area of heavy soil, measurable in square miles, was at Mein. The yellowish soils of Mein are reported to be derived from Cretaceous sedimentary rocks, and with other extensive tracts of like origin farther south and out of our area on the Peninsula, they have been dubbed "cretaceous downs." The natural pastures of the heavy soils are of special value in their fattening qualities for stock.

VEGETATION TYPES

Several classifications have been made of the major vegetation types of Australia and the State of Queensland. Blake (1938) has presented an excellent study of the plant communities of western Queensland. With the exception of its southeastern corner, however, the Cape York Peninsula has received little attention from botanists and plant ecologists. Thus the broad classifications, when they have included the Peninsula, have in large part been based on deductive or presumptive evidence gleaned from the reports of explorers, land surveyors, and other non-botanical observers.

Prescott (1931) recognized and mapped 11 "Principal Vegetation Associations" for Australia, and only two for the Peninsula, namely, tropical savanna woodlands and rain forests. In indicating the occurrence of rain forests north of the fifteenth parallel, his map differs in important points from observa-

tions made on our expedition.

McTaggart (1936) has since published a survey of the pastures and a pasture map of Australia, recognizing 14 "Major Zones" or types of pasture lands for the continent. For the Peninsula his map shows (1) tropical open forest, (2) rain forest-northern, (3) open grassland-northern, and (4) spinifex (*Triodia* species) pastures. We found the map less accurate than Prescott's in regard to rain-forest distribution. Open grasslands (the Cretaceous downs already mentioned) are shown as occurring only in the Mein area. The area coverage of spinifex on the northern end of the Peninsula would appear to be much exaggerated.

A classification of the vegetation of Queensland adopted by White (1930) comes nearest to filling the requirements for our area. It is given below, with the addition of monsoon forest, which Blake (1940) has recognized as occurring in Queensland:

Littoral forests

1. Mangrove forests
2. Beach forests

Sub-littoral forests

1. Fresh-water swamps (coastal swamps or tea-tree swamps)
2. "Wallum"

Open *Eucalyptus* forests

Rain forests

Monsoon forests

River forests

Inland scrubs

Native grassland

1. Interior pastures
2. Salt meadow

The open *Eucalyptus* forests of White include the tropical savanna woodlands of Prescott and the tropical open forest of McTaggart. They also include, in our area, McTaggart's spinifex pastures. "Spinifex" or "spinifex country" are convenient catch-all terms in use for widely differing plant communities in which species of stiff, pungent-leaved, clumped, or tufted grasses of the genus *Triodia* are present or dominant. The spinifex communities vary from treeless sub-desert in the arid far interior of the continent, with *Triodia* dominant, to open forest of various types in higher rainfall areas, in which other *Triodia* species are important grasses. The only spinifex country seen by us

on the Peninsula was at Wenlock, where it was of the open-forest type, on the lateritic top of a sandstone tableland.

Following is a summary of the major plant communities encountered by us on the Peninsula, with notes on their relationships, and observations on the occurrence of some of the communities in New Guinea.

OPEN FOREST

This great, varied formation occupies most of the Peninsula and much of eastern and northern Australia. On differences in tree spacing it could be called savanna forest, savanna woodland, or savanna, but the terms open forest, or simply "forest," are in exclusive local use. *Eucalyptus* species are the principal trees, with other capsular Myrtaceae, such as *Melaleuca* and *Tristania*, and species of *Casuarina*, *Acacia*, *Grevillea*, and *Banksia* more or less important. Malaysian, paleotropical, and pantropical relationships show up in such trees of minor importance as *Careya*, *Timonius*, *Wormia*, *Erythrophloeum*, and *Parinarium*. Fires, lit by man or by lightning, burn the grassy ground cover usually every year or two.

Species of *Melaleuca*, called "tea-trees," characterize distinctive communities developed on poorly drained gray soils—the sour flats already mentioned. These communities grade into the fresh-water tea-tree swamp forests of White. On the Peninsula, however, we saw very little real swamp forest.

The *Eucalyptus*-other species open forest extends into south New Guinea, where it covers thousands of square miles of lowlands (Lam, 1934; Brass, 1938; Rand and Brass, 1941), and into southeast New Guinea (Lane-Poole, 1925; Archbold and Rand, 1935; Brass, 1941). I have observed small areas of open *Eucalyptus* forest while flying over southern Timor.

RAIN FOREST

The presence of extensive tropical rain forests of predominantly Malaysian relationships has led some authors to include north-eastern Australia in the Malaysian phytogeographic region. Colloquially, this type of vegetation is called "scrub" or "vine scrub" in Queensland. Its greatest development is in the area of highest mountains and highest rainfall in the southeastern part of the

Peninsula and extending north to Mt. Amos, some 16 miles below Cooktown.

Isolated gallery strips of edaphic rain forest, or mere sprinklings of rain-forest trees, occur on the banks of streams traversing open forest, sometimes in even the driest areas. Other isolated occurrences, of small extent, are found where soils or soil moisture are favorable, usually close to the coast. The only large, inferentially climatic, tracts north of Mt. Amos are (1) the Rocky Scrub of the McIlwraith Range, probably connected tenuously with rather extensive developments on the closely parallel Macrossan Range; (2) the Iron Range Scrub of the Lloyd Bay and Weymouth Bay hinterland; and (3) an area just south of Cape York, for which the name Lockerbie Scrub is in local use. What appeared to be another large tract was seen from the air, under poor conditions for observing, about the head of the Jardine River (see p. 161).

In positions between Cooktown and the McIlwraith Range, Prescott shows on his map one large and two smaller tracts of rain forest; McTaggart on his map, two large tracts. From inquiries and air observations made in 1948, I should say that the one occurrence of note, and that not large, is on a patch of basalt on the McIvor River. This 150-mile stretch of country between Cooktown and the McIlwraith Range is in general the driest area on all the east coastal fall from the base of the Peninsula to Cape York. It also contains the least rain forest and may be expected to prove the most important gap in the present-day distribution of rain-forest plants and animals.

McTaggart's map shows the Rocky and Iron Range scrubs as one continuous body of rain forest. If they are continuous, the connection is slight. Neither Prescott nor McTaggart shows the quite extensive Lockerbie rain forests.

White's river forests, as represented in our area, are composed in part of rain-forest trees and in part of hygrophilous open-forest trees such as forms of "*Melaleuca leucadendron*,"¹ with the addition, perhaps, of monsoon-forest elements.

¹ The complex of forms comprising *Melaleuca leucadendron* is under revision by S. T. Blake, Queensland Herbarium.

MONSOON FOREST

It is not always easy to draw distinctions between rain forest and monsoon forest. There are transition forests in the areas of least heavy rainfall where rain forest occurs but where clearly recognizable monsoon forest is not present. For example, the Lockerbie Scrub contains monsoon-forest elements about its borders. Considered as seasonally dry forests with deciduous or semi-deciduous upper storey trees, and more or less sclerophyllous and sometimes deciduous or spiny woody undergrowth, the one sizeable area of monsoon forest met with in our area was on the western slopes of the McIlwraith Range at the head of the Peach River.

SCRUBS

A number of types of closely spaced low woody vegetation occurred, especially on the more northern parts of the Peninsula, where some of them covered large areas. Most types of scrub were called "turkey-bush." There would seem to be no usable distinction between scrubs that are turkey-bush and scrubs that are not. The "turkeys" of the country are mound-building megapodes, found commonly in rain forest. I have not seen these birds (or their nesting mounds) in any of the true scrubs, but according to local information they do occur there, and are partial to the small fleshy fruits of epacridaceous shrubs ("turkey-bushes") which grow in some types of scrub. However, some types regularly containing epacrids are not called turkey-bush, and vice versa. The epacrids appear always to be minor elements in the scrub flora.

Practically all occurrences of scrub had major characterizing dominants. These were the principal types met with:

Dune scrub
Black tea-tree scrub
Mountain turkey-bush
Smooth-barked turkey-bush
Wallum

The dune scrubs are the stabilizing vegetation of extensive dune formations on the eastern littoral mentioned on page 161. From the air, they appear bushy-topped and somewhat brownish. In the one area of dune scrub

examined from the ground, at Newcastle Bay, the composition was a mixture of black tea-tree and rain-forest elements, and succession definitely to rain forest.

The black tea-tree scrubs, surrounded by open forest or adjoining rain forest, occupied very low sandy ridges, chiefly north of the Jardine River. They took their name from the dark gray, fibrous bark of the dominant trees. These trees, chiefly *Leptospermum fabricia*, heath-like *Thryptomene oligandra*, *Melaleuca angustifolia*, and a red-flowered species near *M. symphyocarpa*, all of the Myrtaceae, formed dense stands up to about 30 feet tall. A subseral position to rain forest appeared to be indicated.

For want of a distinguishing local name, mountain turkey-bush is here applied to dense and often very rigid scrubs developed under misty and apparently fairly wet climatic conditions at elevations of about 900 to 1800 feet on Tozer Range, inland from Lloyd Bay. Composition is very mixed, with red-flowered *Melaleuca* aff. *symphyocarpa*, a *Casuarina*, *Leptospermum fabricia*, and, locally, *Agonis lysicephala* taking large parts as shrubs or small trees averaging 8 to 10 feet in height. A number of dominants and subsidiary species are shared with the black tea-tree and wallum communities. Phylogenetic relationships are with the Australian open-forest and wallum floras, but succession is to rain forest.

The smooth-barked turkey-bush scrubs occupied dry, rocky, granite ridges in the Pascoe River valley, and occurred under much wetter but otherwise comparable conditions on Tozer Range. They consisted of practically pure stands of an undescribed new species of *Leptospermum* (19346), generally about 15 to 20 feet high. This beautiful little tree of contorted, spreading habit, with smooth purplish bark and ericoid leaves, formed a thin peripheral canopy. In spite of the thin canopy, ground-cover plants were practically absent in most of this scrub.

White (1930), describing the wallum of southeastern Queensland, calls it "barren country in the coastal belt" consisting largely of peat swamps alternating with sandy ridges covered with a sclerophyllous woodland of low, stunted eucalypts, *Banksia aemula*, and other trees. *Sphagnum* may be present, but

the formation of peat is mostly by other plants. The swamps and sandy ridges support a rich flora of shrubs and undershrubs, particularly Leguminosae, Myrtaceae, Epacridaceae, Rutaceae, and Proteaceae endemic in Australia. "Wallum" is an aboriginal name for *Banksia aemula*. According to Blake (1940) the successional relationships of the wallum communities are not clear, but "Drainage appears to be an important factor, the succession from wet to dry being open swamp, *Melaleuca* swamp, *Melaleuca* forest, wallum flats, open forest with undergrowth (wallum scrub), open forest with little undergrowth . . . there is also sometimes a tendency to the development of rain forest. . . ."

Application of the term northern wallum is here proposed for scrubs long known as "Cape York heaths" and "wet desert," but which, up to the time of our expedition, apparently had not been examined botanically. This wallum is reported to occupy large areas in central and eastern parts of the Peninsula between the Batavia River and the Jardine River. We found it as far south as the Pascoe Valley and as far north as Newcastle Bay in our collecting localities, and from air observations it would appear to occur in swales of all the coastal dune areas from Cape Bedford northward. All of Blake's successional stages were present, and in addition quaking bogs, in which alone the ground was peaty. *Sphagnum* did not occur. Considering the extent of the wallum, it was rather poor in plant species. Present in all the communities, and usually the overwhelming dominant of a grayish low scrub covering extensive tracts of poorly drained gray sandy soil, was *Agonis lysicephala*, a slender ericoid shrub of the Myrtaceae called "turkey-bush tea-tree." Co-dominants of the scrub included species of *Fenzlia*, *Dodonaea*, *Jacksonia*, and *Hovea*; and among smaller shrubs species of *Hibbertia*, *Gompholobium*, *Boronia*, and Epacridaceae were usually present. On higher ground *Banksia dentata*, *Grevillea glauca*, and other species came in as overtopping small trees.

Wallum scrub, dominated by *Agonis lysicephala*, occurs in the Wassi Kussa area in

coastal south New Guinea (Rand and Brass, 1940, p. 356), directly across Torres Strait from the Cape York Peninsula.

HIGH-MOUNTAIN SCRUB

Following rain forest in altitudinal sequence and covering the tops of the highest mountains is a densely packed, mossy, low forest or scrub which seems to merit recognition as a distinct major community. We encountered it on Mt. Finnegan and Mt. Bellenden Ker, the former mountain being now its northernmost known limit. Characteristic elements include species of *Austromyrtus*, *Drimys*, *Bubbia*, *Balanops*, *Orites*, *Quintinia*; *Rhododendron lochae*, *Agapetes meiniana*; and on Bellenden Ker, *Dracophyllum sayeri* and *Leptospermum wooroonooran*.

OPEN GRASSLAND

Open grasslands did not occur in any of our collecting localities. The only areas of any considerable size we saw inland were one of several square miles at Mein and a much smaller one at Fairview Telegraph Station, near Laura. These occurrences and a number of very small patches seen elsewhere were all on heavy, more or less hummocked soils. *Themeda australis* and *Bothriochloa intermedia* were important grasses at Mein. A wide area of open grasslands was observed from the air on river plains at the foot of Princess Charlotte Bay.

BEACH FOREST

Fronting the sea on the sandy shores of Newcastle Bay, above high-water mark, were small representations of two types of beach forest: (1) closed, weather-beaten low forest characterized by *Calophyllum inophyllum*, and (2) open stands of *Casuarina equisetifolia* and *Pandanus* species.

MANGROVES

Developments of these tidal forests, usually small, occurred along the length of the east coast on stretches of muddy shore line and in estuaries. The largest areas observed were at the foot of Temple Bay (see p. 161) and in the Escape River delta.

ITINERARY AND NOTES ON ROUTES

INCLUDED HERE, in addition to a record of the movements of the expedition and of its members at times when they were detached from the main party, are notes on our air, sea, and land routes, and on localities in which minor collections were made. The extent of the mammal (M), herpetological (H), and plant (P) collections for all localities visited is indicated in parentheses, as information on which the scope of our work in any particular locality may readily be determined by those who study the collections or plan further biological explorations on the Peninsula. Notes on principal collecting localities are given in the next section following this.

JANUARY

Preceding the rest of the party to attend to details of advance organization, I arrived in Cairns January 27. The ship carrying the expedition cargo from New York berthed in Brisbane the same day.

FEBRUARY

On February 2 I left Cairns by air on a reconnaissance of the Peninsula and returned on the twenty-third. Geoffrey Tate and Van Deusen arrived in Cairns February 25 and George Tate the following day—all three traveling by plane. A strike of railroad and waterfront workers, then several weeks in progress, had paralyzed rail and shipping services, and our equipment and collecting supplies were held up in Brisbane, 900 miles to the south of Cairns. This circumstance forced a revision of plans which had been made for the commencement of field work on the northern tip of the Peninsula early in March. Attention therefore was turned to localities in the vicinity of Cairns that could be reached by road. Fortunately, both mammalogists had brought some equipment and supplies with them, and with the generous help of members of the local field naturalists' club and other friends, and by scouring the town for this item and that, an outfit of bare essentials for limited general collecting was assembled.

Field work began with an excursion to the Atherton Tableland on February 28–29 by George Tate, Van Deusen, and I as guests of

the field naturalists' club. From Yungaburra as a center of operations, the mammal and insect faunas were sampled, and materials of the little-known, rain-forest plant *Austro-baileya scandens* were objects of successful search (M 3, H 1, P 1).

RECONNAISSANCE OF THE PENINSULA

On the outward trip from Cairns, I flew to Thursday Island by Australian National Airways, with brief routine stops at Cooktown, Coen, and Iron Range. The flight of about 520 miles actually terminated at Horn Island, from which neighboring Thursday Island was reached by motor launch.

Weather conditions were excellent for a view of most of the eastern part of the Peninsula, where the interests of the expedition lay. After the first hundred miles, however, the scenic effects as seen from a height could hardly be called striking.

On this first 100 miles the beautiful mountain country between Cairns and Cooktown was viewed to full advantage from a course of flight between the Great Barrier Reef and the coast. Abrupt rocky headlands alternated with deep sandy coves and shallow bays—all under mountains rising steeply from near the sea. Cairns itself lay on the low shores of a salt-water inlet between mountains. The takeoff from the airport was over mangrove flats on silt, not from the inlet but from the Barron River, which dropped 1200 feet from the mountains in an engorged waterfall and rapids a few miles to the north and entered the sea through an indented pocket of rich flat lands. The flat lands were intensively planted to sugarcane and tailed off into an alluvial fan on which the mangroves grew. The Barron fan is growing faster than it should, by deposit of eroded materials from the very fertile Atherton Tableland, which has suffered in the hands of maize farmers and dairymen a pioneer exploitative phase of land usage that has had little regard for posterity.

The mountains that dominated the scene were dark with rain forest under which, on some of the lower slopes, enclaves of paler open forest could be made out. Backward, south of Cairns, was the 5000-foot Bellenden

Ker Range, covered with morning clouds above about the 3500-foot level and not distinguishable as a superior spur of the Great Dividing Range. Fifty miles to the northwest, clouds capped at about the same level the cool, blue bulk of the Mt. Spurgeon-Mt. Armit heights, in which the Great Divide reached an elevation of 4400 feet on Mt. Spurgeon and broadened into the large and still little-known Windsor Tableland, reported to lie at 3000 to 4000 feet above sea level.

Mossman, passed on the line of flight, is the northernmost sugar-growing center in Queensland. Behind it the Mossman River leaves the mountains from a conspicuous dark gorge in which the expedition was later to have a collecting camp. A few miles farther up the coast a patch of mangroves screened the mouth of the Daintree River, and mountains hid the lower valley of the river in which cleared rain-forest land was planted to pastures for dairying and cattle fattening.

From the Daintree to near Cooktown, with a break at the mouth of the Bloomfield River, a bold coastal range of mountains rose virtually from the water's edge. Outstanding heights were Thornton Peak (4508 feet), on which I had botanized in 1931 and again in 1937; Mt. Peter Botte, with a remarkable crook-necked rock pinnacle forming its 3425-foot summit; and Mt. Finnegan (3740 feet), chosen early as an objective of the expedition. Continuous rain forest, broken by only minor patches of open forest, clothed these mountains as far north as Mt. Amos (2810 feet), beyond which the range rapidly lost altitude. At Cape Tribulation, off which Captain Cook holed his ship, an isolated family group grew tropical fruits which were carried to the Cairns market by passing small craft. On the lower Bloomfield River was another lonely little settlement, long a base for miners with tin claims in the mountains.

The abrupt ending of the coast range at Mt. Amos threw open to view a broad and hilly landscape of which first impressions were of great distance and half-obscurer brown haze. While still hidden by the coast range, the Great Dividing Range had lost altitude, turned sharply inland, and was now out of sight. And with the ending of mountains high

enough to have pronounced influence on the climate, the rain forests of the wet "Cairns Coast" had given way to drab open forests of *Eucalyptus* and other trees. Outlier patches of rain forest continued, however, especially on the higher hills along the coast, and rain forests covered much of Mt. Cook (1408 feet), standing isolated near the mouth of the Endeavour River. The open forests appeared singularly lifeless under the haze, as indeed they were. Their indeterminate grays and browns were as much the hues of the soil as of the vegetation. This was cattle country. Most of the grass had been burned. The soaking wet-season rains, which would bring green to the ground and freshen the trees, were a month overdue here, although Cairns was having heavy downpours almost every day. A lighthouse on Archer Point and a telephone line and a rough two-wheel-track road leading to it were the only signs of man's work.

At Cooktown, 10 miles farther on, the Endeavour River emptied into a sheltered small harbor through low mangroves and salt flats. The town was attractively situated on high ground with a view inland to an extensive basin of flat and ridgy lands, almost ringed around by mountains, and containing isolated peaks. The highest of the mountains rose 800 or 900 feet and carried conspicuous cliffed caps of horizontal sandstone.

In the brief peak of its prosperity as port for the Palmer goldfield, Cooktown had a population estimated at 10,000 and boasted 36 hotels on its one main street. In 1948, as base of supply for a few miners working their own tin and gold claims in the hinterland, a handful of farmers, and a great area of thinly stocked cattle country, the town had shrunk to 300 inhabitants, and only three of the old hotels remained in business. A single-track railway went 67 miles towards the Palmer, to end at Laura. The old Palmer roads by which supplies were hauled over the mountains in drays, or carried on pack horses and by Chinese coolies, were too much washed out for the motor vehicles of modern transport. This left the railway sole carrier for the more distant back country. There was no rail or road connection with the larger centers of population to the south. The small ships that could pass over a shallowing bar called infrequently. Cooktown had, however, two air-

dromes important for peninsular traffic and for fueling aircraft on the route from eastern Australia to New Guinea.

Leaving the coast at Cooktown the line of flight was direct to Coen airdrome, 184 air miles to the northwest. Small bits of rain forest continued on mountain tops within the Endeavour River basin and in strips on the banks of the river and its tributaries. Beyond, on the Normanby River fall, was an expanse of about 60 miles of monotonous, dry, poor-looking open-forest ridges, often very thinly timbered with stunted trees and showing much bare, yellow and reddish soil.

Near the Normanby the open-forest ridges gave place to wide, almost treeless grass plains. Old meander scrolls on the plains showed the Normanby to be a wandering river. In flush from recent rains, the water was yellow with silt, and the main stream appeared to be about 100 yards in width. The Normanby is the largest and easternmost of several anastomosing rivers whose waters, in the wet season, meet in a maze of looping channels near the coast of Princess Charlotte Bay. Utilization of the plains has not advanced beyond the open-range grazing of cattle, although the soils are reported fertile and the area is considered to have possibilities for the cultivation of sugarcane. The plains front on the bight of the bay in a crescentic belt of short tidal creeks and large saltpans, which present a striking pattern from the air.

From the mouth of Saltwater Creek, in the saltpan area, we passed over Princess Charlotte Bay to strike the coast again near the mouth of Balclutha Creek. Here well-defined open-forest ridges sloped up to the open-forested crest of the Great Dividing Range, about 20 miles inland. The range appeared to be not more than 1000 feet high. A change to a broad coastal plain of low ridges, with a very open forest of grayish small trees, took place with the crossing of the Stewart River, in an area called the Silver Plains.

At this point the Great Dividing Range gained altitude and took on a more massive appearance. This relatively high section of the divide, extending about 80 miles north from the Stewart River and averaging perhaps 2000 to 2500 feet in altitude, bears the distinguishing name McIlwraith Range. Its

steep seaward face was crossed about 12 miles southeast of Coen. The range top had the form of a rather shallowly etched upland, sloping gradually to the west, and broadening to a width of at least 10 miles to the northeast of Coen. Rain forest, in bodies narrowing downward, filled ravines on the eastern face of the range. On the range top, rain forest at first occurred mainly in hollows, but with the widening of the upland it became continuous in considerable areas over both ridges and hollows, especially on the more elevated eastern parts of the range. The rain forests contained an abundance of tall, protruding, coniferous trees which we later found to be *Araucaria cunninghamii*, the valuable "hoop pine" of Queensland timbermen.

Coen, glimpsed under the western edge of the range, might not have attracted much attention had its few buildings not been the only habitations seen in an otherwise empty land, after a farmhouse or two near Cooktown. The airdrome was 16 miles north of the township, at an altitude of about 500 feet in the flat, open-forested valley of Croll Creek, a tributary of the Peach River.

From Coen airdrome to Iron Range the distance was 72 miles. Seen from its western side, the McIlwraith Range rose boldly and from a prominence called Mt. Croll curved east to form, with the Blue Mountains spur range projecting farther to the north, a semi-circle of mountains around the broad upper valley of the Peach. The expedition was later to camp at the head of this valley and from there cross the range to work in the Rocky Scrub rain forests of the eastern slopes.

Taller timber marked the courses of creeks in monotonous open-forested country in the Peach Valley, but the first rain forest distinguishable was on the western end of the Blue Mountains, where brushy growths occurred on rocky slopes. There were small gold mines here. Past the Blue Mountains the dry open forest continued in vast expanse, but somewhat relieving the monotony were scattered lines of hills and strips of fringing rain forest on headwater creeks of the Archer and Wenlock rivers.

The divide between Gulf of Carpentaria and Pacific waters was recrossed at Mt. Carter. This prominent peak of probably more than 2000 feet marks the northern end

of the McIlwraith Range. From it the Great Divide turns sharply west and again north and takes the name Sir William Thompson Range. Thrusting north is a spur range which bears successively the names Table Range, Tozer Range, and Janet Range, and ends near the mouth of the Pascoe River. Mt. Carter is a little-known mountain. Covering it were seemingly luxuriant rain forests several square miles in area, with many trees in flower, and tall fan palms rising well above the canopy.

Iron Range airfield, down on the coastal plain, was approached over a wide belt of open-forested low ridges stretching from the foot of the mountains to the lower Lockhart River and thence north 15 to 20 miles to about opposite Lloyd Island on Lloyd Bay. North of this, between the coast and the Tozer and Janet ranges, and ascending the slopes of these mountains, was the big area of at least 100 square miles of rain forest known as the Iron Range Scrub. This in large part was lowland rain forest, spread over valleys of the branching Claudie River and a block of ridgy terrain elevated about 50 to 450 feet above sea level. The steep seaward face and the crest of Tozer Range were largely rain forested. Not so the only slightly lower Janet Range, which on its topmost parts carried mostly open forest, and on some of its northern heights was grassy and treeless as if rather recently denuded of rain forest by fire. The continuous rain forests ended 2 or 3 miles south of the Pascoe River. To the west of them were the great open forests of the inland, and to the east a coastal strip of open forest cut them off more or less completely from the sea.

To the south, the Iron Range rain forests were continuous with an attenuated strip under the scarped eastern face of Table Range. Whether or not this strip joined with the rain forests of Mt. Carter, and these in turn continued unbroken along the length of the McIlwraith Range to the Stewart River, could not be determined with certainty on the reconnaissance flight, or subsequently. The end impression was gained, however, that if breaks occurred on the McIlwraith Range they must be slight. The rain forests of this range are probably connected with those that partially cover the closely parallel, coast-

fronting Macrossan Range by linkages across the narrow north-south valleys of the Lockhart and Nesbit rivers, which separate the two ranges.

The general locality name Iron Range derives from a ridge of iron ore, considered of great potential economic value but so far unexploited, in which, however, gold-bearing stone has been mined. The airfield is about 6 miles south of the gold mines and close below the southern edge of the continuous rain forests. It was established as a military air base during the Second World War, with adjunct installations dispersed through the surrounding area. A few sound, habitable buildings remained in 1948. One of them, a former radio station near the gold mines, was used by us as headquarters when we worked in the locality. A good road connected the airfield with Portland Roads on Weymouth Bay. Branching from this at the old radio station, and leading inland through the rain forests to Tozer Gap (between Tozer Range and Janet Range) and on south to Wenlock, Coen, and Laura, was another road, usable by motor traffic only in the dry season.

The rugged mountain country of the Peninsula ends in Carron Range, which rises directly from the shore line, and from the mouth of the Pascoe River follows the coast to Fair Cape and thence northwest to the foot of Temple Bay. Kennedy Hill, 1440 feet, is the highest peak. Parts of the range present a jagged crest line of bare, pale pinkish or brownish rock having the appearance of porphyry. Vegetation cover is chiefly open forest. There are sizable tracts of treeless grassy summit and patches of light rain forest.

North of this the highest elevation given on the maps is "about 600 feet," on the Richardson Range section of the Great Divide, behind Shelburne Bay. Surface rocks, where any appear, are reported to be horizontal sandstones, lateritic duricrust, and occasional showings of granite. For about 60 miles the only rain forest observed in an unimposing landscape of lowland plains and low hills and tablelands, stretching into the distance back from the coast, was in fringing strips on streams and in isolated small patches near the sea.

A quite extensive development of tall man-

grove forest occurred at the foot of Temple Bay. Whole patches of this forest were dead, the trees standing leafless and gray, or their long straight trunks lying prone on the mud. Disease or insect attack seemed a possible explanation for the wholesale dying of these mangroves on a coast uninhabited except for a few wandering blacks and seldom visited by anyone else.

The next conspicuous feature along the Temple Bay coast was an area of scrubby sand dunes, scarred by whitish blowouts, about the mouths of what seemed to be Glennie Creek and another big creek close to it. Between this and the Olive River came about 10 miles of somewhat elevated, apparently open-forested plain, scarped to the sea and projecting in several grassy capes on which the rock was exposed in red bluffs. One of these bluffs appears on the charts as the "Remarkable Red Cliffs." A little rain forest was seen on the edge of the escarpment.

Beginning at the Olive River was a great tract of sand dunes which, in varying depth and with an occasional break or island of solid ground, extended along the coast for about 85 air miles to the mouth of the Escape River. These dunes were no mere beach-line fringe. They reached inland as far as 10 miles. The lie of the dunes seemed generally to be parallel with the strike of the southeast trade winds, although transverse dunes also occurred. Swale ponds were common locally. Most of the dunes had an aspect of permanence under their stabilizing scrub. Blowouts of the sand were numerous, however, and small areas of more actively rejuvenating dunes were noted. Rain forest, established on some old dunes, indicated the ultimate in succession from the sand scrub. Patches of grayish shrubbery in swale depressions had the appearance of wallum scrub.

At about latitude $11^{\circ} 37' S.$ and 4 or 5 miles inland, on a course of approximately 335 degrees, we passed over the eastern edge of a large body of light-colored closed forest that looked like rain forest. Beginning on ridgy terrain which represented the Great Dividing Range at the head of the Jardine River, this forest continued for about 27 miles, with only one apparent interruption by open forest. The first 18 miles of the closed forest

seemed indeed to be rain forest. And in confirmation of its presence thereabouts in bulk, we have accounts of the harrowing experiences of the Jardine brothers in the wet season of 1865 (p. 147), cutting track for their cattle through "dense pine and vine scrub" containing *Caryota* and other tall palms. In the same general locality, 15 years later, Jack's party experienced similar trials. The conifers found by these explorers were "cypress pines," or *Callitris*, which we found growing in rain forest farther south at Tozer Gap, although they are not commonly regarded as rain-forest trees. The northern parts of the closed forest were puzzling in some respects. Rain forest was definitely recognized on elevated ridges. But much of the forest was too uniform in height, tree shape, and leaf color for the usual rain forest of many mixed species, and in several places a glint of water caught through the tree tops suggested some kind of tall swamp forest.

Farther on, the Jardine River was crossed twice over open-forested country, with rain forest patched scantily on ridges, and wallum flats, which continued to Jacky Jacky Creek. This winding, wide, salt arm was fringed with mangroves which increased towards the sea and merged into a much more extensive mangrove formation in the Escape River delta. Higgins Field, a deactivated World War II air base, lay off the north bank of the creek.

Red soil, appearing at Higgins Field for the first time north of the Iron Range area, drew attention to a change and an improvement in environmental conditions and a rapidly altering vegetation cover on approach to the tip of the Peninsula. The open forests were taller and more closely spaced than those immediately to the south. And with the rise of the land in a broad, flat-topped ridge, dark rain forest became prominent on the higher ground and in thin strips on watercourses. Pinched off at first into island-like patches in the prevailing open forest, the rain forest soon closed in to form an indented and irregular but continuous body, which occupied from one-third to one-half of the land area north of Jacky Jacky Creek. The continuous rain forests touched on the east coast, but they were cut off from the west coast by a hilly belt of open forest that reached to Cape York.

Good views of the southern islands of Torres Strait were had before the plane landed on Horn Island. The islands were coral-fringed and appeared to be chiefly of granite and old metamorphic rocks. Most of them were elevated, the larger ones rough and mountainous with top heights of 300 to 400 feet, and up to 800 feet on Prince of Wales Island and 1300 feet on distant Banks Island, visible to the north. Vegetation cover was a poor open forest of low trees, some brushy growths on rocky slopes, and small developments of rain forest. With the hilly area of the peninsular west coast near Cape York, where Mt. Brenner rose to 400 feet and Peak Hill to 460 feet, the Torres Strait Islands gave a strong impression of their being protruding heights of a foundered outlier of the eastern highlands, of which no other recognizable part was seen north of the Carron Range. With intervals between them of about 30 miles at most, the high islands extend across the Strait. A related occurrence of granite is located at Mabadauan on the opposite New Guinea coast (Rand and Brass, 1940, p. 357).

Horn Island, about 25 square miles in area, is a squarish block of dry rocky ridges on which reef gold has been mined. Thursday Island, about one-tenth the size, has somewhat greater claim to fertility and consists of a hilly ridge rising to 340 feet. The stony soil supports a thin open forest of crooked little *Eucalyptus* trees and scraps of once more extensive rain forest, plus planted shade trees in the town. It would be hard to imagine a less glamorous tropic isle, although such appurtenances as coral, pearls, and coconut palms were there.

In 1948 the stragglers little town of about 900 whites, islanders, and sundry races was staging a slow recovery from neglect and disruption of normal activities which followed the evacuation of most of the population during the war. Elements for a boom in pearl shelling were present in phenomenally high market prices and an abundance of shell at shallow depths on beds that had been worked only one season since 1941. But the pre-war fleet of 70 luggers was reduced to 30. Inexperienced white men and islanders had taken the place of the Japanese who formerly did most of the diving. As a result, the stacks of

shell in the warehouses were small when the boats ceased operations at Christmas for the customary wet-season lay-off, and when these observations were made the town was almost as stagnant as the overheated air under its galvanized iron roofs.

Thursday Island was experiencing an unseasonal drought. The household rain-water cisterns were empty, and the town water supply system had partially broken down. A promise of the long-awaited wet season came on February 8, when the wind changed to a fitful northeaster. Clouds began to build up. That night there was a shower, next morning a downpour. The air was cooler, the dust had gone from the rough streets, and so had the tension all had felt in the last days of unrelieved and unrelenting heat.

February 7 and 8 were spent on a visit to the peninsular mainland on a launch that went to Red Island Point once a week to bring fresh beef for Thursday Island. Red Island Point (abbreviated locally to R.I.P.) was attractive, with a clean sandy beach and a scattering of *Terminalia catappa* and other big shady trees. During the war it was the port for Higgins Field. A wharf built then was falling into disrepair, and the usual rusting remains of war surplus equipment lay strewn around. Fat cattle, brought long distances up the Peninsula by drovers, were held on grass until the butchers needed them. A small settlement occupied clearings in a belt of brushy rain forest that lay between the sea and the inland open forests. Some small granite knolls occurred in the neighborhood.

The country to the southeast was examined on a 10-mile jeep drive to Higgins Field by a good road of lateritic red soil built by the United States engineer unit that established the airfield. Passing over gentle ridges, the road skirted patches of rain forest in the first five miles. The tall open forests noted from the air were found to be of bloodwood (*Eucalyptus polycarpa*) and messmate (*E. tetradonia*) 60 to 80 feet high, with the latter forming practically pure stands on highly lateritized, thinly grassed ridges. Elsewhere a thick body of grass, 2 or 3 feet high, was green and fresh from early rains that had favored this part of the mainland. A typical unformed bush road led through open forest to the homestead of Mr. C. T. Holland's Lockerbie

cattle run, 11 miles northeast of Red Island Point and on the edge of the big rain forests. Lockerbie was well situated for our purposes, and on the invitation of its hospitable owner it was decided to place there the main base for work on the tip of the Peninsula.

On February 12 a boat trip was made through the Torres Strait islands west of Thursday Island and a landing made on Friday Island. The island was badly overstocked by deer said to have been brought from Java and let go years before, when the island was the site of a quarantine and leper station. Deer tracks were everywhere. Grass was scarce, and the shrubs and low trees of a scrubby open forest and patches of brushy rain forest were heavily browsed. Wallaby sign also was seen, and a skull picked up was later identified by George Tate as *Protemnodon agilis*.

Apparently there is no record of wallabies being indigenous on any of the Torres Strait islands. Those of Friday Island were probably introduced from the mainland. In the late 1930's, according to Mr. C. O'Leary, Director of Native Affairs and formerly Protector of Islanders resident in the Strait, wallabies were brought from the Mitchell River and liberated on Badu Island (Mulgrave Island) by a St. Paul's Mission teacher named Samuel Kiwat.

February 13 I returned by air to Iron Range, made a ground inspection of that locality, and went on to Portland Roads as the guest of Mr. and Mrs. Douglas Fisher. By this time the wet season had set in in earnest on the northern parts of the Peninsula. Nearly 12 inches of rain fell in the 48 hours after my arrival at Portland Roads.

Portland Roads still bore evidence of having been the busy landing place for Iron Range Airfield during the war. A jetty, designed to accommodate big ships, was left to serve the small steamer which made monthly calls with supplies for Wenlock and about 20 miners and prospectors in the more immediate neighborhood. The jetty-keeper and the Fisher family of five comprised the population of Portland Roads itself. Mr. Fisher kindly offered for our use one of several buildings of a war-time radar station which he owned.

On February 16 I left Portland Roads for

Cooktown on the 52-foot motor vessel "Lochiel," on what proved to be anything but a pleasant voyage inside the Great Barrier Reef. Rough seas and head winds of gale force were encountered from a cyclonic disturbance. The little ship, over-buoyant with a cargo of empty gasoline drums below and on deck, was several times forced to take shelter behind islands and arrived in Cooktown on the twentieth, two days overdue and out of food.

Next day, with a hired truck and several volunteer helpers in case of trouble on the road, I visited Shipton's Flat, 30 miles south of Cooktown and under the western slopes of Mt. Finnegan. The unformed dirt road gave access to tin mining country in the mountains at the head of the Annan and Normanby rivers and had been used for hauling lumber from a sawmill at Shipton's Flat. Heavy rains, flooding unbridged streams, made the road impassable at times in the wet season. But on this wet-weather trip the only difficulties were with slippery conditions on red-soil mountain ridges, and the bogging down of the truck on a tea-tree flat through a mistake of the driver in leaving the old hard-packed road and trying to follow a new one.

Four miles from Cooktown a mangrove-fringed reach of the lower Annan was crossed on a good bridge. At Green Hills cattle station, about 6 miles farther on, astonishing numbers of wallabies, running into hundreds, were seen about sunset on the return journey. The animals were feeding on short new grass the rains had produced in burned open forest. They varied in size from small to very large. Two species may have been present, for some were a rusty brown, others grayish, in color.

Some 16 or 17 miles on the way the road passed through a gap in a spectacular high ridge of loose granite boulders appropriately named Black Mountain. Black with the color of coating algae, the rocks were piled in a jumbled mass rising in places 1000 feet above the surrounding country, bare of soil, and of vegetation apart from a few patches of brushy tree growth. Black Mountain is inhabited by rock wallabies (*Petrogale*). It is held in superstitious fear by the aborigines, who will not go near it at night.

We came to the mountains proper at Helenvale, on the Annan River 21 miles from

Cooktown, and about west of the northern end of the coast range and its big rain forests at Mt. Amos. After 50 years in which tin mining had waxed and waned in the mountains thereabouts, Helenvale survived as the center from which supplies were taken to the workings by pack-horse train, or by motor truck, which carried bags of tin ore as return loading. It consisted of the packer's corrals and saddle sheds, and the Lion's Den Hotel, a picturesque old bush hostelry of round timbers and galvanized iron, shaded by great mango trees rooting in the alluvial soil of the river bank.

From Helenvale, 330 feet above sea level, the road passed through some good fringing rain forest as it followed the rocky and sandy Annan 2 miles to "The Forks," where an eastern branch, called Wallaby Creek, was crossed on a bridge at its junction with the main stream. From there, climbing through good tall open forest and past patches of rain forest, the road reached an altitude of over 1000 feet on spur ridges of the coast range before it dropped down to Shipton's Flat, in the narrow valley of Parrot Creek, another big tributary of the Annan.

Shipton's Flat was at an altitude of about 900 feet, about a mile from the base of Mt. Finnegan and 3 miles from its summit. The peak stood high above rugged mountain country, black with clothing rain forest and looking like a stiff climb. From Mr. J. T. Roberts, caretaker of the idle sawmill and solitary householder at the Flat, it was learned that owing to washouts this was as far as the truck could go, although logging roads went to the foot of the peak and ramified through the great rain forests of the range top to the north of Mt. Finnegan. The sawmill living quarters had been offered for the use of the expedition by the owners, Messrs. Bunning Brothers of Cairns. For range of altitude and diversity of habitat within practicable reach from a main line of supply, no better base could have been had for work on the coast range between Cooktown and the Daintree River.

The preliminary reconnaissance of the Peninsula ended February 23 with my return to Cairns from Cooktown by air. From new knowledge gained of the bodies of rain forest, which from the Papuan affinities of their

flora and fauna were of particular importance to us, the large tracts of the Lockerbie, Iron Range, Rocky Scrub, and Mt. Finnegan areas were clinched in plans as prime centers for field work. Only the Rocky Scrub still presented problems of approach. Sites for base camps and some subsidiary camps were chosen for the other principal localities, and arrangements were made for most of the land transport which would be required for the operations of the party.

The reconnaissance also confirmed previous recognition of the fact that no one party of men could hope to accomplish in six months more than a very incomplete examination of even the eastern part of the Peninsula, let alone the western and central parts, which though doubtless less varied and overall rich in plant and animal life, deserved more attention than they had received up to that time. As it was, lack of time and difficulty of access ruled out of our program work in any one of the extensive sand-dune areas on the eastern coast.

MARCH

This was a month of disappointed hopes for the ending of the transport strike, tempered by moderate achievements in field work in the area surrounding Cairns.

From March 3 to 8 George Tate and Van Deusen collected inland, the former spending most of his time on bat hunts in limestone caves near Chillagoe and in mines at Lappa Lappa and Irvinebank (M 33, H 4). Van Deusen based at a Main Roads construction camp in virgin rain forest at an altitude of about 2500 feet on the Walter Hill Range, 12 miles south of Millaa Millaa on the Maalan-Suttie's Gap Road (M 27, H 5). He also visited Ravenshoe (M 4, H 3). Field work on the Walter Hill Range was hampered by very wet weather.

On March 11 Geoffrey Tate and Van Deusen established a collecting camp in the Mossman River Gorge, where I joined them on the fifteenth, and the three of us remained until the nineteenth (M 25, H 9, P 40).

March 15 to 19 was occupied by George Tate on a visit to the farm of Mr. P. Hanna on Devil Devil Creek, near Julatten, primarily in search of the shy and seldom collected least rat-kangaroo (*Hypsiprymnodon*),

which he was successful in shooting in the rain forest (M 21, H 2).

With members of the naturalists' club, all members of our party visited Speewah, in the valley of the upper Clohesy River, March 26 to 29 (M 32, H 14, P 47).

Bat hunts were carried out in the flume tunnel of a hydro-electric plant at Barron Falls (M 4); in granite fissures under White Cliffs, on the ocean front about 25 miles north of Cairns (M 2); and at a flying-fox camp at Koah, on the lower Clohesy River (M 4). From various short excursions, and contributions from local residents, 20 mammals and 14 reptiles and amphibians were added to the collections.

APRIL

Our more important field work in the vicinity of Cairns was concluded at a camp on the Junction Creek tributary of the Russell River, occupied by all the party April 1 to 8 (M 66, H 6, P 32). This camp was at the eastern foot of Mt. Bellenden Ker, and from it George Tate and I made an ascent of the 5220-foot central peak of the mountain April 5 to 7 (P 59).

The transport strike ended while we were on Bellenden Ker and by April 13 our cargo was unloaded in Cairns.

VOYAGE FROM CAIRNS TO RED ISLAND POINT

With full equipment and supplies for two months, we left Cairns on the roach-infested "Lochiel" about midnight of April 15. The vessel, bound for Thursday Island with relief supplies of food stuffs, would by arrangement drop our party at Red Island Point. Quarters down below were cramped, to say the least of it, and movement on deck a scramble over piled cases of fruit, vegetables, eggs, and sacks of butcher's salt. But fortunately for both cargo and passengers the weather held fair for the four-day voyage.

A call was made at Cooktown the evening of the sixteenth, and at dawn next morning Cape Flattery lay abeam. This prominent feature and Point Lookout, another bold cape about 11 miles farther up the coast, have steep bases of reddish rock and largely grass-covered upper slopes. They jut out from the great tract of scrubby sand dunes which lie between the McIvor and Starcke rivers and

perhaps are continuous with the dunes of the Cape Bedford area farther south.

Past the dune area was an inhospitable, rocky, and mountainous coast extending about 60 miles to Cape Melville. Off this coast and within the Great Barrier Reef were numerous high and low islands and coral reefs. We made a stop at Switzer Reef to examine a wrecked pearling vessel and to take some exercise by wading on the coral at low tide and fossicking for shells. Cape Melville, passed in the night on this trip but seen on my first voyage on the "Lochiel," is a high, rough mass of hills of purple-gray bare rock and loose boulders, reported to be granite, on which sparse patches of low brush occur. It is the most sterile headland on a coast that for well over 400 miles between Cooktown and Cape York seldom presents any semblance of luxuriance as viewed from a passing vessel and impresses one as much with its vast emptiness in terms of human occupation as with its headlands and bays and mountains.

At daylight on the eighteenth the Flinders Group of islands lay well astern, and heights of the Great Dividing Range showed far to the west across Princess Charlotte Bay. Farther north the blue heights of the McIlwraith Range were topped with white cloud which soon broke and scattered as the sun gained strength. Still farther north our course later in the day took us close to the Macrossan Range, which rose parallel with the shore for some 50 miles and had 28 peaks and eminences of 1000 feet to over 1600 feet in elevation.

Though considerably lower than the McIlwraith Range, which stands directly behind it, the Macrossan Range figures more prominently on the maps. It carries much rain forest on its seaward side. This forest is mostly on the middle to upper slopes and on the crest of the range, while the lower slopes and a narrow coastal plain are occupied by open forest. Conspicuous pale green areas showed where the rain forests appeared to have been destroyed by fire and replaced by grass. The most striking occurrences of this induced grassland were on spur ridges, on several of which fires had burned a narrow strip, no wider than a road clearing, reaching clear to the top of the range between dark

walls of rain forest. Similar patterns of open grassland and rain forest occur in the Cairns area, where they are definitely the result of fires.

The Macrossan Range tails off in its northern extremity to an open-forested ridge a few hundred feet in height at most, which ends in a 490-foot granite hill on Cape Direction. A dense scrubby vegetation on the cape appeared still to be as Jukes the naturalist described it more than 100 years before (1847, p. 107), with one important difference. At that time the scrub gave concealment to natives who fatally speared a seaman of Jukes' landing party from the survey vessel "Bramble," in one of the violent actions which not infrequently marked the contacts of white men with black on the Peninsula until times within living memory. That is changed now. From Lockhart River Mission, a few miles south of the cape, the men hire out as divers on trochus-shelling boats and have the reputation of being good workers, easy to manage.

Sunday Island, northernmost of a group of small to largish elevated islands of reddish rock off Cape Grenville, was passed early in the morning of the nineteenth. White sand hills showed on the cape and at intervals northward along the unimpressive scrubby sand-dune coast of Shelburne Bay.

Later in the day the engine gave out. An anchorage in the lee of the Hannibal Islands was reached under sail, and while the engineer worked below, passengers and crew went ashore to explore and try for something for the larder. There were two small islands, about half a mile apart on the eastern and western edges of a circular coral reef. The western island, on which we landed, was raised perhaps 10 feet above high-water mark. It consisted of coral sand resting on a base of flat-bedded rock that appeared to be composed mainly of coral sand cemented by lime. A roosting place for Torres Strait pigeons (*Myristicivora spilorrhoea*), the island above the tides was covered with brushy low forest containing large wongai trees (*Mimusops browniana*). *Casuarina equisetifolia* and other strand trees edged the forest, and beach trailers spread over the sand. Parts of the reef shallowly submerged at low tide carried a rich algal flora and several species of brain

coral. Efforts at spearing fish along the edge of the reef, and diving for crayfish with glass facepiece and spear, yielded nothing. But results were better for turtle eggs, discovered just above high-water mark by pushing a stick down into the sand and examining it for telltale signs. About 60 eggs were dug out from one "nest," 110 by actual count from another. Crew opinion differed as to whether the nests were of hawkbill or green turtle. Whatever the species, the eggs made excellent omelettes. Some eggs that had started to incubate were preserved by George Tate and Van Deusen for Kesteven's studies on embryology.

The anchor was raised at nightfall, and by dawn we had passed through Albany Pass and were rounding Cape York, marked by a flashing navigation light on off-lying Eborac Island. Entering Endeavour Strait about two hours later we coasted the western side of Possession Island, where a monument on a rocky little promontory commemorated the landing of Captain Cook in 1770. In 1895 it was discovered that, unknown to Cook, his historic flag-raising ceremony was performed on the top of a gold-bearing reef. We did not land on the island, but on a subsequent trip Bill Wallace and Terry McLeod of the "Lochiel" crew went ashore and as a result our collections benefited by a good catch of bats (*Chalinolobus rogersi*, *Miniopterus schreibersii blepotis*, *Taphozous australis*) taken in old mine tunnels a few yards from the monument.

The next, and last, point of special interest was Red Island Point itself and the tricky, narrow channel through shore-fringing reefs by which the "Lochiel" was taken to tie up at the wharf about mid-morning.

The voyage from Cairns, through the barrier reef lagoon and close to land, had been slow but pleasant and at all times full of interest. In its leisurely progress it had given, better than any airplane flight could, an appreciation of the great size of the Peninsula. Long stretches of uninhabited coast always invited observation in daylight hours. In glimpses of what lay behind the coast, the voyage gave revealing impressions of the character and possibilities of the area in which our work was to be done. Physically the coast had ruggedness, but north of Cook-

town it lacked grandeur. It presented few striking ecological contrasts. Almost always in view was some part of the ubiquitous dry open forest that in one form or another covers, and imparts a certain monotony of character to, all but a small fraction of the total land area.

At Red Island Point we were joined by McLaughlin. The unloading of cargo had not progressed far when two black boys rode in, barefooted in their stirrups, from Cowal Creek Mission, some 8 or 10 miles to the south. Following them on foot was an older man carrying, besides his "swag" or bedroll, a bunch of spears and a woomera. Advance arrangements had been made for the employment of the three aborigines, the two younger of whom did not turn out satisfactorily and soon were replaced by others who served loyally and well throughout the expedition. Old George Moreton lived up to his reputation as a first-class hunter, as accustomed to firearms as to his spears. With Roy Stephen, whose skill went more to trapping, he helped in the collection of mammals. Willie Somerset developed into a valuable helper in the plants department.

Upon arrival at Red Island Point on April 20 we were also met by Mr. Holland with his truck, and by evening our tents and flies were partly set up under a group of shady mango trees on the edge of the Lockerbie homestead clearing. With kindly forethought, Mr. Holland had made extensive preparations for our coming. We found a shack set up for cookhouse and dining place, a shower room with water piped in from a spring that supplied the homestead, and even a pile of wood for a stove provided for the cook.

MAY

Collecting from Lockerbie base camp continued until May 6, when we moved across to the east coast and established a camp on Newcastle Bay, about $2\frac{1}{2}$ miles south of Somerset.

It was still early after the wet season for bush travel, and the journey of 12 miles to the Newcastle Bay camp site occupied five and a half hours. For 2 miles we skirted the broad central ridge, then turned east up a small valley and into the rain forest (the "Big Scrub") that covered the ridge. Within

another mile the road came to a house in a new garden clearing, then, in an open forest pocket completely surrounded by the rain forest, a small sawmill. The owner of this establishment, Mr. Tom Holland, was cutting timber mainly for making the heavy cases in which pearl shell is packed for export from Thursday Island.

For 3 miles past the sawmill the rain forest continued unbroken on the central ridge, and it was there that our troubles began. Trees had been broken and uprooted by a cyclone, and stout looping vines shaken down over a road which at most was only an old cut trail giving bare clearance for the passage of the truck. The vines threatened to drag us from our perches on the loaded vehicle. Fallen trees had to be cleared from the road, or a new road cut when that promised least labor. In enclosed pockets of open forest which appeared again on the eastern fall of the ridge, at least there were no vines to contend with. Downed timber could often be dodged by detouring through long grass that reduced the driver's ground visibility to nil. But the open forest pockets occupied depressions in which the lower ground was boggy away from the strip of hard-packed roadway, and playing it safe meant more hard work with the axes.

In an open-forest pocket about 3 miles from the east coast we left the old Lockerbie-Somerset road, which we had traveled thus far, and struck south by a suggestion of another old road that passed through a neck of rain forest and brought us into the open again at Lake Boronto. This deep-looking, roughly circular body of water, about 400 yards across and with sedgy margins, is enclosed to the west and south by sand ridge carrying dense black tea-tree scrub. It appears on the military 1-mile map as Lake Wincheura, a name that rightly belongs to a smaller and apparently shallower lake, in the same open-forest pocket, which the military map makers have called Lake "Bronto." Both lakes are without surface outlet.

From the lake to near the coast we followed a sandy strip of open forest, hemmed in by scrub to the south and rain forest to the north. An unavoidable, deep gully cut across the lower end of the pocket, and in this we stuck, within sound of the sea, until with

much effort the bogged truck was prized out with lever and fulcrum, and the bog-holes were filled with timber under the wheels. From there, through a final strip of rain forest, we emerged on an open grassy headland called Naru Point, immediately to the south of which the truck was unloaded and camp pitched beside a small stream.

On May 13 George Tate, Van Deusen, and I visited Somerset to compare that classic locality for biological collections with the areas we had already examined on the tip of the Peninsula. Driving along the coast from camp, we crossed rockbound bald headlands by wheel tracks left by wartime military traffic, and ran along the hard sand of beaches in between. Somerset we found deserted, and the old Jardine house in a bad state of disrepair. Floors and rusting roof were starting to collapse. Doors and windows had been broken open by vandals from passing vessels, and countless bats (*Hipposideros g. cervinus*) swirled in the rooms (M 38, P 3).

Leaving Newcastle Bay camp (M 23, H 57, P 153) May 14 we returned to Lockerbie. The following day Van Deusen, accompanied by George Moreton, moved back to the sawmill to collect in the rain forests and remained there until May 21 (M 33, H 2). During our previous occupation of Lockerbie base camp collections were made at Cody Creek, Laradenya Creek, and Tuckinu, all within a radius of 3 or 4 miles.

Lockerbie camp (M 193, H 56, P 315) was vacated May 18, when the main party traveled south 39 miles via Red Island Point and Higgins Field and set up camp on the Jardine River, near the crossing place of the telegraph line. Apart from some softish wallum flats and doubtful bridges over small streams towards the Jardine, this road offered no difficulties and was traveled in less than five hours. For the last 16 miles we followed the telegraph line, most of the way on low ridges which continued lateritic but were practically without rain forest patches. In this area there were extensive developments of wallum scrub in broad depressions, and in one of them, about 2 miles out from the river, we came to a mile-wide body of water named Sanamere Lagoon. We had thought of camping there, but in its heathy surroundings and under the drizzling sky of that day, Sanamere looked

as austere as an alpine lake, and tent poles would have been hard to find in the stunted timber of the ridges. A good camp site was found about halfway between the lagoon and the river and occupied until May 22 (M 3, H 1, P 102).

May 22 saw the party reassembled at Red Island Point, with two days remaining of the time allotted for work on the tip of the Peninsula. This interval we spent in drying and packing specimens and in spot collecting (M 8, H 4, P 10). Then two more days passed before the arrival of a landing barge (a wartime L.C.I.) expected at any hour to load pearl-case lumber and take us to Thursday Island.

On Thursday Island, May 27 and 28, there were opportunities for bat hunts in the underground chambers and passages of an old fort on Green Hill, at the western end of the island (M 67, P 3).

Leaving Thursday Island on the 700-ton steamer "Alagna" the morning of May 29 we landed 24 hours later at Portland Roads. There we were met by Vernon, who had arrived by a northbound boat the day before and already begun field work.

JUNE

Collecting at Portland Roads, the first of our second series of camps, continued until June 4 (M 33, H 20, P 93). During this time, on June 3, George Tate and I made a reconnaissance trip to Tozer Gap (P 11).

Moving to Iron Range June 5, we remained there for three weeks (M 237, H 40, P 284). Van Deusen and Geoffrey Tate collected from a subsidiary camp at the airfield June 22 to 24 (M 21, H 17). On June 13 George Tate and I drove through Tozer Gap and chose a camp site on Brown's Creek in the Pascoe River drainage basin (P 24).

At Iron Range our party was temporarily increased by an aborigine from Lockhart River Mission, James Butcher, taken on as shooting boy by Vernon. This man was from a tribe strange to our own three natives, and it was interesting to see the cautious reception he had into the camp, especially from George Moreton, the hunter, who felt his reputation immediately at stake when James in his first morning brought in three spotted cuscus, shot from the tops of high trees in the

rain forest. In the keen rivalry that developed between the two hunters, there was an almost embarrassing loyalty to their respective employers which we respected by making solemn exchanges of specimens they shot—a splendid male cassowary that old George collected, and we did not want, being given to Vernon for a spiny anteater that James brought in, and so on. The hunters no doubt retained their ancient privileges in regard to tid-bits of the meat. We left such things to their discretion, and the possible friction and squabbles we watched for did not develop.

From Iron Range, camp was shifted to Tozer Gap on June 27. Most of the journey of 8 miles was through rain forest by a road made slippery by rains and in places rooted out by wild pigs. On the rise of the foothills of Tozer Range the road was difficult even for a truck with four-wheel drive to negotiate. The rain forest was best developed on or close to the banks of the Claudie River. This short river has three main branches: the East Claudie, Running Claudie, and West Claudie. All three were crossed on the way to Tozer Gap, the first two on bridges, the West Claudie by a ford of logs and rocks. All were running well at that time, but only the Running Claudie maintained a flow throughout a normal year.

Collecting at Tozer Gap (M 49, H 12, P 135) went on simultaneously with track cutting to the top of Tozer Range and its highest peak (1784-foot Mt. Tozer) and the occupation of a small subsidiary camp at an altitude of about 1300 feet on the crest of the range. In three days George Tate and Roy Stephen did the bulk of the hard work of opening up the route to the high country, and it was completed by others of us in a day and a half. Slopes were steep and rocky, the rain forest was dense with undergrowth, and trail cutting very laborious in thick, hard-wooded scrub that replaced the rain forest to a large extent at the upper levels.

JULY

Tozer Range camp was occupied in wet weather by Van Deusen and Vernon July 2 to 4, by Geoffrey Tate and myself July 6 and 7, and by George Tate July 7 to 9 (M 6, H 7, P 62). Everything needed for this camp was toted up the range on our backs.

July 12 we moved to Brown's Creek, about 12 miles from Tozer Gap by the road leading to Wenlock and about $8\frac{1}{2}$ miles west as measured on the map. The journey with a heavily loaded truck took two and three-quarters hours. Travel was good for a bush road on the Peninsula, but it was always slow on even the best of the roads. We followed gaps and small valleys through hilly country in which granite outcropped occasionally. What little rain forest there was occurred in very narrow, interrupted gallery strips on some of the creeks, and particularly on creeks that appeared to carry permanent water. The vegetation generally was an open forest of rather tall messmate and bloodwood trees, broken by belts of wallum scrub.

Often the closely spaced messmate trees were thinly encrusted with termite workings that completely covered the trunks, on the northern half of their circumference, to a height of 20 to 30 feet above the ground. These extraordinary termitaria were reddish or yellowish, according to local soil color, and they gave the impression of a forest of painted trees.

Our chief interest in the Brown's Creek locality (M 21, H 26, P 122) was in the scrubs, there mainly of the wallum type, which reportedly occupy large areas north to the Jardine but according to reports and our own later observations do not extend much farther south in the interior.

On July 18 Van Deusen, accompanied by Moreton, went on to Wenlock with a supply truck returning from the coast. The following day the rest of us returned to Iron Range to prepare collections for shipment and to reorganize for a third series of camps in the Wenlock and Coen areas. Further collecting was done at Iron Range during a four-day period. The moist coolness of the rain forests we found pleasant to experience again after the harsher touch of the air at Brown's Creek, on the dry side of Tozer Range.

With truck and trailer we left Iron Range at dawn July 24 on a 50-mile drive to Wenlock. Stopping at Brown's Creek to pick up gear that had been left there (as always on the Peninsula without fear of theft, but with care to put it above the reach of wild pigs) and again at the Pascoe River to boil the tea billy (P 4), we arrived at our destination, hot

and dusty, in eight hours. For about 13 miles from Brown's Creek to the Pascoe the road continued to skirt the western edge of a broad block of granite mountains of which Tozer Range formed the coast-facing front. With a change from generally sandy to harder ridges, in parts rocky, ironbark, box, and poplar-gum entered the composition of a drier-looking open *Eucalyptus* forest. The Pascoe, where crossed by a ford, was a pretty stream entrenched between high banks and running about a foot deep and 10 yards wide in a much broader bottom of sand and big water-worn granite rocks. A coarse, flat-bedded conglomerate lay exposed on the south bank. Thin lines of rain forest trees grew with tall tea-trees within the river banks, and rain forest of sorts covered parts of the mountains close upstream.

From the Pascoe at about 200 feet elevation the road soon began a rough ascent of the Sir William Thompson Range section of the Great Divide. In 5 miles we reached the top in a gap at about 600 feet and started to drop down into the broad, hazy valley of the Batavia River. The range, generally 800 to 1000 feet high thereabouts, was of granite and carried a dry, very open forest of small ironbark and box trees. Conditions became progressively drier as we traveled down 12 miles of the Batavia Valley. The first bush fires of the season had burned through parts of the open forest, leaving the ground black and bare. Wenlock, a gold-mining township, lay under the scarp edge of a sandstone tableland which there and for some miles up and down stream rose from close to the eastern bank of the river. Settling ourselves in the sheds of a closed-down mine we continued for four days the collecting that Van Deusen had started and carried on very successfully in the neighborhood (M 56, H 21, P 58).

July 29 we moved 34 miles towards Coen and established a short term camp on the north bank of the Archer River. On a first stage of 14 miles west to Mein Telegraph Station the Batavia was crossed at Wenlock, and about 2 miles farther on the road made a sharp ascent of 100 feet or so to the top of an escarpment of sedimentary rocks. We approached Mein over wide flats of yellowish melon-holed soil timbered with box, which opened up into a succession of slightly undu-

lating plains carrying at most a thin scattering of trees. The old telegraph station or "fort" was not in use. Improvements in the techniques of long-distance transmission had made it no longer necessary. A landmark since the 1880's, the big loopholed building of galvanized iron, in the form of a hollow square, had as inhabitants only a few bats which eluded our efforts to capture them.

From Mein we turned south along the telegraph line. The melon-holed country continued for several miles, to be succeeded by varied ridgy terrain. On a hard lateritic ridge we had the excitement of "speeding" for a few minutes at 20 miles an hour in the fastest travel anywhere in our journeying by truck on the Peninsula. Massive beds of laterite appeared on the western slopes of the low Geikie Range, and the Archer was approached over poor sandy ridges carrying mostly messmate timber. Riverine strips of rain-forest trees occurred on flood banks of both the Batavia and Archer, but between the rivers this type of vegetation was absent, and the grass plains at Mein constituted the only break in the prevailing open forest.

Camp on the Archer (M 6, H 19, P 46) consisted merely of a cooking fire, and folding tables, chairs, and mosquito-netted cots set up, for safety from grass fires, on a burned-over, high, flood-bank terrace of the river. For the first time in our field work in the advancing dry season, shelter from at least occasional showers was not needed. Vernon skinned his birds in the shade of a bushy tree. Geoffrey Tate elected to work on his collections in the open. The mammalogists contrived for themselves an odd shelter of ground sheets and leafy cool *Eucalyptus* boughs. The only tent rigged was to keep the plant-drying papers from being blown away by a strong southeast wind.

AUGUST

From the Archer River on August 1 a dusty drive of 46 miles brought us to Coen in five and a half hours. This time did not include delays, such as helping out and clearing from the road a truck stuck deep in the sand of a dry creek bed. Travel was approximately southeast-by-south along the telegraph line, which followed up the low-ridgy valleys of the Archer and its main tributary the Peach

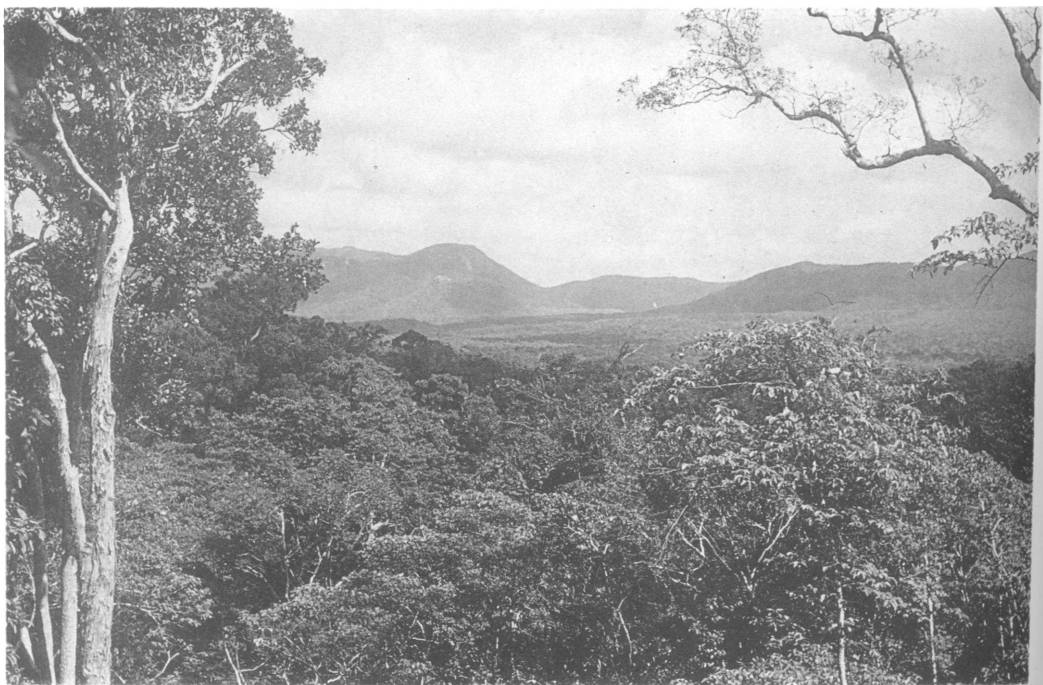


1



2

Naru Beach, fronting scrubby sand dunes in Newcastle Bay
Undercut cliffs of lateritic rock, Naru Point, Newcastle Bay. A habitat of the bat *Taphozous australis*



1



2

1. Tozer Gap, viewed across the rain forests of the Claudie River valley from Iron Range
2. Face of the rain forest on a roadway at Iron Range



1



2

Gulubia costata) and *Pandanus* swamp in rain forest at Iron Range
"white-barked turkey-bush," a species of *Leptospermum* which forms pure scrubs. Tozer Range



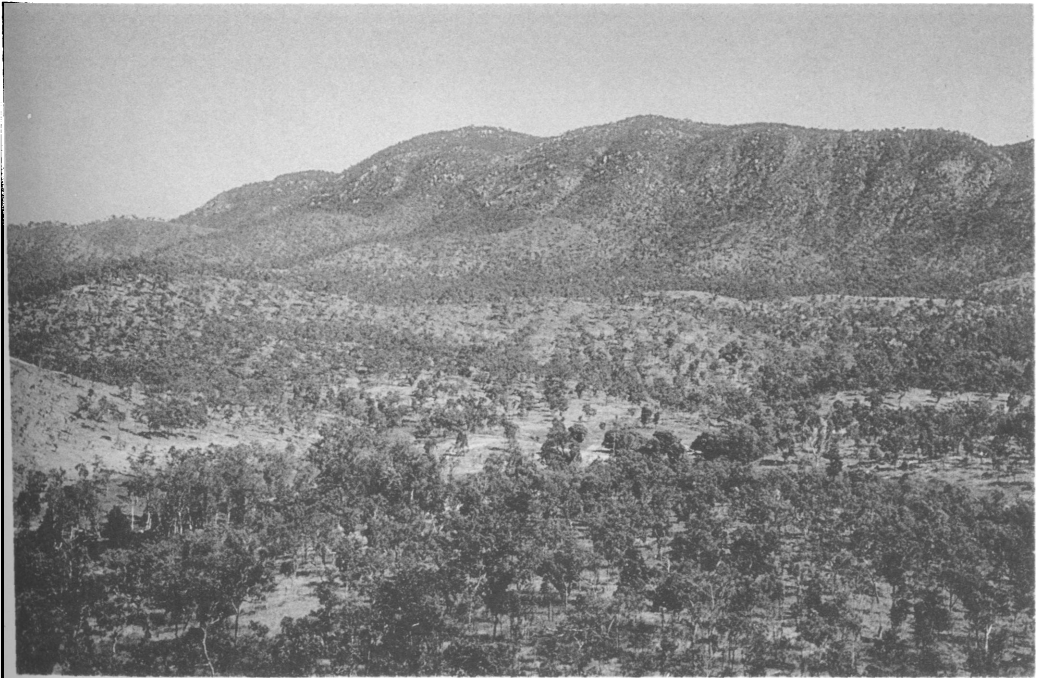
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2

1. Dense open forest, mainly of bloodwood (*Eucalyptus dichromophloia*) and messmate (*Allocasuarina littoralis*), Brown's Creek, Pascoe River

2. Bed of the Batavia River at Wenlock, early in the dry season. The high banks of river of periodic flow are masked by gallery rain forest containing (right) paper-bark (*Melaleuca leucadendron*)

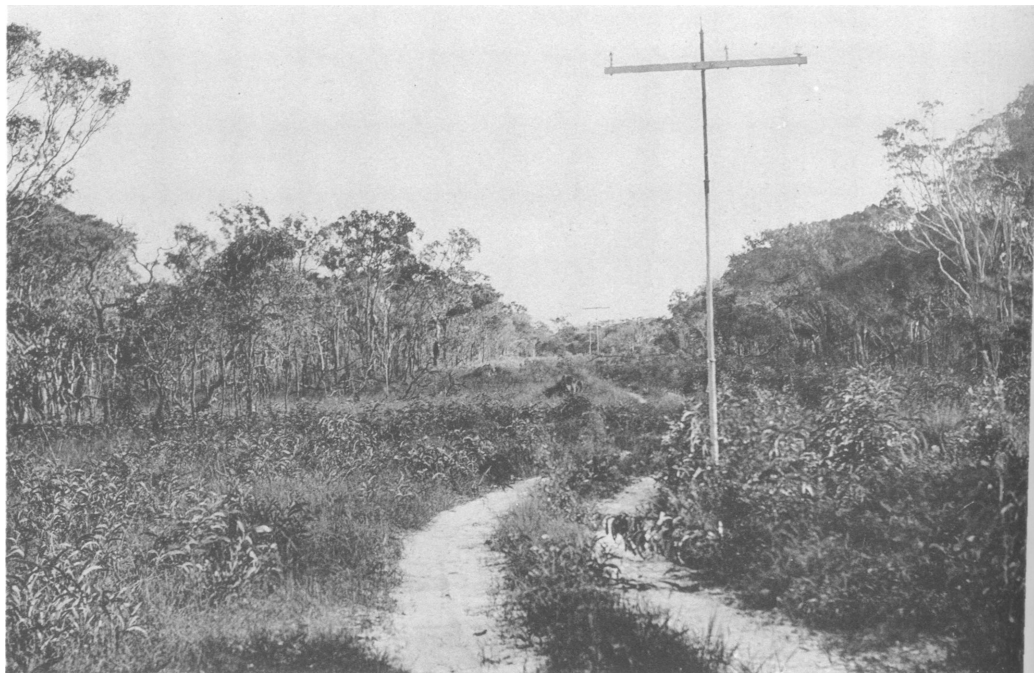


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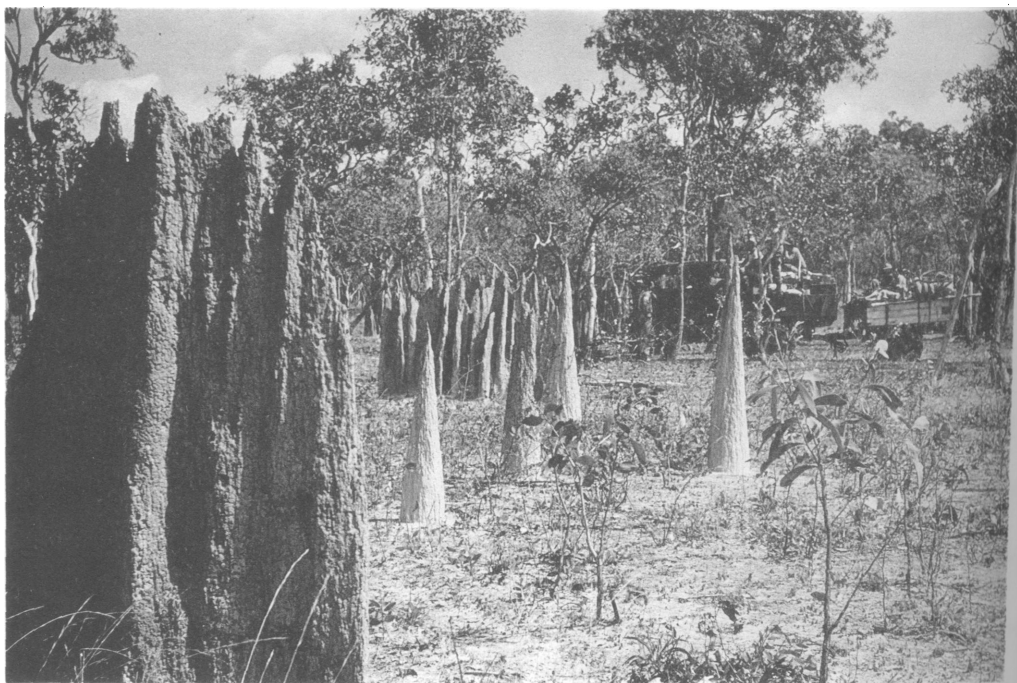


2

sted valley of the Coen River, at The Bend, near Coen township
on truck and trailer in dry open *Eucalyptus* forest on the crest of Sir William Thompson



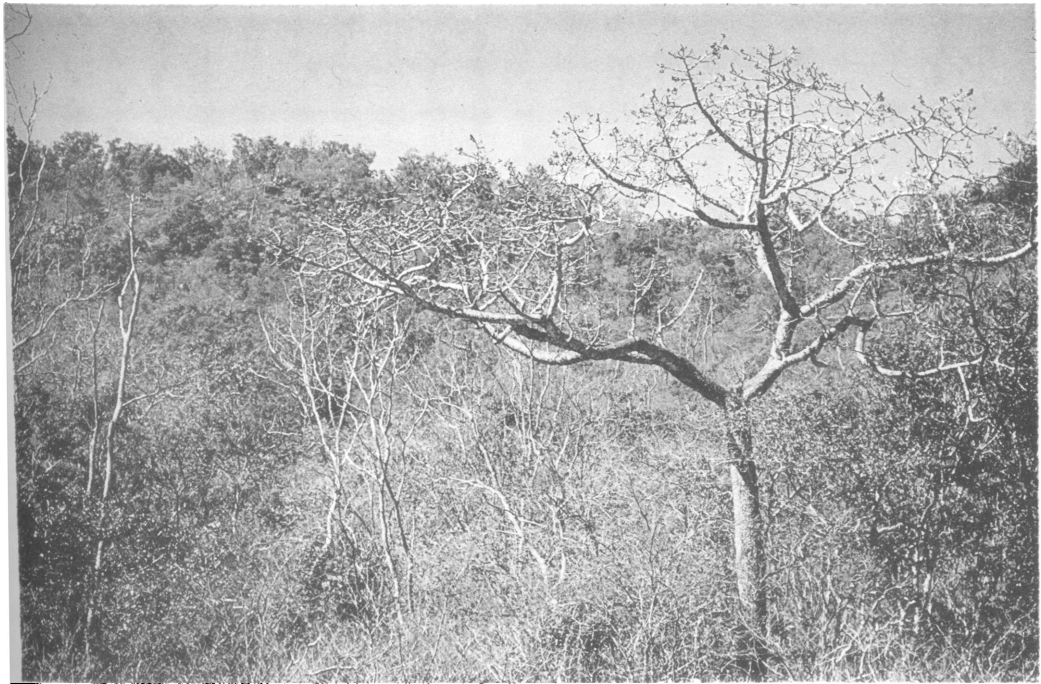
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2

1. The Cape York Telegraph Line and the main North Road, in poor open forest about north of the Jardine River

2. A termite town on a burned-over tea-tree flat between the Archer River and Coen. Below first "witches'-hat" on left is a "magnetic ant-hill"



1



2

Bombax malabaricum tree, leafless and in flower, in monsoon forest in the valley of Bonanza
upper Peach River
Cantonment camp in gallery rain forest on Bonanza Creek, upper Peach River

River, then Croll Creek. Within 4 miles of Coen the road passed over a saddle that connected the McIlwraith Range with a short mountain range to the west and divided Peach River from Coen River waters. The country was open forest: largely messmate and bloodwood ridges and tea-tree flats. On Croll Creek, about 20 miles from Coen, a change took place to flats of stiff dark soil lightly timbered with box, followed by more mixed open forest in the hill country about the township.

Termite mounds of different kinds are familiar to all who travel the open forests of northern Australia. Some are so small and inconspicuous that one stumbles over them in the grass. At Lockerbie there were tall, fluted mounds three times the height of a man. Singular towns of termites occur, often of more than one species, each building its own type of mound. Ant hills, to use their local name, are seen in great numbers and many shapes, sizes, and colors in the hundreds of miles of cleared laneway along the Cape York Telegraph Line. Some of the most remarkable towns we saw were on tea-tree flats between the Archer River and Coen. The tea-tree flats are in depressions. In the rainy season the podsolized gray soil becomes wet and boggy, and in the dry time of year it sets very hard. The termite towns that attracted our particular attention were seemingly inhabited by three species of the insect. One built the well-known magnetic ant hills, of cathedral design in gray, 4 or 5 feet high, straight sided, narrowly buttressed laterally, many pinnacled on top, and oriented with their long axis about north and south. A second species had taller mounds, deeply fluted, somewhat tapered upward, pinnacled more coarsely, and without any particular orientation. The third formed beautifully symmetrical, slenderly tapered, sharp-pointed structures that invited Geoffrey Tate's whimsical comparison of them to witches' hats. For some reason, which may have been that the insects brought their building materials from deeper underground, the second and third kinds of termitaria were pale yellowish to reddish, rather than the gray of neighboring magnetic hills.

As headquarters at Coen we had placed at our disposal on the usual rent-free and use-

it-as-long-as-you-like basis a solitary vacant house at The Bend, 2 miles up the river from the township. We planned only a short stay, as our chief objective in the general area was the Rocky Scrub. But we took too little account of the annual race meeting, due to begin five days after we got there. The race-horses had already arrived from cattle stations distant as far as 150 miles and were being given work-outs on the track. Racegoers, white and black, were coming in by motor vehicles and on horseback, and the hills resounded at night with the bells of horses hobbled out on grass. Transport arrangements we had made with genial H. J. Thompson (cattleman, storekeeper, hotel-keeper, carrier, and owner of our house at The Bend) were well in abeyance until the horses had won or lost and the patrons had gone home. Then there was further delay while all trucks were sent 80 miles to the coast to meet a boat that arrived with supplies (M 89, H 15, P 49).

After midday on August 9 we started towards the Rocky Scrub, men and cargo on a three-ton truck and, traveling independently, a string of riding horses and pack-horses in charge of an elderly black boy named Willie Alf Young. Our destination was the site of a former gold-crushing battery (Shepherd's Battery) on Bonanza Creek, a headwaters stream of the Peach. About 11 miles from Coen on the Wenlock road we turned east to cross Croll Creek at a place found after some search by an aboriginal guide, one Tommy Fox, we had on the truck. This was the start of an old bush road over which, we were told, no vehicle had passed since 1932. The truck was got across the loose sand of the creek bed with some difficulty. Then the real work began. Afraid of punctures in his thin tires, the driver insisted on some sort of road to follow. The only semblances of a road were marked trees, blazed so long past that often the guiding cuts were visible only as healed scars on the bark, and in places a horse pad. So we were obliged to walk ahead, clearing fallen timber, breaking down termite mounds, cutting trees, and doing pick and shovel work at creek and gully crossings. This continued by the headlights of the truck until two hours after dark, when we reached good running water in "L" Creek tributary of the

Peach, ate supper, spread our freshly salted beef supply to air on a bed of bushes, and camped for the night.

Next morning we crossed a big running stream called Falls Creek and about one o'clock reached Bonanza Creek and off-loaded. A total of 10 hours of road clearing through ridgy open forest had brought us 16 miles from the Croll Creek turn-off, and as far as the truck could go. Shephard's Battery site was at the very foot of the McIlwraith Range, about 800 feet above sea level, and perhaps 20 air miles northeast of Coen. Its exact position could not be determined from the inadequate maps available for this part of the Peninsula. From it an old blazed trail mounted and crossed the range to Leo Creek, a branch of the Nesbit River, in the Rocky Scrub.

Riding with Willie Alf as guide, George Tate and I spent August 11 in opening up for the pack-horses about 6 of the 9 miles of trail across the range, leaving the rest of the work to be done when transport started the following day. Approximately the first third of the route was through open forest becoming taller and moister with increasing altitude, and in which, at about 1300 feet, strips of rain forest containing fine tall hoop-pines began to appear in the valleys of small creeks. The next 3 miles or so were through a succession of open-forest pockets in rain forest, in the first and largest of which, called Camp Oven Pocket, the main stream of the Bonanza cascaded in a rocky bed at 1500 feet elevation. Past the pockets the trail was in continuous dense rain forest in which it reached a top elevation of 1850 feet before descending to the Leo at 1400 feet. Laden pack-horses could do the journey in about five hours after the trail was cleared.

Transport into the Rocky Scrub, with a team of five pack-horses, was organized in relays with myself attending to pack loads and going in last. Bonanza Creek camp was maintained as supply base and horse camp in charge of McLaughlin, who cooked bread and beef and sent it across the range every other day. First to arrive at the Leo (M 66, H 29, P 127) were George Tate and Vernon, August 13; last to leave were Geoffrey Tate and I, August 22. George Tate and Van Deusen collected at Camp Oven Pocket

August 19 to 23 (M 28, P 1). During this part of the expedition McLaughlin and I suffered attacks of epidemic influenza, which in my case seriously limited botanical collecting in an area almost if not quite unknown for plants.

Bonanza Creek camp (M 31, H 9, P 19) was vacated and we returned to Coen August 25.

A four-day journey of about 180 miles south and southeast from Coen to railhead at Laura was begun August 27. The usual travel time for a truck was two and a half days, but we wished to make easy stages to allow time for mammal trapping and other collecting at night stops at Ebagoola, Musgrave Telegraph Station, and the Hann River.

Ebagoola is a long-defunct goldfield center still shown on modern maps, which do not, however, show the good bush road of 26 miles that leads to the old town site from Coen and continues on southward. On the road from Coen broken ridgy granite country with quartz reefs, and mainly ironbark and bloodwood timber, prevailed to 12-Mile Creek, which contained a spring-fed waterhole. Beyond that were mostly red sandy messmate ridges with fairly large trees. Camp at Ebagoola was among *Pandanus* trees near a well on a tea-tree flat, at an altitude of about 850 feet (M 4, H 2, P 6).

Musgrave was reached in a rather dreary stage of 40 miles through varied open forest. Brief stops were made at Yarraden cattle station (to deliver a telegram, and receive a gift of steaks for our supper), then at Yarraden of the maps, and Speinkop, where there was some small activity in gold mining. Traveling through ridgy country with scarcely perceptible general fall towards the Gulf of Carpentaria, about 30 miles from Ebagoola we edged east to the crest of the Great Divide and from an altitude of 950 feet descended a steep granite escarpment to the border of the coastal plain of Princess Charlotte Bay. Musgrave, at about 450 feet elevation on Saltwater Creek, had long been closed as a telegraph station and been made the homestead of a cattle property owned by Mr. Fred Shephard. Near by was a big warm spring of sulphur-smelling water at which we camped (M 3, H 1, P 5). No water was seen in any of the creeks crossed during the day.

At Musgrave a good vegetable garden was irrigated from the spring, and colorful shrubs and big mango trees surrounded the homestead. At Coen, too, in an environment almost as dry, there were some very good gardens. Throughout the Peninsula, in fact, one could not but be impressed by the efforts of the few white residents to grow food plants of one kind and another, and almost as often plants for the ornamentation of their homes.

The best results in gardening were seen where there were women folk. The success of nearly all plantings depended upon the availability of water and means of bringing it to the soil, for few people lived in the rain forests, and even there, on the upper parts of the Peninsula, the dry season was pronounced enough to be contended with in the cultivation of herbaceous plants. In the wet season, excessive rains and high temperatures were too much for many garden crops that could be grown by watering in the dry and cooler part of the year. Water as a rule was carried, by the owners of the gardens or by hired blacks, from a natural water hole, a well, or some other source of supply, and sprinkled on the beds. Gardens, therefore, seldom were large. Often they were pathetically small, considering the need for fresh vegetable food in the tropical climate and the large dependence of most of the people on what they themselves could grow.

Fresh meat, commercial dried fruits, and perhaps the fresh-made tea that all drank copiously were dietary aids to the seemingly high general levels of health and vitality maintained in the country. In the north-Australian cattle country, which embraces most of the Peninsula, milk takes a rather minor place in the predominantly white bread and meat diet of adults. One sees more canned milk than fresh. In the mustering camps, where the men spend much of their time, no one would think of milking a cow even if it were often practical to do so. At the homesteads there are milch cows or goats, whose product goes largely to flavoring tea and making milk puddings.

Air transport in recent years has ameliorated the lot of some residents of the Peninsula in regard to fresh vegetables and fruit, especially in the dry season when the roads are open to the widely spaced airdromes. But air

transport costs are high, the service is limited, and the need for gardens remains. The wild food plants of the aboriginal inhabitants receive scant attention, perhaps not so much through want of knowledge of them as dislike for their flavor or the often considerable amount of time involved in gathering them from the bush.

Only two food plants in general cultivation on the upper Peninsula seem able really to thrive all year in all environments in which the white man has established his long-term camps and permanent dwellings: the mango tree and the sweet potato. The latter, besides being an important root crop of the gardens, provides pot greens in the wet season, when there is difficulty in growing other leaf vegetables. Herbaceous food plants commonly grown include tomatoes, cabbage, shallots, Chinese long beans, Chinese cabbage, carrots, radishes, white turnips, salamander lettuce, pumpkins (squash), papayas, and bananas. Citrus fruits are often planted, especially West Indian limes. Mango trees, in these days of diminished population, are frequently the only indicators of spots once inhabited. Unowned and untended, they may thrive for many years under conditions of climate and soil impossible for any other introduced fruit tree in the area.

A 40-mile stage along the telegraph line from Musgrave to the Hann River was notable in that, for the first time in three days, we met a traveler on the road. It was the overland mailman, traveling with pack-horses on his fortnightly trip from Laura to Coen and back. On our route through generally sandy open forest the waterless sandy channels of Saltwater Creek and the Morehead River were crossed. The spring-fed Hann was a perennial stream. At the road crossing, about 350 feet above sea level, it ran 10 to 15 yards in width, with clear water too cold to bathe in with comfort. Upstream a little, flying foxes (*Pteropus scapulatus*) took the air and flew noisily and erratically when we approached their camp in tall tea-trees edging a long, deep water hole. Salt-water crocodiles (*Crocodylus porosus*), fresh-water crocodiles (*C. johnstoni*), and fresh-water sharks were said to occur in the river, but we saw none of them, and efforts towards a fish dinner went unrewarded. The Hann (M 5, H 8, P 6) car-

ried an abundant water supply through sandy messmate ridges which looked promising for the cultivation of tobacco.

Between the Hann and Laura we crossed the North Kennedy, Kennedy, Little Laura, and Laura rivers. All were bigger rivers than any crossed since the Archer. Only the Little Laura held visible water this late in the dry season, although there were water holes away from the road and water could at all times be obtained by digging in the sandy beds of such rivers. Extensive stands of tall messmate occurred in generally sandy open forest. Near Fairview Telegraph Station was a big patch of heavy blackish soil, largely treeless and with the usual dense body of grass. Other variations included, especially in the last few miles, "bull dust" flats with small tea-trees and great numbers of magnetic ant hills where choking clouds of powdery gray dust were raised by the wheels of the truck.

Of special botanical interest was a stand of great fan-leaved "cabbage palms," *Corypha elata*, on a dry creek about a mile south of the Kennedy River. About 60 or 70 feet tall and with massive trunks, they grew on yellowish, sun-baked, clayey soil in a strip of open, monsoon-forest type of vegetation characterized by deciduous *Terminalia* trees. In Australian botanical records this Asiatic palm seems to have been previously known to occur only on the Mitchell and Gilbert rivers, which flow west on the Peninsula to the Gulf of Carpentaria.

The placid little township of Laura reflected the sparse occupation and economic undevelopment of the great area of cattle country which it served as supply point. A railway goods shed, postoffice-store, a rambling old bush hotel, and one-constable police station comprised most of the buildings. Supplies went out to the cattle properties from here, but the fat cattle marketed in the lush period after the wet season were driven more than 100 miles farther south to sale yards and meat works in the Cairns hinterland. Regularly on Tuesdays, a rail motor and trailer made a round trip from Cooktown with freight and passengers. There were stirrings, however, which perhaps augured a brighter future. It had been found that with irrigation tobacco did well on the sandy soils. Observations had shown that

temperatures were never low enough for the reproductive processes of blue mold, from which the area was free. Planted acreage was still small, but Laura lemon-leaf had topped the Australian market in 1947, and new farmers had come in to expand the industry.

The third phase of the expedition ended August 31 with our arrival in Cooktown from Laura on the weekly rail motor.

SEPTEMBER

We moved from Cooktown to Shipton's Flat on September 2 and there established our last main collecting base. The following day George Tate and I, with a local native named Norgi as guide, reconnoitered the approaches to Mt. Finnegan and reached an altitude of 2700 feet on its western slopes.

Carrying back packs ourselves, and with two pack-horses lent by Mr. Roberts and in charge of Norgi, Van Deusen, Vernon, and I, and the black boys Willie and Roy set up, on September 6, a subsidiary camp for work on the higher parts of Mt. Finnegan. The camp site, reached in two and a half hours of steady climbing from Shipton's Flat, was at 2600 feet, just within the lower edge of the continuous rain forest on the main western spur of the mountain and as far as pack-horses could be taken without our cutting trail. Van Deusen and Vernon occupied the mountain camp until September 9 (M 55, H 6). With Willie, I found a way to the 3740-foot summit of the peak on September 7, and returned to Shipton's Flat next day. Botanical work on the upper levels of Mt. Finnegan (P 169) ended with an 11-hour excursion from the Flat on September 21.

Using pack-horse transport, George Tate on September 7 started a subsidiary camp in the edge of the big rain forest on upper Parrot Creek, between 1 and 2 miles east of Shipton's Flat and about 1150 feet above sea level. Geoffrey Tate and I worked in this area on one-day excursions from the base at Shipton's Flat (H 24, P 135). Van Deusen and Vernon joined George Tate at the upper Parrot Creek camp September 11, and all three vacated it September 15 (M 73).

Work in the general area accessible from Shipton's Flat was continued by Vernon, Geoffrey Tate, and myself until September 23, when the camp (M 38, H 19, P 64) was

closed and we returned to Cooktown to attend to the details of winding up the expedition.

From September 16 George Tate and Van Deusen, accompanied by their aboriginal helpers George Moreton and Roy Stephen, collected at short-term camps in localities with habitat conditions differing from any found in the mountains near Shipton's Flat. They camped at Helenvale, on the Annan River, September 16 to 19 (M 13, H 5); moved September 20 to Bowie's Spring at the

south end of Black Mountain (M 9, H 9); visited the Annan River Gorge below Helenvale (M 9) and reached Cooktown September 21. Leaving Cooktown (M 3) September 23 they camped at Alderbury, 25 miles along the railway towards Laura, and returned next day (M 6, H 6). With a three-day visit to Seagren's Farm on the Endeavour River 10 miles west of Cooktown (M 18), the field work of the expedition ended on September 27.

COLLECTING STATIONS

THE DESCRIPTIONS of principal collecting localities follow a geographical sequence beginning with Lockerbie in the far north and ending with the Russell River and Mt. Belenden Ker, farthest south in our area.

LOCKERBIE, TEN MILES WEST-SOUTHWEST OF SOMERSET

APRIL 20 TO MAY 5, MAY 14 TO 17

At Lockerbie, 8½ miles from the tip of Cape York, we were at the northernmost cattle station in Australia. Cattle had been grazed there since the 1860's. Following the abandonment of the station on war evacuation orders in 1942, the cattle for several years were harried by "walkabout" mission blacks and shot at by sportive troops. The result was that in 1948 the very wild survivors and their progeny were what Australian cattlemen call "scrubbers," from their habit of living in thick cover (in this case the rain forests) and seldom venturing into the open in daylight. Pigs had run wild at an earlier date. Their rootings were common in both rain forest and open forest. But feral pigs were in evidence virtually wherever we went on the Peninsula and often much of a nuisance.

Our camp at Lockerbie homestead was about 100 feet above sea level on the western side and immediately at the foot of the rather abrupt, more or less table-topped ridge of lateritic ironstone which formed the backbone of the northern extremity of the Peninsula. The general elevation of the central ridge was about 200 feet and its width 2 to 3 miles. Between it and the west coast, 2 to 4 miles distant, lay first a parallel valley, then an irregular line or group of hills with heights exceeding the central ridge in elevation. Drainage in the parallel valley was away from Cape York, with Laradenya Creek occupying its northern and central parts, and Cody Creek (called Paterson Creek on the military 1-mile map) its southern end. Named high points of the coastal hills included Paterson Hill (260 feet) farthest south, Galloway's Hill (294 feet), and Peak Hill (460 feet) farthest north.

The streams were intermittent in flow, and although running well in April and May they

would be reduced to series of water holes later in the dry season. A good spring issued from the base of the central ridge at Lockerbie with volume enough to maintain a small hollow below it in semi-marshy condition. Other springs and permanent soaks occurred along the base of the ridge and in valleys eroded into its edges. A part of the wet-season drainage from the central ridge was in extensive surface seepages from its base, which contributed to stream flow for a month or two into the dry season.

Continuous rain forest covered the central ridge for 16 miles of its length from the base of Cape York and also occupied a large part of the area between the ridge and the east coast. On the western side of the ridge, under conditions perhaps drier climatically, the rain forest gave place to open forest in which a few isolated small patches of rain forest occurred and rain forest followed the larger streams in gallery woods diminishing towards the coast. The open type of vegetation occupied numerous reëntrant valleys of the central ridge and also occurred in islands or "pockets" completely surrounded by the rain forest. The open-forest belt of the west coast represented an uninterrupted extension to Cape York of the great tropical open-forest formation which occupied most of the Peninsula and continued unbroken across the continent to the coast of Western Australia. A coast to coast barrier of open forest separated the Lockerbie rain forests from the nearest rain forests of any consequence, which occurred in extensive patches on the Escape River, about 20 miles to the southeast.

The wet season had ended at Lockerbie with heavy rains lasting through March. The southeast trade winds began to blow about the time of our arrival. Their force broken by the central ridge, the trades usually were felt as a gentle to moderate breeze starting with the heat of the day, about eight o'clock in the morning, and dying down about sunset. Evenings were pleasantly cool and, towards daylight, one needed at least one blanket for comfort. Early-morning field work in the open forest meant a wetting from abundant dew on the grass unless, as sometimes happened, the trade wind blew through the night,

without much cloud but with temperatures higher than usual. Shade temperatures for 13 consecutive days from April 23 to May 5 inclusive were: maximum 86° to 90°, mean 88°; minimum 61° to 75°, mean 68° F. Scattered light showers fell on two days during this period, and between May 9 and 12 a spell of squally southeast weather brought 2½ inches of rain.

The rain forest of the central ridge was of an inferior, dryish type composed of scattered, fairly big trees averaging about 80 feet tall, a denser stand of trees of second magnitude, and an abundant undergrowth of slender small trees usually easy to walk through. Herbaceous undergrowth, epiphytes, and large lianas were very poorly represented. A tinge of green moss appeared on the bases of some trees and on outcropping blocks of lateritic rock. Looking through the forest one noticed a vine here and there, but inconspicuous thin-stemmed species, entangling the tops of the undergrowth trees, were abundant. In the forest edges a scrambling *Zizyphus* with hooked spines, appropriately called "wait-a-while," often hindered one's progress. The presence of *Bombax malabaricum* as one of the larger trees was assurance of a dryish climate. Palms, however, were much in evidence. Seven species, feather-leaved and fan-leaved and including *Hydraia-stele wendlandiana* and the black palm (*Caryota rumphiana*), were noted, and in relatively moist hollows fine groups of *Gulubia costata*, 60 feet high, were associated with a tall, stilt-rooted *Pandanus*. On first sight the rain forest appeared to be in a resting period, with nothing flowering or fruiting. But careful examination revealed a sprinkling of canopy trees and lesser species with inconspicuous flowers or fruits, or both.

The open forests showed considerable local variation correlated with differences in soils. In the Laradenya Valley the soil was generally a deep, reddish, lateritic, sandy loam and the characteristic tree a bloodwood (*Eucalyptus polycarpa*), 40 to 60 feet tall. Moreton Bay ash (*E. tessellaris*) was common near the edges of rain forest, and a poplar-gum (*E. alba*) grew on sandy soil towards the coast. Associated with the eucalypts and, like them, usually with crooked stem and branches, were over 20 other tree species including,

most commonly, swamp mahogany (*Tristania suaveolens*), growing on dry ground; *T. longivalvis*, with rose-scented yellow flowers; and, among smaller trees, nonda (*Parinari nonda*), beefwood (*Grevillea parallela*), and a phyllodineous *Acacia*. A fan-palm (*Livistona*) and a *Pandanus* were prominent locally and tended to be gregarious in groves. In contrast with the dense closed-canopy shade of the rain forest, the shade provided by the eucalypts was thin and the canopy far from complete. A rich ground cover dominated by grasses contained many herbs, especially perennials, but few shrubs. Many small annuals grew on hard, pebbly, lateritic ridges with ephemeral "fire grasses," so named because they are the first grasses that can be burned after the wet season. The principal grasses in the Laradenya Valley were the bunched perennials *Cenchrus elymoides* and *Heteropogon triticeus*, their leafy parts forming a thick ground cover about waist high and tiresome to walk through, and their flowering stems rising to 6 or 8 feet. The trees and ground plants of the open forest had different reproductive seasons; most of the former being sterile during our visit and nearly all of the latter fertile. The bloodwoods began to open flowers in the middle of May.

The tea-tree flat type of open forest occurred in poorly drained hollows semi-swampy and boggy in the wet season and remaining so for some time after the big rains. In April and May the podsolized gray soil was merely wet, or covered with up to 2 or 3 inches of brownish water. Slightly raised hummocks of drier ground usually were present, and on these most of the trees grew. Some of the flats carried very few trees. A low, open but fairly closely spaced stand of very crooked, broad-leaved tea-trees (*Melaleuca viridiflora*), 15 to 20 feet high and with whitish papery bark, was more usual. Other trees generally present were *M. symphyocarpa*, with yellow flower heads and drooping branchlets, and a bottle-brush (*Banksia dentata*). Small sedges formed most of the ground cover. Common small herbs included species of *Eriocaulon*, *Xyris*, *Drosera*, *Cartonema*, and a wealth of terrestrial bladderworts (*Utricularia* spp.). Shrubby pitcher-plants (*Nepenthes mirabilis*) usually occurred.

The tea-tree flats were not immune to fire in the dry season, but because of their low ground cover the fires were much less severe than in the open forests on drier ground.

Black tea-tree scrubs occupied patches of poor gray sand elevated a little above adjacent wet tea-tree flats. *Thryptomene oligandra* was chief dominant in a dense stand of bushy-topped trees 20 to 30 feet high; co-dominants included *Leptospermum fabricia*, and *Melaleuca* aff. *symphyocarpa* with red flower heads on erect branchlets. Two epacrids or Australian heaths supplied the bulk of a dense undergrowth 6 to 12 feet high. As a rule there were open glades in which one could walk freely through the scrub. Wiry, tufted *Leptocarpus schultzei* of the Restionaceae, and a few stiff sedges supplied what little ground cover there was in the glades, apart from two common mosses (*Leucobryum candidum* and *Campylopus umbellatus*) cushioned mostly under bordering heaths. Attractive epiphytic orchids grew close to the ground in the scrub. Other common epiphytes, found also in open forest, were climbing, succulent *Dischidia rafflesiana* and *D. ?nummularia*.

For mammals, which were our chief zoological interest, a differential pattern of distribution could be drawn for the rain forest and open forest, but by no means along rigid lines. For example, a bandicoot (*Isodon o. peninsulae*) of the open forest seemed to enter the rain forest, while the sand wallaby (*Protemnodon agilis*) of the open country at least sheltered in rain-forest edges. The arboreal striped phalanger (*Dactylopsila i. picata*) occurred in both types of forest.

Fourteen of our total of 21 species and subspecies of mammals collected on the tip of the Peninsula were taken at Lockerbie. Previous collections from named localities on the tip, and the vague locality "Cape York," totaled 16 forms. The diverse flora of the Lockerbie area could not be collected thoroughly in the time available to us.

A herpetological find calling for special mention was the supposedly very rare gekkonid lizard *Torresia australis*,¹ which appears to have been known previously from only one or two specimens collected on islands of Torres Strait and one from "Cape York." Three specimens were collected at

¹ Determined by Max K. Hecht.

Lockerbie by Geoffrey Tate, who later found the species in various localities to as far south on the Peninsula as Alderbury, near Cooktown.

NEWCASTLE BAY, TWO AND ONE-HALF MILES SOUTH OF SOMERSET MAY 6 TO 13

Our camp was at the north end of Naru Beach (Narau Beach on the maps) and under the south side of Naru Point, where a small stream of peat-stained fresh water flowed through sand dunes to enter the sea. For a mile south to Chandogoo Point, and perhaps beyond, the coast was fronted by scrubby sand dunes some 50 feet high and extending a few hundred yards inland. Behind the dunes and up the coast to Somerset, sandy or lateritic ridges of about 100 feet top elevation extended inland about 4 miles to the central ridge of the Peninsula and were covered with rain forest much broken by pockets of open forest. Topography and soils suggested an ancient extension of the dunes inland for 2 miles to Lake Wincheura and Lake Boronto, with these lakes and others south of them occupying broad dune basins without surface outlet.

Sea-facing low sandstone cliffs appeared just north of Somerset and on opposite Albany Island. From Somerset southward the whole coast apparently was underlain by a bed of laterite exposed in massive rock form on small headlands named, successively, Fly, Vallack, Naru, and Chandogoo Points, and probably including Cliffy Point 2 miles farther on at the mouth of Jacky Jacky Creek.

Viewed from the edge of the rain forest, which cut across its base, Naru Point appeared as a sloping, bald, sandy headland covered with bluish short grass (*Eriachne trisetata*), projecting a scant 200 yards and fringed against the sea with grotesque, wind-beaten *Pandanus spiralis* trees. From the water's edge the view was of rough reddish rock marching into the sea, serried and caved by wave action under cliffs rising about 25 feet and broken off in large angular blocks. Portions of an old shore line appeared as a shelf elevated perhaps 10 feet above high-water mark. It might be said in passing that, thanks to McLaughlin's foraging, the rocks

of Naru Point yielded us quantities of very tasty small oysters.

Our arrival at Newcastle Bay coincided with the beginning of a bout of bad weather which lasted until the day before we vacated the camp. The southeast trade wind blew continuously day and night, first with occasional showers, then developing into hard squalls with rain frequent and heavy enough to interfere seriously with field work. The tents were placed at the windward ends of three small parallel dunes, where combs of loose sand provided some shelter and dense growths of contorted low trees covered the camp. Hard-biting green ants (*Oecophylla*), infesting the trees, resented our presence for the first day or two. Sand blew into our food and drifted into tents and beds, until laid by rain.

Limited areas of shifting dunes occurred. Where partially stabilized the whitish sand carried an assortment of woody vegetation, including on low sea-fronting dunes the strand trees *Casuarina equisetifolia*, *Pandanus pedunculatus*, and low gnarled *Calophyllum inophyllum*.

The scrub of the stabilized dunes was so dense that botanizing and trapping in it necessitated path cutting, and night hunting was out of the question. Trees of the black tea-tree community provided most of the canopy layer and rain-forest elements most of the undergrowth of a scrub about 15 to 20 feet high. Chief dominants were *Melaleuca angustifolia*, with cream-colored flower heads, and *Leptospermum fabricia*. Associated smaller trees and undergrowth shrubs included, commonly, *Acronychia ?imperfurata* and *Eriostemon banksii*. Small ponds of dark still water in the dense scrub were edged with thickets of the great sedge *Gahnia sieberiana*, fully 10 feet tall and with harsh, cutting leaves.

The rain forests, behind the dunes and fronting the coast towards Somerset, were much like those of Lockerbie in general character. They were chiefly remarkable for an abundance of palms, including *Hydraistele wendlandiana* and *Ptychosperma elegans*, and *Pandanus* of several species. On blown sand where they edged the sea the rain forests were narrowly bordered with very dense, wind-clipped scrub, different from the scrub of the

dune area, in which *Parinarium nonda*, *Petalostigma quadriloculare*, and *Grevillea glauca* were particularly abundant as shrubs or small trees.

In the open-forest pockets inland, well-grown bloodwoods (*Eucalyptus polycarpa*) and a form of the polymorphic "*Melaleuca leucadendron*," up to about 60 feet high and 2 feet in diameter, were the characteristic trees. Grass cover on the deep sandy soils was often incomplete. Small patches of black tea-tree scrub occurred, and the tea-tree flat type of vegetation occupied low hollows.

A wet and partly boggy and peaty hollow close behind camp gave us our first opportunity to examine the wallum type of scrub. There were only a few acres of it, dominated mainly by *Agonis lysicephala* and at most breast high. Other important shrubs included pink-flowered *Fenzlia obtusa*, *Dodonaea vestita*, and bushy *Melaleuca acacioides* with citron-scented leaves. *Nepenthes mirabilis* was common on the wetter ground, the flowers of both male and female plants having a strong mousy odor.

In more favorable weather this locality of such varied habitats would probably have yielded better zoological results than it did. In botanical collecting, which is least affected by weather, the lashing of the wind between rains often made it impossible to see whether the trees held flowers or fruits. Collecting for insects was especially discouraging. Mammal collecting was remarkable in that no fewer than 12 species were represented in a meager total of 23 specimens taken under conditions most unfavorable for trapping and night hunting. *Dactylopsila*, the sugar glider *Petaurus breviceps*, and the pygmy glider *Acrobates pygmaeus* were shot in one flowering bloodwood tree in one night's hunting.

JARDINE RIVER CAMP, ABOUT LONGITUDE 142° 21' EAST

MAY 18 TO 21

A more convenient local designation for the position of this camp would be: about half-way along the telegraph line between the north bank of the Jardine and Sanamere Lagoon. Sanamere is 1½ miles out from the river.

We camped on the edge of a non-permanent

water hole made attractive by an open stand of paper-barked tea-trees growing in water up to 3 or 4 feet deep. Near by was a rough yard or corral used by drovers taking killer cattle to Red Island Point. It was one of the few camps we had where mosquitoes were numerous enough to be troublesome. Most of the mosquitoes were anophelines, but either through the absence of malaria in an area only occasionally visited by telegraph line-men, drovers, and wandering blacks, or the preventive properties of the atebine or quinine variously relied upon by our party, the locality proved healthy as far as we were concerned.

The Jardine is a perennial stream. In this part of its course, 18 air miles from its mouth, the river had a strong current and ran about 150 yards in width through open forest with here and there bits of rain forest on its banks. Beaches and bars of whitish sand alternated with sharp-cut banks on bends. A cable punt, capable of carrying a motor truck, was stranded on a sand bank in midstream at the telegraph line, and on the south bank stood a galvanized iron hut marked on the military map as a boat shed. In the known presence of estuarine crocodiles and the absence of a boat, we deemed it wiser not to attempt a crossing of the river. Upstream three-quarters of a mile was a ford crossable later in the dry season.

The open forests were inferior in timber growth and grassing to those of the tip of the Peninsula. They could be divided into types occurring within reach of high floods and types occurring on a flat-topped lateritic ridge lying between the river plain and Sanamere Lagoon. The river plain was approximately 30 feet above sea level, the ridge about 25 feet higher. Bloodwood (*Eucalyptus polycarpa*) and a tea-tree ("*Melaleuca leucadendron*") were the chief trees on the grayish sandy soils of the flood plain, the former forming nearly pure stands on slight elevations of looser sand, and the latter taking over on poorly drained flats. *Sclerandrium grandiflorum*, *Eriachne trisetia*, and *E. pallescens* formed the bulk of a fairly good body of grass, 2 or 3 feet high, on the drier soils. On tea-tree flats the grasses were replaced by *Leptocarpus schultzei* and *Schoenus sparteus*, sparsely tufted and only 12 to 18 inches high.

On the lateritic ridge, which rose immediately from our camp, the topsoil varied from pale, loose sand to hard-packed soil, reddish and pebbly. Clumps of black tea-tree scrub, dominated by *Leptospermum fabricia* and containing *Dodonaea viscosa* var. *laurina* and an epacrid as tall shrubs, occurred on the looser sand. The prevailing open forest was of poorly grown bloodwood and messmate (*Eucalyptus tetradonta*), sparsely grassed with wiry species, but with an abundant and often dense undergrowth of shrubs and small trees chiefly of species coming in from wallum scrub on the Sanamere side of the ridge.

Sanamere lay at about river level in a long east-west depression. About a mile long and wide, it was big enough to be called a lake. The water appeared to be shallow. Long narrow bars covered with tall marsh sedges jutted far out from the shores and in two places seemed to extend right across the lake. The southeastern shore, the only one examined, exhibited very distinct zonation in its vegetation: (1) the deeper-water zone of marsh sedges covering the bars and extending round the shores, (2) a zone of hummocked, wet, peaty ground covered with impenetrable thickets of *Gahnia sieberiana*, *Agonis lysicephala*, and shrubby *Melaleuca leucadendron* var. *lancifolia*, over head high, (3) sloping gray sand wet with an even film of seepage water and carrying numerous bladderworts and a scattering of knee-high, spindly, dwarfed *Agonis lysicephala* and *Thryptomene oligandra* as shrubs, and (4) wallum scrub on dry sandy ground.

The wallum scrub blended into the messmate-bloodwood open forest of the ridge. It consisted of an abundant but open stand of stunted little trees (*Banksia dentata*, *Grevillea glauca*, *Acacia* 18853) rising incompletely above shrubberies chiefly of *Agonis lysicephala*, *Fenzlia obtusa*, *Jacksonia* 18834, and smaller *Hibbertia* 18838, *Gompholobium* 18843, and *Boronia* 18835. Extensive tracts of low ground in the lake depression, and other depressions to the north of it, were covered with another type of wallum in which the *Agonis* greatly preponderated and gave a grayish appearance to the landscape.

Our short stay at the Jardine, in unsettled and somewhat showery weather, was very profitable for plants and insects but exceed-

ingly poor in results for mammals, reptiles, and amphibians in all habitats including the lake shores. Traps yielded not a single mammal, and hunting only three sand wallabies. Birds, however, were plentiful along the river and in the open forest. An emu (one of the few observed on the expedition) was seen running in open forest near Sanamere. But on Sanamere, where conditions appeared favorable for them, swimming and wading birds seemed entirely absent at that time of year.

PORTLAND ROADS

MAY 30 TO JUNE 4

The boisterous and at times showery weather we had experienced on the far north of the Peninsula since early May continued at Portland Roads. The rain did not amount to much, but we were glad, nevertheless, to have as headquarters a somewhat leaky 70 by 20-foot army hut which had been part of a wartime radar station.

Camp was in open forest about half a mile from the jetty, under the inland side of a mile-long rocky granite ridge which rose directly from the sea to a maximum height of 390 feet and was named Aylene Hills. From the top of Aylene Hills fine views were had of a picturesque indented coast. Inland 2 miles to the west were the Round Back Hills, rising to 1200 feet, and beyond them and to the distant southwest, Janet Range and Tozer Range. Rain forest covered most of the Round Back Hills. It also occurred sparingly on the upper inland slopes of Aylene Hills, mostly in gullies, and there were small strips of it along the shores of Weymouth Bay. The nearer shores of this bay were muddy behind a shore-fringing coral reef and lined to a depth of 100 yards or more with *Rhizophora-Bruguiera-Avicennia* mangrove forest 20 to 30 feet high.

The exposed seaward slopes of the Aylene Hills were more or less grassy and rocky, but in parts thinly covered with leaning, wind-clipped, low scrub, or carrying small patches of stunted rain forest. The northern crests were mainly rocky grassland, thinly sprinkled with small *Grevillea glauca* trees, and supporting shrubby clumps of rain-forest species. Similar grassy conditions on bald headlands and coast-fronting mountain ridges are a conspicuous feature of the great length of coast

between Cape Tribulation and Somerset, in areas where rain forest is seen close to the sea. The only comparable conditions noted at any distance inland were on the Janet Range, about 4 to 12 miles back from the coast. The grass, it would seem, occupies terrain that was formerly rain forested. Destruction of the forest by fire would appear to be the only feasible explanation for the bald areas, on which, if trees are present, they are not the prevailing trees of near-by open forest. The crews of small boats, ranging the coast for trochus, bêche-de-mer, and sandalwood since the advent of the white man, may have been responsible for much of the burning.

The country in general about Portland Roads consisted of open-forested sandy ridges elevated about 50 to 100 feet. Big granite boulders occurred occasionally, singly or in groups. A bloodwood (*Eucalyptus dimorphophloia*), 30 to 50 feet tall, was the principal tree. The bloodwood (*E. polycarpa*) prevalent north of the Jardine River came in on flats and the lower ridges. On stony slopes a box (*E. leptophleba*) replaced the bloodwoods. *E. tessellaris*, straighter and taller than the other eucalypts, grew plentifully about the edges of rain forest. Protean "*Melaleuca leucadendron*" appeared in several forms on the ridges and as usual on sour flats and as relatively tall trees on the banks of streams and watercourses. On limited, almost grassless patches of hard-packed sand, called "scalded flats," bushy *Petalostigma banksii*, sometimes accompanied by *P. quadriloculare* ("quinine-tree"), formed small-tree scrubs.

The open forests were poorer in species than those north of the Jardine and especially those of Lockerbie. The deficiency was particularly noticeable in the grass flora and in small wet-season herbs of the tea-tree flats. Also, ground species very important in our most northerly localities were missing or unimportant here. For example, *Cenchrus elymoides*, a dominant on the better soils of Lockerbie, seemed absent at Portland Roads where its place was taken by *Heteropogon contortus*, a minor species at Lockerbie. This troublesome "bunch spear-grass" was shedding its ripe seeds, which went through our tough khaki drill trousers as readily as a tin tack. Important grasses of the sandier soils included *Eriachne pallescens*, *E. squarrosa*,

and *Aristida browniana*, 2 to 3 feet tall and seldom covering the ground completely.

Vernon, who joined the expedition at Portland Roads, had good hunting for birds at this short-term camp. Mammal collecting, as so often pertained in open forest, was poor for both trapping and hunting and yielded 11 species. Only two arboreal mammals, *Petaurus breviceps* and *Uromys caudimaculatus*, were taken in diligent night hunting with jacklights. On some open-forest ridges the bark of hollow box trees was covered with the scratches of climbing animals, not necessarily mammals, but exploration of the cavities by poking down into them and revolving a long cleft stick failed to discover anything by evidence of smell or by hairs adhering to the stick. Gould's flying fox was collected in the mangroves.

IRON RANGE

JUNE 5 TO 26, JULY 19 TO 23

The position and surroundings of this important camp locality have already been sketched in some detail in the section on itinerary and routes. For our very convenient headquarters at the erstwhile military radio station we were indebted to the hospitality of Mr. and Mrs. Bert Connell, whose home was in one end of the building. Bert Connell and his partner, Malcolm Holmes, owned a two-man mine from which they were getting good gold from vugs in the Iron Range ridge. At that time theirs was the only mine working. Several prospecting shafts in the neighborhood were abandoned, as was the discovery show, Gordon's Mine, which had been worked successfully between 1934 and its closing through exigencies of war in 1942.

Camp was in an open-forest pocket on the east bank of the East Claudie River, about 50 feet above sea level. Rising parallel with the river, and close to the east of it, was the ridge of hematite-impregnated schist, there 250 feet high, from which the countryside took its name, and on which Mt. Shea (Lamond Hill of the maps) reached an altitude of 622 feet. East and west of the Iron Range ridge the country rock was granite.

The predominance of rain forest was exaggerated on the military 1-mile map, and some occurrences of open forest were not shown at all, but within practical pedestrian collecting

range this was essentially a rain-forest locality. A few treeless grass patches occurred down the river towards the airfield. There were open-forest pockets other than the one we camped in, some of them quite extensive. Most of the open-forest areas were downstream from camp, and in them rain forest occupied the hollows of gullies and creeks.

Some timber had been felled in the rain forests for local use, and rattan canes (*Calamus* species) cut commercially. The miners had had garden clearings, but disturbance by man's activities had been chiefly in road making. Limes and mangoes survived in the regrowths of old garden clearings. Papaws (*Carica papaya*) had become naturalized along the roadways and bore good fruit when flying foxes gave it a chance to ripen. Less desirable introductions by white men were pigs. They were useful for meat in this area where there were no cattle, and beef when we were there had to be brought in by air. But disturbance by over-numerous pigs was very evident in the rain forests and perhaps affected the ground flora and fauna, especially ground-nesting birds such as the megapodes.

Mist clouds often hung on the top of Mt. Shea in the early morning and covered the higher Tozer and Janet ranges inland across the Claudie Valley. Some rain fell every day or night for the first 12 days of our stay in June, after which there was a dry spell of eight days, followed by more rain. The rain came in showers from the southeast, usually light, and seldom so heavy or prolonged that one could not keep fairly dry in the field by sheltering at times against tree trunks or, better, under the dense leafy crown of a *Pandanus*. Shade temperatures for the 16 days June 10 to 25 were: maximum 79° to 83°, mean 81°; minimum 56° to 73°, mean 66° F. Some mornings in dry weather there was a decided nip in the air.

The June rains were not heavy enough to flush the streams. Most of the smaller streams had ceased to flow. They ran only during and shortly after the big wet season. The East Claudie was still an active stream flowing, too wide to leap, between water holes which would remain permanent in an otherwise dry channel later in the year. The main Claudie could properly be called a river. The East Claudie branch, with a cut channel averaging

perhaps 50 feet in width, and the Running Claudie and West Claudie branches were only creeks of a length up to about 10 miles.

The rain forests of the river flood plains differed substantially in floristics and appearance from those of the higher ground and ridges. On the East Claudie, flood plains of deep, fertile-appearing alluvium, grooved by dry anabranches, extended up to one-fourth of a mile out from the west bank. These flood plains, and others of the river system, carried very high forest. Many giant trees, notably a Leichhardt-tree (*Nauclea*) and a deciduous fig, must have been 150 feet tall and a good 6 feet in diameter in clear bole. Some of the large trees had enormously developed buttresses. Common lesser canopy trees attaining 100 feet or more included *Panax* 19109, *Arytera o'shanesiana*, Sapotaceae 19111, *Myristica insipida*, and *Garcinia* 19659. Floods of the last wet season, inundating the plain to depths of 6 to 10 feet, had swept the ground clear of leaf litter. There were few herbaceous species in an undergrowth characterized by tall shrubs and thin treelets such as *Lunasia amara*, *Croton* 19303, and *Rhyticaryum* 19054, and in places consisting of extensive dense thickets of a thin-walled bamboo (*Arundinaria cobonii*) over 20 feet high. Apart from *Calamus* palms, called lawyer-canes in Queensland and represented here by several species, climbing plants were few. Most of the few epiphytic ferns and orchids lived high on the big trees. The most striking features of the flood-plain rain forests were the larger canopy trees, spectacular groupings of these great trees, and the prevalence of pig rootings. The forest was not rich in species. In species of lowly stature it was exceptionally poor.

Botanizing in tall rain forest involves the tracing of flowering and fruiting canopy trees and lianas by their fallen flowers and fruits, and by the noise of feeding birds and the buzzing of insects out of sight high over head. In doing this one's progress is usually arrested by undergrowth shrubs and herbs which by their flower or fruit colors, though they are seldom startling, do something to relieve the gloom of the forest and from their variety add substantially to the bag. The banks of streams, when open to light in tall rain forest, usually are prolific in ground

plants and in epiphytes growing close to the ground. Not so here. Not a single stream-side ground species was found on the silty, pig-rooted banks of the East Claudie, and only a few small ferns, mosses, and hepatics attached themselves low on the trees.

The rain forests of higher ground, especially in hollows and ravines between ridges, exhibited a relative wealth of species but still were deficient in herbaceous undergrowth and epiphytes. Also, they lacked the very large trees of the flood plains. On often highly lateritized ridge crests, the forest was anything but luxuriant and contained in the canopy layer a good deal of scrub-hickory (*Acacia aulacocarpa*), which always indicated dryish and inferior rain forest. Frequent among canopy trees growing 80 to 120 feet tall in the better forests were *Castanospermum australe*, *Terminalia* 19149, *Macadamia* 19124, *Litsea leefeana*, and *Calophyllum* 19294. Many other species contributed to the canopy and supplied subcanopy, substage, and high undergrowth tree layers. High-climbing lianas came into some prominence with, for example, a common *Calamus* (*C. australis*), *Strychnos* 19143, *Omphalea* 19295, with big soft orange fruits, and in moist ravines root-climbing *Piper* 19327 and very robust growths of *Freycinetia carolana*. The wet bottom of one ravine contained a striking swamp forest of towering slender palms (*Gulubia costata*), over 100 feet tall, and a tall *Pandanus* with greatly developed flying-buttress roots. Other palms and pandans were conspicuous in the forest, the latter showing preference for gullies and ravines and including *P. krauelianus*, a species widespread in New Guinea but not hitherto known to occur in Australia.

Species of *Commersonia*, *Macaranga*, and *Breynia* figured largely in the rain-forest second growths of quick-growing small trees which crowded road sides and other clearings and occurred wherever there was natural disturbance in the primary forest. A wild banana (*Musa banksii*), with seedy fruits of good flavor, was prominent in regrowths in hollows. And in shaded openings in the forest a virulent stinging shrub or small tree (*Laportea* 19191) soon made its presence known to the unwary.

Several types of open forest occurred. South

of the airport and of the big rain forests, low ridges of pebbly brown laterite carried fairly tall and dense pure stands of messmate (*Eucalyptus tetradonta*) remarkable for the straightness of the fibrous-barked tree trunks and often the virtual absence of ground plants of any kind. Under better conditions of soil and moisture in pockets surrounded by rain forest, *Tristania suaveolens*, *Xanthostemon crenulatus* (seen at Lockerbie but previously known only from south New Guinea), *Wormia alata*, with reddish papery bark and big yellow flowers, *Acacia* species, and groves of *Pandanus* 19312 were commonly associated with the prevailing bloodwood (*Eucalyptus polycarpa*). Shrubs including *Melastoma malabathricum* grew plentifully in a good cover of tall grasses. Orchids and gouty "ant-houses" (*Myrmecodia* 19305) were frequent epiphytes in this open forest. Low-lying areas of grayish or yellowish soil carried the tea-tree flat type of vegetation. Burning of the grass "to clear the ground" was begun in June.

An interesting development of wallum scrub occupied the top of an infertile ridge of broken white quartz and sparse gray soil about 3 miles east of camp and 350 feet above sea level. *Agonis lysicephala* and a small grass-tree (*Xanthorrhoea* 19094) were the principal elements, and flat-stemmed *Acacia* 19104, *Jacksonia* 19086, and *Hibbertia* 19087 were abundant in shrubberies 3 to 5 feet high. Small trees, widely spaced in the shrubberies or closing in to form a sort of low open forest, included *Leptospermum fabricia*, red-flowered *Melaleuca* aff. *symphyocarpa*, *Casuarina* 19082, and a *Banksia*. The peculiar grass-trees produce a very inflammable resin, and their young-leaf "heart" is as good to eat as that of most palms.

The Iron Range area proved rich in bird life. Among striking forms were megapodes of two species, the cassowary, and the great gray palm cockatoo. Insects, though not abounding at that season, offered good collecting. Some excellent catches of small night-flying insects were had by hanging an inverted cone of white cloth under a lamp in the rain forest. Ground-inhabiting spiders were taken in numbers by hunting them at night by the gleam of their eyes caught with a jack-lamp.

Very satisfactory trapping and hunting for mammals yielded 21 species, of which several, such as a marsupial mouse (*Sminthopsis*), the spiny anteater (*Tachyglossus*), the brown cuscus (*Phalanger orientalis*), and the rare fruit bat *Dobsonia m. magna*, were new to the collection. The spotted cuscus (*Phalanger maculatus*) was quite abundant in the rain forests. Spiny anteaters lived in both rain forest and open forest and were not uncommon. One was found hopelessly entangled in a camouflage net left by the armed forces. Another, discovered one morning dug in beside a steel trap, had apparently sprung the trap and, in fright, dug itself a hole to hide in. Large numbers of insectivorous bats inhabited one of the old tunnels of Gordon's Mine, where *Rhinolophus megaphyllus*, *Hipposideros g. cervinus*, and the large *H. diadema* were taken in good series.

The botanical collections included virtually every plant found in flower or fruit in June, except road side weeds. As at Lockerbie, the season was not right for the reproductive processes of many rain-forest species. During our brief stay in July, however, a sprinkling of trees that had been sterile in June were found in flower, and others would soon be opening buds.

TOZER GAP

JUNE 27 TO JULY 11

Tozer Gap is a low saddle, about 5 miles through, separating Tozer Range to the south from Janet Range to the north. Camp was placed on a smooth open-forest ridge between two running gullies in the east end of the Gap 300 feet above sea level. It was about $1\frac{1}{2}$ miles east-northeast from the summit of Mt. Tozer (1784 feet) on Tozer Range, and 2 miles nearly south from the South Pap (1400 feet), terminating Janet Range. Less than half a mile to the north the main stream of the West Claudie (Mishap Creek on the Queensland 4-mile map) formed cascades and dropped over waterfalls in a narrow rocky gorge cut in the eastern end of the Gap. Mt. Tozer was screened from view by a 1000-foot end peak of Tozer Range which rose very steeply immediately to the west of camp. As this prominence had no name, we called it Puffdelooney Peak for the Australian version

of fried biscuits which were carried for lunch the first day we climbed it.

Camp was on a line of junction of open forest with rain forest. The open forest advanced through the Gap from drier country to the west of the ranges, and formed a pocket of a few hundred acres on foothill ridges and the lower east slopes of Tozer Range. The rain forest followed up the West Claudie to the head of the gorge. It was continuous with that of the Iron Range camp locality, 5 air miles to the northeast, and with the rain forests which covered much of Tozer Range and the eastern face of Janet Range. Wallum scrub replaced open forest to some extent in the inner parts of the Gap.

The rain forests of the mountains were examined from a subsidiary camp on the summit of Tozer Range. Those of the foothills were not greatly different from the unflooded forests of Iron Range in character, although moister on the whole, richer in epiphytes, and containing numerous plant species which were not observed at Iron Range. A cypress-pine (*Callitris* 19407) grew plentifully in the forest of the gorge, where orchids (few of them flowering) were notably abundant on shaded granite rocks. A climbing *Hoya* (19447) had umbels of remarkably large, blackish purple, gardenia-scented flowers, each over 3 inches in diameter.

On the better soils a bloodwood characterized the open forest, and there was a good body of coarse grasses. Tall, paper-barked tea-trees grew along the edges of streams and in swampy hollows, where pitcher-plants (*Nepenthes mirabilis*) also found conditions to their liking. On the sandier soils, red-flowered *Melaleuca* aff. *symphyocarpa* and *M. viridiflora* formed often dense tree stands with a thin ground cover of wiry grasses, or frequently an abundant undergrowth of wallum shrubs such as *Agonis lysicephala*, *Hibbertia*, *Gompholobium*, and pink-flowered *Boronia alulata*.

Showery weather prevailed until almost the end of our stay in the Gap. While it did not rain every day and night, we had hard falls and at other times drizzles which kept the rain forests generally wet and unpleasant to work in. Clothing, once wet, was hard to dry. Leather camera cases and gun slings began to rot from wetting in the field and con-

stant moisture in the tents. There was difficulty in drying mammal and bird skins and keeping them free from mold.

Collecting was fairly good for plants and insects, excellent for birds, and poor for mammals. The rain, and water dripping from the trees, often made conditions bad for night hunting with lights. Mammal signs, especially small rootings as of bandicoot, were abundant in the rain forests but traps yielded little. As old Moreton the black boy summed it up, "Plenty mark all about, but trap can't take 'im." The mammal collection of 11 species contained only one, the marsupial "cat" *Satanellus hallucatus*, which was not taken at Iron Range camp.

TOZER RANGE

JULY 2 TO 4 AND 6 TO 9

This subsidiary camp, at about 1300 feet, was placed snugly in rain forest on a small ledge in the lee of the narrow crest of the sea-facing scarp of the range. Mt. Tozer rose half a mile to the west across a high basin in the range. In a deep ravine that occupied most of the basin a stream flowed north between the mountain and Puffdelooney Peak and dropped down into Tozer Gap to join the West Claudie. The camp consisted of a fly, with beds of tree fern fronds on the ground, and storage platforms of sticks hung under the peak of the roof. Water was got from the stream in the ravine, about 200 feet below camp level.

The track cut to the camp site started 10 minutes' walk southwest of Tozer Gap camp at a running stream where many fan- and feather-palms grew in the edge of the rain forest at 350 feet altitude. From there it passed diagonally up the steep face of the range, through rain forest in gullies, a viney bastard rain forest in between gullies, and on very steep and in parts rocky slopes above about 900 feet a type of scrub not previously met with on the expedition.

This "mountain turkey-bush" covered perhaps one-third of the upper eastern slopes of the range. It also occupied all but the ravine and the sheltered east side of the camp basin, and extended south an undetermined distance on the broad, ridgy, 1600- to 1700-foot top of the range. From about 6 to 15 feet in height, the component small trees and shrubs

formed a very dense and often very rigid growth difficult to cut through. Composition varied locally, the principal dominants being red-flowered *Melaleuca* aff. *symphyocarpa*, *Casuarina* 19387, *Leptospermum fabricia*, a phyllodineous *Acacia*, *Hyptiandra bidwillii*, *Grevillea pteridifolia*, and *Agonis lysicephala*. The coarse clump sedges *Gahnia aspera* and *Lepidosperma laterale* grew in openings and as undergrowth in the thinner scrub. The ground was soft with humus and partly decayed *Casuarina* twigs bedded over leached gray sand. Parts of the scrub were fast regenerating after a fire which had killed it to the ground and left the components standing as a miniature forest of gray skeletons over the new growth. The fire probably climbed the range from the dry western slopes a year or two before our visit.

Mount Tozer had the appearance of an exfoliation dome of granite. Our cut trail to its summit skirted around the head of the camp basin on a bench at about 1500 feet elevation. Under the southern lift of the mountain we crossed a swampy gully with *Gleichenia* ferneries and many *Pandanus* trees and pitcher plants, then went up the slopes through low scrub with here and there a steep face of almost bare granite rock. Where exposed to strong southeast winds on the summit, the scrub grew low and so stiff that our shins were made sore from pushing through it. A fragrant white orchid (*Dendrobium fusiforme*) occurred plentifully on otherwise bare rock. Large flat rock surfaces exposed to the sun had scaled off in thin slabs which tilted and clattered when walked upon and gave cover to a species of sluggish small lizard. A cairn of stones and a trig pole, erected by a military survey party during the war, marked the highest point at 1784 feet. The survey party apparently had climbed the peak from the northwest. We found no cut trail or any other marks of man on our route.

Puffdelooney Peak was ascended from Tozer Gap camp. The crests and slopes of rocky bluffs at its 1000-foot summit carried an open scrub of an undescribed *Leptospermum* (19346), which in its contorted shapeliness recalled the dwarfed, pot-grown trees of the Japanese. This extraordinarily beautiful small tree of 12 to 18 feet, with ericoid leaves and small white flowers, was the so-called

"smooth-barked turkey-bush." Its thin, smooth bark was a soft shade of reddish purple, and its greenish yellow wood was so very hard that it crinkled the cutting edges of our machetes. On the rocky summit of Mt. Tozer the same species assumed a sprawling, espalier habit of growth.

The bastard rain forest mentioned above occupied the upper slopes and most of the small summit area of Puffdelooney Peak. It was a dense, brushy forest, containing rain-forest trees but dominated mainly by *Tristania suaveolens*, a tree normally of the open-forest formation and its ecotone with rain forest. A small tree *Pandanus* was plentiful in the underbrush, and supplejack (*Flagellaria indica*) a common climber. Slender vines, such as *Smilax glycyphylla*, with stems as thin and almost as tough as wire, much encumbered this forest and were also present in the scrubs of the range.

For mountain rain forests, growing under conditions presumably moist through most of the year, those of the camp basin were rather poor in species. Probably the steep slopes were in part responsible for this. The tallest trees were only about 60 feet high and the stoutest 2 feet in trunk diameter. Canopy trees included long-leaved *Podocarpus* 19458, *Halfordia kendack*, *Acronychia melicopoides*, *Quintinia* 19356, and a *Xanthostemon*. The undergrowth, characterized by woody plants except for *Dianella ensifolia* and a few ferns, was largely of slender treelets. Epiphytes included large clumps of the curious elk-horn fern (*Platyserium alpicorne*), small filmy ferns (Hymenophyllaceae) growing near the ground and on rocks, and a few orchids. A small amount of moss grew on the trees and rocks. Touches of luxuriance were supplied by a robust climbing orchid (19469), and especially a slender tree fern (*Cyathea* 19399) which abounded in the ravine and was the only tree fern seen this far north on the Peninsula.

Collecting activities were hampered and curtailed by rainy and misty weather which prevailed most of the time the camp on the range was occupied. This weather let up only when the demands of a planned itinerary required us to move on to another general locality.

For four nights with over 100 traps out, the only rewards in mammals were six speci-

mens of *Melomys lutillus australis*, which occurred also at Tozer Gap and Iron Range. These rats were trapped on the one rainless night that favored the mammalogists. But bad weather was not wholly responsible for the meager over-all results. A plague of white-kneed crickets ate the bait from the traps on rainy nights. Traps set near the camp were rebaited three and four times in an evening, only to be sprung minutes later by the raiders. Metal guards devised to protect the bait could not prevent the crickets from springing the traps in efforts to get at the tasty mash of peanut butter, ham, raisins, and oatmeal. Different groups of our party had two rainless nights on the top of the range, and on these nights no crickets were seen.

BROWN'S CREEK, PASCOE RIVER JULY 12 TO 18

At Brown's Creek we were 200 feet above sea level on the inland side of Tozer Range, in country much drier climatically than any we had been in before. A big eastern branch of the Pascoe, the creek flowed all the year from springs under the range, and at the crossing of the Wenlock-Iron Range road it ran about 10 yards in width in a bouldery and gravelly bed. The creek was a favored camping place on this lonely road. Poles were in position for stretching our tents and flies, and a galley with rusty corrugated iron roof stood ready for the cook. The only human resident anywhere in the Pascoe drainage basin was a solitary miner working tin some miles to the north of our position.

The road crossing was at the mouth of a valley about $1\frac{1}{2}$ miles across, which wedged into the range and was encompassed by heights of 1000 feet and more. In the valley the creek held a succession of long, deep water holes fringed with tall, paper-barked tea-trees and smooth-barked *Metrosideros tetrapetala* and in some places narrow strips of inferior rain forest. Below the road the valley opened up into varied ridgy country. The stream flowed over gravelly riffles deepening into small pools, and in the rainy season divided around and flowed over low islands in a broad, braided flood channel. The sandy and gravelly low islands and flood banks carried some brushy low rain forest in which

cypress-pines (*Callitris* 19185) were conspicuous, and corky-barked *Carallia brachiata* was another common tree.

Out from the creek banks the vegetation consisted of wallum scrub and open forest in about equal area, and small developments of smooth-barked turkey-bush scrub. On deep sandy soils near the creek, isolated small clumps of rain forest occurred in the open forest. These open forests of the better soils were chiefly of bloodwood (*Eucalyptus dichromophloia*). *Persoonia falcata*, *Careya australis*, and *Pandanus cookii* occurred commonly as smaller trees. Rather numerous shrubs in the grass included *Hibiscus* 19181, with very large creamy flowers, and *Morinda reticulata*, made showy by its big, leafy, white sepals. On level ridges of poorer, somewhat lateritic sand, messmate (*Eucalyptus tetradonta*) or messmate and bloodwood formed dense stands 70 or 80 feet tall, with ground cover of wiry grasses and sedges (chiefly *Eriachne trisetata* and *Schoenus sparteus*); slender shrubs such as *Helicteres angustifolius* and *Acacia* 19638; and abundant low grass-trees (*Xanthorrhoea* 19164).

The wallum scrub occupied, for the most part, level-topped or slightly rolling ridges of poor, gray, podsolized soil. It also covered foothill ridges of considerable slope. *Agonis lysicephala*, growing 4 to 8 feet high and in somewhat open order, formed the great bulk of the scrub. Co-dominants coming in with local soil changes included *Fenzlia retusa*, *F. obtusa*, violet-flowered *Hovea* 19184, *Dodonaea viscosa* var. *laurina*, and Euphorbiaceae 19539. Common small shrubs, mostly low and bushy, were *Boronia* 19179, *?Cryptandra* 19169, *Tephrosia* 19176, and a heath (19569). In the more open scrub, wiry *Schoenus sparteus* provided a sparse, tufted ground cover, and bushy *Haloragis* 19571 and other herbs were common locally. Great termite mounds, gray or yellowish, were a conspicuous feature, protruding above the top of the scrub. Fires lit by roving prospectors had burned much of the wallum during the dry season or two before our visit. The slender fire-killed stems of the shrubs could be pushed over easily with one's foot. Burned *Agonis* and minor dominants had grown clumps of tall shoots from underground root stocks, but most of the smaller woody plants

had disappeared for the time being. The fires were made to expose any rock that might be outcropping. They also made travel easy through the wallum, until the next season, when the traveler had the dead sticks as well as the vigorous regrowths to contend with.

The smooth-barked turkey-bush (*Leptospermum* 19346) scrubs were chiefly on higher ridges of rotten, reddish brown granite, where rock lay exposed and soils at most were thin and very dry. One could pass through these scrubs by stooping under the spreading branches of the trees. A thin canopy overhead let in plenty of light, but usually the ground was quite bare but for tufts of the xeric small ferns 19595 and 19596.

Above the road a little, off the north bank of the creek, a spring formed a big, quaking, sedge and pitcher-plant bog several acres in area, much rooted around its mucky edges by wild pigs. As principal sedges, great *Gahnia sieberiana* formed thickets 6 to 10 feet high, and *Cladium glomeratum* had erect, needle-tipped leaves that called for careful avoidance when one stooped to dig up the little bladderworts, eriocaulons, sundews, and *Xyris* that abounded in the bog. The pitcher-plant was variable *Nepenthes mirabilis*, confined to northern parts of the Peninsula and the only known species in Australia. *Agonis lysicephala* invaded the bog from neighboring wallum, and shapely bushes of *Melaleuca leucadendron* var. *lanceifolia* grew plentifully on firm margins. Especially interesting finds were orchids of epiphytic type (19561, 19646) rooting in the peaty bog and seen nowhere else on the expedition.

Intermittent showers wet the grass and dripped water from the trees, but were not enough to moisten the dust-dry ground. My journal for July 18 read: "The overcast, showery weather continues through the daylight hours, although nights are fine. Last night was typical. Waking about one o'clock, I heard the loud, quarrelsome noise of fruit-bats and got up to investigate. A thin, sharp breeze was coming out of the southeast. High white wisps of cloud scudded across a bright moon, and the night was full of subdued sound. Frogs down in the creek. Crickets and cicadas out in the timber. Now and then the whooshing sweep of a fruit-bat's wings as it shifted its feeding place in the flowering tea-

trees on the banks of the stream. Rousing Van, we went down with guns, and he added another *Pteropus gouldi* to the collection."

Not many mammals were got by trapping, or night hunting with special attention to flowering tea-trees and eucalypts. But among 10 species secured were two rarities found by us only in this locality: a bat, *Taphozous mixtus*, and the peculiar tree-dwelling rodent *Mesembriomys gouldii*, trapped by George Tate. Collecting was good in all other fields. Several species of fishes were taken from the creek by netting and by shooting with a .303 rifle.

WENLOCK, BATAVIA RIVER

JULY 10 TO 28

The Batavia has been renamed Wenlock River and so appears on recent maps, but in common usage the old name still holds. Wenlock township is the present-day center of a goldfield which has gone through various ups and downs since its discovery in 1892. In 1948 alluvial gold was being won by shaft mining from fossil wash about 90 feet below the surface. The total population of Wenlock and the field numbered some 30 men, women, and children, plus a few aborigines. Mails arrived fortnightly from Coen by pack-horse in the dry season and whenever the mailman could get through in the wet. A spur from the Telegraph Line provided telephone communication. Each household had a radio receiver. But for months in the rainy season, when flooded rivers and bog made wheeled traffic impossible, the little community lived virtually in physical isolation from the rest of the world. In 1948, for example, the first replenishment of stores arrived at the end of May.

The dry season was further advanced here, on the western side of the Great Dividing Range, than in our collecting localities nearer the coast and on the eastern side of the range. Fires had burned over most of the country, leaving only small patches of dry grass in sheltered or moist places, as in gullies, along the river frontage, and about a chain of lagoons across the river from the township. Only light showers had reached here from the weather disturbances we experienced nearer the coast.

The altitude at Wenlock was about 500

feet. Though only 25 miles from its source, the river had a channel about 100 yards in width, entrenched between steep, high, loamy banks. Its flow in late July was reduced to a shallow stream, about 20 feet in width, meandering in a broad sandy bottom. Later in the dry season, when surface flow ceased altogether, water would always be obtainable from scoured-out holes or by digging in the sand. Flood-bent red bottle-brush trees (*Callistemon viminalis*) grew plentifully in the sandy river bed. Reed (*Phragmites karka*) thickets covered sandy islands. On low silty flood terraces and the slopes of high banks, shady gallery woods consisted of a mixture of tall, paper-barked tea-trees and rain-forest elements such as *Buchanania arborescens*, *Carallia brachiata*, and a large "plum tree" (*Parinarium corymbosum*) said to bear palatable red fruits. The tea-trees were in flower and attracting many birds by day and little flying foxes (*Pteropus scapulatus*) by night, but most other trees were sterile.

This was essentially a locality of *Eucalyptus* open forests, of drier type than any seen heretofore. A notable increase in *Eucalyptus* species took place as one progressed southward on the Peninsula. Only six species were seen in all the area north of the Jardine River, as against 10 within a mile of Wenlock.

Bloodwood (*E. dichromophloia*) and messmate (*E. tetradonta*) continued as the prevailing eucalypts, the former characterizing the open forests of river flats and mixing with messmate on low sand ridges in the valley. On flats disturbed by cutting for mine timbers and firewood, a second-growth *Acacia* bore a profusion of golden yellow blossoms. On low sand ridges, burned over sometime before our visit, many perennial herbs and undershrubs were sending up, without benefit of rain, new flowering shoots from thick underground stems or deep enlarged tap roots.

One of the plant communities known as "spinifex country" covered the dry rocky top of an extensive sandstone or sandstone and conglomerate tableland that rose about 100 feet from the eastern side of the river plain. Stunted messmate and bloodwood formed an open forest in which a resinous "spinifex" grass (*Triodia* aff. *microstachya*) grew in large clumps amongst dried-out ephemeral grasses and herbs.

The big, permanent lagoons on the west side of the river contained many aquatic plants. Well represented were blue and white water lilies (*Nymphaea*), *Limnanthemum* species, and a *Utricularia* with inflated large float leaves. *Agonis longifolia*, with smooth gray bark and slender, drooping branches, grew as a small tree on the banks, and was also common in the river.

Wenlock was chiefly a mammal-collecting camp operated by Van Deusen. The rest of us spent only four days there. Four of the 15 mammal species collected were not taken farther north: the great gray kangaroo (*Macropus canguru*), the red-gray wallaroo (*Macropus r. erubescens*), brush-tailed possum (*Trichosurus v. eburacensis*), and the tiny mouse *Leggadina delicatula*. *Leggadina* was found by Geoffrey Tate under a sheet of corrugated iron lying in an old camp site in open forest. Water rats (*Hydromys chryso-gaster*) seemed unusually common in the river and were trapped in the vicinity of old drift logs on the banks. Rock wallabies (*Petrogale inornata*), reported common, had possibly been driven out by the recent grass fires.

Aboriginal rock carvings and animal paintings in red were found under the overhang of sandstone cliffs on the dissected edge of the tableland.

ARCHER RIVER, WENLOCK-COEN ROAD

JULY 29 TO 31

This large, permanently flowing river is notoriously difficult to cross in flood time and on that account is known as the "terrible Archer." Where we camped, at the crossing of the road and the telegraph line, the river channel must have been 400 yards in width and was full of great, rounded granite boulders polished, apparently, by the combined action of floods and wind-blown sand. At this point, 400 feet above sea level, the Archer cut through the Geikie Range and flowed over a granite bar for about half a mile. Above and below the bar, the river had a sandy bed, and downstream it gave off numerous side channels or anabranches deeply cut into dark gray alluvium. Throughout its length thereabouts the river had numerous long, narrow islands of sand and silt in its main channel. As we

saw it at low stage, the running stream, passing between islands, spreading shallowly over the sand, and contracting and forming pools in miniature rocky gorges on the bar, occupied but a fraction of the width of the great channel.

A tea-tree (*Melaleuca saligna*) with gray leaves and stout trunk pushed into leaning and reclining positions by the force of flood waters was the characteristic big tree of the islands and low banks. Rain-forest trees, shrubs, and lianas (*Parinarium*, *Nauclea*, *Cryptocarya*, *Diospyros*, *Crataeva*, *Mallotus*, *Faradaya*, etc.) congregated in brushy growths on some islands and on low terraces of the main banks formed strips of closed forest, open underneath and trampled and browsed by cattle. Scrub-turkeys were seen in these rain-forest strips, but not their nesting mounds. As on the Batavia River, the gallery rain forests were no doubt attenuated extensions of the rain forests of the Dividing Range, following the edaphically moist conditions of the river channel. The climatic rain forests at the head of the Archer were 30 miles above the road crossing.

The open forests through which the river flowed were so dry that vegetal functions were virtually at a standstill. Somewhat relieving the dull monotony of the scene, however, were the orange-red flowers of deciduous, leafless *Erythrina* 19760. And on dry open upper banks of the river the bare branches of another small deciduous tree, *Cochlospermum* 19747, were bright with big yellow blooms and bending under the weight of ripening capsules about to shed their cotony seeds.

In spite of the surrounding dryness, the river made this a pleasant camp. Mornings and evenings the air felt soft rather than cool. A strong southeast wind blew during the day, and when not hidden by clouds the sun shone hot enough to make one look for shade. A scud of rain came over now and then. After the day's work, the clear water of our bathing rock hole had the same relaxing quality as an air-conditioned room in summer.

Our short-term sampling at the Archer gave good results except in mammals, of which only two common murid and one bat species were taken. From the river came our first specimen of the fresh-water crocodile

(*Crocodylus johnstoni*), shot with the aid of a jacklight by Van Deusen, and nine kinds of fishes including the therapoid genus and species *Archeria jamesonoides* described as new by Nichols in 1949 (Nichols, 1949).

COEN

AUGUST 1 TO 8

The township of Coen nestles in a flat basin where Lankelly Creek joins the Coen River. All around it are high, thinly timbered, dry, rocky granite hills. Patches of dark tree growths, on the upper parts of some of the higher hills, had the appearance of depauperate outposts of rain forest. Eight or 10 miles to the east, tall hoop-pines could be seen protruding against the skyline in rain forest on top of the McIlwraith Range, where the Coen and Lankelly had their source.

A long-established, quietly active, small gold-mining and cattle-ranching center with a population of perhaps 50 people, Coen had its beginnings back in 1876. Activities had ceased at the local mines some years before our visit, but the township remained the base for prospectors in a large auriferous district and supply point for a number of small mines in the general area. Its airdrome, 16 miles to the north, was barely usable in very wet weather. Bulk supplies came from a boat landing on the Annie River, 80 miles to the southeast by a road trafficable only from about June to December. There was an important telegraph line station at Coen, and in a central position in the streetless township of galvanized iron stood a rambling building topped with the large, and to most travelers on the dusty roads appealing, sign, "Drink at Herb Thompson's Exchange Hotel."

For headquarters we had a mango-shaded four-roomed house on the right bank of the river about 2 miles up from the township, at a place appropriately called The Bend. The river there took a sharp turn, with a good water hole in its crook, after flowing picturesquely in an open rocky bed from the mouth of a shallow gorge. Downstream were smaller water holes in a rocky and sandy channel more or less shaded by tall tea-trees. Altitude by aneroid at The Bend was about 650 feet.

Here in the hill country flanking the western side of the Great Divide conditions in the

open forest were as dry as on the Archer. Early burning had denuded most of the area, leaving the stony ground supporting a poor growth of box and other *Eucalyptus* trees and pickings of green feed. Profitable plant and insect collecting therefore was practically limited to the flood bed and banks of the river, where a varied woody and herbaceous vegetation contained a sprinkling of rain-forest elements.

Vernon, as was usually the case, found plenty of birds for his attention. In mammals, too, though spotty from day to day, results were satisfactory, with 15 species collected. With the guidance of Mr. J. Fisher, owner of a good hunting dog, the mammalogists had one exciting afternoon which produced both bandicoot and native cat from an area of open forest littered with hollow logs. The same locality (in the neighborhood of Croll Creek, about 8 miles north of camp) also afforded excellent night hunting for brush-tailed possums and Cook's ring-tails (*Pseudocheirus p. peregrinus*). Several species of bats were captured in old mine workings in the vicinity of Coen.

BONANZA CREEK, UPPER
PEACH RIVER
AUGUST 10 TO 24

This was primarily a base for pack-horse transport across the McIlwraith Range to Leo Creek in the Rocky Scrub, at which collections were made as opportunity occurred. Camp was at an altitude of about 800 feet at the very foot of the range, in the edge of a strip of flood-bank rain forest that afforded shade and shelter from the strong southeast wind. The creek, some 10 to 15 yards in width, and gravelly, carried a good stream of water which deepened into cool, shadowy pools. Our establishment was on the left bank, a little above Shephard's old battery site. Fine weather prevailed until the last day of our stay, when a little rain fell in light showers.

Along the creek, on low flood banks up to about 100 yards in width, were developments of quite tall rain forest, with trees of good diameter, and high-climbing lianas, but virtually no low woody undergrowth, perhaps as a result of long disturbance by brows-

ing cattle. Rustling dry leaves covered the hard gray soil, and a scattering of shade-loving grasses occurred as ground plants. Among tall trees of this forest were Leichhardt-trees (*Nauclea*), *Blepharocarya involucigera*, *Cupaniopsis anacardioides*, and the Burdekin-plum (*Pleiogynium cerasiferum*); and in substage role, *Pavetta* 19824, ?*Quintinia* 19825, and other species. The fine pinnate palm *Archontophoenix alexandrae*, first seen at Iron Range, grew on edges of the running stream.

Creek flats and low ridgy country below the range carried open forest in which the trees, chiefly box, bloodwood, and ironbark, generally were much better grown than at Coen. The open forest extended upstream into a narrow valley through which the creek came down from the range.

On dry mountain slopes a deciduous monsoon forest, almost leafless in August, took partial control from the open forest and covered considerable areas. There were local variations in this forest, but for the most part it consisted of a scrubby stand of *Desmodium* 19755 with soft yellowish bark, and other small trees, too dense to get through with horses without track cutting. *Albizia ?procera* (19837) was a common larger tree. *Bombax malabaricum*, with big red flowers bedecking its leafless branches, occurred sparingly as an overtopping tree up to about 80 feet tall and 3 feet in trunk diameter. A sparse herbaceous cover on the leaf-strewn ground was characterized by an acanthaceous species (19833).

In approximate levels of zonation observed on the range, monsoon forest gave place to open forest at about 1200 feet, and rain forest succeeded open forest completely at about 1800 feet. The monsoon forest reached its highest elevation on dry spur ridges and slopes between streams; the open forest its upper extension in pockets surrounded by rain forest. Rain forest persisted, perhaps discontinuously, from the crest of the range down the Bonanza and the Peach River, and on down the Archer at least as far as the crossing of the Wenlock-Coen road at 400 feet elevation.

Found in numbers in the fringing rain forest on Bonanza Creek were the brown cuscus (*Phalanger orientalis*) and the spectacled flying fox (*Pteropus conspicillatus*).

The spotted cuscus (*Phalanger maculatus*) also occurred. By probable accident Vernon caught in a rat trap set on the ground in the rain forest a specimen of the pygmy marsupial glider *Acrobates pygmaeus*. *Acrobates* came to the collections in strange ways. The only other specimen taken on the upper Peninsula was shot by jacklight from a flowering bloodwood tree at Newcastle Bay, by Van Deusen, and recovered next morning from the belly of a carpet snake that swallowed it after it fell and was lost in the grass. In all, 10 mammal species were collected on Bonanza Creek.

From August 19 to 23 George Tate and Van Deusen had a mammal-collecting camp in Camp Oven Pocket, at an altitude of about 1500 feet on Bonanza Creek. Of nine species collected in the open forest and the rain forest around this camp, only two, *Rattus leucopus* and *Melomys lutillus*, were also taken at the foot of the range.

LEO CREEK, UPPER NESBIT RIVER (ROCKY SCRUB)

AUGUST 13 TO 21

Here in the depths of the rain forest called Rocky Scrub, where it covered the eastern slopes of the McIlwraith Range, we were at an altitude of about 1400 feet on the left bank of a large creek that ran approximately northeast to join the Nesbit River. The creek flowed in a narrow valley, little more than a ravine, with the main range rising to 1800 or 2000 feet on its western side and a high parallel ridge hemming it in to the east. These rugged rain-forested mountains had been the scene of alluvial and reef mining for gold, starting 55 years before our visit, in which at one time about 300 men took part. Mining had ceased for some years. We found numerous shallow old workings overgrown by forest. About 20 minutes' walk back along the way we came over the range from Bonanza Creek, the track forked at a tall old axe-scarred mango tree at an altitude of 1800 feet. The northern branch, pretty well closed by forest but used as a trail by wild cattle, was said to lead down to a grassy pocket (Neville Pocket) about 3 miles distant, where there was a slaughter yard in the old mining days. The southern branch of the track made a well-graded descent to Leo Creek, where

William Lakeland, discoverer of the goldfield, formerly had a water-powered battery for crushing ore.

We camped at Lakeland's old battery site, still marked by a stone forge and the remains of a water wheel. A rather extensive clearing along the creek had been mostly reclaimed by forest regrowths. In a small open space were the collapsed ruins of a hut from which we took sheets of galvanized iron to serve as work tables and beds to sleep on. Old mango and lime trees stood in the forest regrowths; also rows of pineapples, grown thin and tall and looking like primitive gray-green members of the bromeliad family.

It was a wild and lovely spot. Apart from the clearing at camp, the only open space in the forest was the rocky granite bed of the creek which formed a narrow cleft in the dense vegetation. A waterfall sounded pleasantly in our ears, and upstream there were other falls. The water was clear and cold and, so far as we could determine, without any fish. Fringing the stream were palms and lines of tall, often leaning *Tristania exiliflora* trees, whose big gray trunks and bark peeling in scrolls gave them the appearance of gum-barked eucalypts. Many epiphytic ferns were as much at home on moist shady rocks of the creek banks as on trees in the forest.

The rain forest developed luxuriantly on flattish terraces along the creek, in moist gullies, and on moderately steep lower slopes. Canopy trees seemed few in species, however, and there were not many large trees or large lianas. It was chiefly in small trees, woody undergrowth, herbaceous undergrowth characterized by ferns, a host of epiphytic ferns, and mosses, that the forest could be called rich. Palms were abundant in at least eight species, excluding climbing *Calamus*. A small tree fern (*Cyathea* 19859) was abundant and conspicuous. *Bowenia* 19929, an acaulescent cycad, occurred plentifully in drier situations. Steep upper slopes and the east-facing edge of the range crest supported a drier type of forest much poorer floristically, in which scrub-hickory (*Acacia aulacocarpa*) was much in evidence. Farther back, on the broad top of the range, the forest improved in timber volume, and an enriched flora, especially in streamways, looked interesting botanically.

Botanical collections, however, were not

what they might have been, mainly because so many plants of the rain forest, other than ferns and bryophytes, were sterile in August. Also, a bout of influenza curtailed my field work. Perhaps the most advantageous times for botanizing in this locality would be from October to December for flowers and through the wet season for fruits as well as flowers.

About the only insects prominent were butterflies and Odonata of few species, in open sunny reaches of the creek and in the camp clearing. Nights in the rainless weather we experienced were too clear and moonlit and, with minimum temperatures of 58° to 60° F., perhaps too cool for nocturnal flying things to be very active.

Birds were there in plenty, but they were hard to see in the thick cover. Among birds usually noisy in the rain forest, megapodes of two species were seen but their calls never heard. The ringing boom of the cassowary also was absent, and we saw no traces of this great ground bird and feeder on fallen fruits. Rifle-birds alone were loud in calls in the tree tops.

Nine species of mammals were collected, the largest in size and the only arboreal marsupial being *Dactylopsila trivirgata*. *Rattus leucopus* and *Antechinus* made up much of the take from traps. The small bats *Hipposideros m. semoni* and *Rhinolophus megaphyllus* were netted in a flyway in the forest.

Up to this time our work in the rain forests of the Peninsula had been remarkably free from the discomfort occasioned by two all too prevalent pests of the environment in the New Guinean-northeast Australian region: scrub itch (*Trombicula*) and land leeches. The Lockerbie rain forests were entirely free of both in our experience, and remained so even in the wet season according to local report. At Iron Range there were few leeches and no scrub itch. The same could be said of Tozer Range, wet as it was. But in the Rocky Scrub we picked up moderately bad infestations of the scrub itch mite, and leeches were plentiful locally in the moister parts of the forest.

SHIPTON'S FLAT, PARROT CREEK, AND MT. FINNEGAN AREA

SEPTEMBER 2 TO 23

From our base at Shipton's Flat, at an ele-

vation of about 900 feet on the Parrot Creek tributary of the Annan River, we ranged over terrain from altitudes of 800 feet down the creek to 3740 feet on the summit of Mt. Finnegan. Subsidiary collecting camps were established at 2600 feet on the western slopes of Mt. Finnegan and at 1150 feet on upper Parrot Creek under the northwestern slopes of the mountain.

Formerly, there was considerable activity in mining stream tin in this area, and one small hydraulic sluicing show was still in operation at Shipton's Flat. Old tin workings were noticed up to 2400 feet on Mt. Finnegan and the remains of water races as high as 3000 feet. One old race, on upper Parrot Creek, passed through a tunnel in which bats (*Rhinolophus megaphyllus*) were collected. In the late 1930's attention was turned to lumbering in the great rain forests of the section of the coast range of mountains drained by Parrot Creek. A sawmill, built at Shipton's Flat, worked until 1945, when lumbering ceased, owing to operational difficulties. The buildings of the abandoned sawmill served us as a base. By following the ramifications of old logging roads, we were able to work through the rain forests up to an altitude of 1800 feet and close to the top of the range to the north of Mt. Finnegan. The subsidiary camp on upper Parrot Creek was just within the big forest, on a flattish area called The Tabletop.

Parrot Creek flowed strongly in a bouldery, rock-pooled, or sometimes gravelly bed. Below the great rain forests it gorged in the granite of the country, then fell rapidly over rocky bars, sunlit, or shaded by fringing rain forest. Opposite camp at Shipton's Flat the creek spread around low gravelly islands covered, as were the banks, by thin rain forest inundated by wet-season floods and containing a dense woody underbrush, of which *Melicope sessiliflora*, *Hedraianthera porphyropetala*, and *Euonymus* 20019 were the most abundant species. Lining the banks in moist shade were big clumps of grass-like *Lomandra longifolia* and very large grayish moss cushions of *Leucobryum bowringii*.

Shipton's Flat was in tall open forest interrupted by strips of rain forest in gullies as well as along the creek. On spur ridges at about 1000 to 1200 feet, the open forest con-

tained magnificent stands of a bloodwood, a messmate (*Eucalyptus* spp.), and dead-finish (*E. cloeziana*), approaching 150 feet in height and up to about 6 feet in diameter. Grass growth at the lower levels was tall and coarse, and on the high ridges and mountain spurs kangaroo-grass (*Themeda australis*) formed a thick cover less than 2 feet high. The line of juncture between open forest and continuous rain forest in the valley of Parrot Creek was around 1100 to 1200 feet, while on Mt. Finnegan the open forest, largely of *Casuarina* 20257, persisted unbroken to 2600 feet on a spur ridge on the western slopes.

Up to about 1500 feet the big rain forests of the range could not be called luxuriant except on the banks of streams and in moist hollows. Conditions were rather dry during our visit and presumably became so in the course of every dry season. Above about 1500 feet moister conditions prevailed. Probably more showers fell there, or mist clouds piled up by the southeast wind settled on the heights. At the upper levels the canopy trees were smaller, the forest was richer in undergrowth species, and floristics changed greatly as compared with lower levels.

The rain-forest tree most important to the lumbermen was a kauri-pine (*Agathis*). Growing sporadically, it was made conspicuous by its blotched and pitted gray bark and great size. One big kauri surviving on rocky ground had a breast-high diameter of 9 feet. A wealth of canopy and subcanopy trees in the forest included species of *Flindersia*, *Cedrela* (*C. toona*, the valuable red cedar), *Elaeocarpus*, *Sloanea*, *Endiandra*, *Cryptocarya*, *Ilex*, *Podocarpus*, *Calophyllum*, *Syzygium*, *Decaspermum*, *Darlingia*, *Helicia*, and a host of other genera. Under the upper storey trees were slender substage trees, and below these a predominantly woody undergrowth of little trees and tall shrubs usually not so dense as to hinder greatly one's progress through the forest. Herbaceous ground plants were chiefly ferns, seldom abundant away from streams. Palms and *Pandanus* were not greatly in evidence. A very large tree fern (*Cyathea* 20302) grew occasionally in gullies. Among many large climbers, *Calamus* species were conspicuous, and root-climbing *Piper* 20182, *P.* 20243, and *Pothos brownii* enveloped tree trunks in a thick green mantle

to 30 or 40 feet above the ground. Tangles of *Calamus* developed under conditions of naturally broken canopy, as along streams and on ridge crests and where tree felling and logging roads had let in an increased amount of light. The tenacious hooked flagella or tendrils of these "lawyer-canes" were a familiar nuisance in the forest, tearing one's skin and hard on clothing.

On Mt. Finnegan the rain forest was less tropical than down below. Steep slopes and local exposure to strong winds were restraints on growth. Rather numerous epiphytic ferns, and mosses and hepatics in a fuzzy coating on the lower tree trunks, indicated a moist climate. But there were few large-leaved plants, and the one place where the vegetation burgeoned into luxuriance was on a stream at 2950 feet, from which came the water supply for our mountain camp. The tremendously steep stream bed was a beautiful place of mossy rocks roofed over by tall trees and edged with robust sword-leaved *Helmholtzia acorifolia* and the large ferns *Marattia* 20047 and *Blechnum* 20324.

At about 3400 feet on our route to the mountain top, the rain forest gave place to stunted high-mountain forest or scrub. It seemed in large part an actual change in composition of the vegetation rather than dwarfing and close crowding of the trees due to exposure. The one probable occurrence of true rain forest above 3400 feet was isolated in the sheltered head of a glen that led up to the base of the culminating peak, where a military survey party had camped some years before our visit. The high mountain scrub was generally about 8 to 15 feet high, and up to 30 feet where sheltered. In very exposed situations it was so close-packed and rigid that one could scramble and even walk over the top of it without much risk of breaking through.

Surrounded by the scrub where we first encountered it on the western slopes was a big open area of flat granite rock and piled boulders, from which a grand view opened out south across the Bloomfield River valley to Mt. Peter Botte and Thornton Peak and west to the Great Dividing Range. Various sterile sedges grew on the sparse soil; *Helichrysum* 20112 as a large herb, *Zieria* 20113 and an *epacrid* (20325) as small shrubs.

Shrubby, low, sometimes cushion-forming *Borya septentrionalis* occurred in great abundance, the red of its drying leaves making a blaze of color to contrast with the white of countless *Dendrobium fusiforme* plants flowering on the rocks.

Common components of the scrub included *Drimys* 20331, ?*Austromyrtus* 20131, *Alyxia* 20105, *Halfordia kendack*, *Sarcopteryx* aff. *martyana*, *Balanops* 20328, *Trochocarpha laurina*, scandent *Quintinia fawkenri* with small white blossoms, and *Tecoma* 20101 with great red flowers. Australia's only representatives of the Ericaceae and Vacciniaceae (red-flowered *Rhododendron lochae* and *Agapetes meiniana*) came in as stiff shrubs. The feather-palm *Calyptrocalyx australasicus* occurred commonly, especially in the glen, where tree ferns of three species (*Cyathea* 20064, *C.* 20066, *C.* 20069) graced the banks of a stream. Mist clouds, settling over the mountain top most days before noon, kept the environment suitably moist for a wealth of small epiphytic ferns and orchids and often colorful yellow, golden, brown, and reddish mosses and hepatics which covered the little trees and came down to the ground in open places.

Temperatures on Mt. Finnegan became more than pleasantly cool when the mist clouds closed over, and the camp fire was a welcome mitigator of the night chill. Down at Shipton's Flat maximum shade temperatures for September 5 to 22 ranged between 79° and 90° F. mean 84° (minimum 54° to 68°, mean 58°), and light showers fell on only two days during our entire visit. Occasional days were overcast, with clouds almost constantly on the mountain top. Clear skies, hazy with smoke from distant bush fires, were the rule. Average annual rainfall at Shipton's Flat was about 60 inches.

Temperatures were rising slowly with the approach of summer, and in spite of the dry weather, increasing numbers of rain-forest trees were coming into flower. Botanical collecting was better than in any other rain forest on the Peninsula, and in another month it would have been good in this locality. October also promised well for Mt. Finnegan, where the great majority of plants of the scrubby forest were without flowers or fruits, but many were making new growth.

Insect collecting in both rain forest and open forest brought poor results. Birds were plentiful and active in the flowering trees. On Mt. Finnegan, 45 traps set in rain forest yielded the phenomenal catch of 28 *Rattus l. cooktownensis* and *Melomys cervinipes* in one night. By hunting, the tree-climbing kangaroo (*Dendrolagus bennettianus*) and spiny anteater were secured in rain forest above 2600 feet, and *Hypsipyrmodon* in mossy low scrub at 3400 feet. The spiny anteater was also one of 10 mammal species found in the rain forest of upper Parrot Creek, other ground inhabitants there being *Thylogale stigmatica* (pademelon), *Perameles nasuta* (bandicoot), *Antechinus flavipes*, *Melomys cervinipes*, *Rattus l. cooktownensis*, and *R. g. conatus*. No truly arboreal mammals were taken at this camp, although *Dactylopsila* and *Petaurus breviceps* were collected at Shipton's Flat. Native cats (*Satanellus*) were unusually common at the Flat. Platypuses were reported in the creek at this lower camp but were not collected.

MOSSMAN RIVER GORGE

MARCH 11 TO 19

A narrow road entered the deep gorge of the Mossman River from sugarcane fields at the foot of rain-forested mountains fronting the main ridge of the Great Dividing Range. In a mile the road reached a small hydroelectric plant that supplied power for the town of Mossman, and from there, about 300 feet above sea level, continued a few hundred yards to the powerhouse intake. A trail had been cut up the south side of the gorge to the top of Mt. Demi (3500 feet); another, seldom used but old, climbed westerly some miles to tin workings near the head of the river and on Mt. Spurgeon (4400 feet).

Rapid white water and swirling green pools between richly vegetated banks framing imposing vistas of the gorge and its enclosing dark, cloud-capped mountains gave the rocky Mossman an exceptional wildness and beauty. Rushing over and between great rounded granite boulders with constant roar from wet-season rains, the water always ran clear from a rugged and entirely forested catchment area undisturbed by cultivation.

At the powerhouse was a clearing in which the caretaker, who shared his quarters with

us, had a garden planted with bananas, papayas, pineapples, and trellised granadilla vines. Other parts of the clearing were growing up to second-growth forest and lantana thickets, over which blue and black *Ulysses* butterflies zigzagged in flight in the humid heat of the day. At night, fireflies flickered in the forest. Other insects swarmed to the light on the powerhouse verandah and, falling to the dirt floor, were quickly licked up by the darting tongues of waiting giant toads.¹

The rain forest of the gorge grew tall and dense, and much of it was too cluttered with rocks to be easy to get about in. For luxuriance and richness of flora, we saw nothing to excel it on the expedition. In the moist environment, climbing aroids and freycinetias flourished in great abundance. Ferns were everywhere: dense brakes of *Gleichenia flabellata* looking oddly primitive on banks of the river; filmy ferns and others matted on rocks and within reach on bases of trees in the forest; and many species associated with orchids and lycopodiums on thickly mossed rocks and trees bordering the river.

In all this abundance, only mammals were hard to come by for the collections. Heavy night rains frequently washed the bait from the traps. But difficulties in securing species that were virtually all nocturnal were chiefly owing to makeshift equipment at a time when our proper outfit was held up by a shipping strike down the coast. Ground-inhabiting pademelons could be jacked with a hand flashlight held under a gun barrel or lashed on hat-top, but a more efficient source of light was needed for arboreal mammals in tall forest and for the tube-nosed fruit bats (*Nyctimene*) whose sharp notes could be heard high among the trees.

SPEEWAH, UPPER CLOHESY RIVER

MARCH 26 TO 29

It may as well be confessed that one of our chief reasons for visiting Speewah was to search for the "marsupial tiger." Virtually every man of the bush we met and talked with had a story of animals extra large or

¹ Introduced into coastal North Queensland to combat the cane-beetle pest of the sugarfields, the Surinam giant toad (*Bufo marinus*) has spread through the rain forests adjacent to cane-growing areas, with reported depleting effects upon the forest beetle fauna.

extra small, or peculiar in some other way, and usually a habitant a long distance from where the story was told. The tales seldom took consideration of birds or insects. Snakes, of course, were not neglected. There were accounts of enormous pythons, side-crawling snakes, and the deadly taipan or "two-minute snake" from the bite of which there seems to be no recorded case of recovery. [After Speewah, Geoffrey Tate secured taipans (*Oxyuranus scutellatus*) from Lockerbie and Iron Range.]

Troughton (1947) has taken cognizance of a striped marsupial-cat of North Queensland, "described as a cat just growing into a tiger," and has given reports on it originating from seemingly responsible observers. From other observers, whose word would not have been doubted on other counts, we heard tales of this beast whose skin or skull never yet has reached a museum collection.

My own opinion is that these stories are not unfounded. George Tate, having a greater sense of responsibility in regard to mammals, is inclined to doubt the existence of the marsupial tiger but, admitting that all accounts of it are not likely to be imaginative, expresses the thought that at some time since European settlement, a civet—a pregnant civet—may have escaped from captivity and spread its progeny through the wilder parts of the mountain rain forests between Cardwell and Cooktown.

At any rate, on information that seemed as good as any, we visited Speewah as the house guests of Mr. and Mrs. George Veivers, and in three nights seven mammal species were taken, including a marsupial mouse (*Antechinus flavipes*) but not the "marsupial tiger."

The Speewah homestead of the Veivers is situated at 1500 feet, where the rain forest of Lamb Range joins the open forest of the inland slopes in the valley of Moonooba Creek, a feeder stream of the Clohesy River. The Clohesy is the main southern affluent of the Barron River. A rain-forest clearing of about 50 acres was planted to molasses grass (*Melinis minutiflora*) for cattle feed. Two miles to the east and southeast, covered with rain forest and overlooking Cairns and the east coast, Mt. Williams rose to 3400 feet and Chujeba Peak to 3250 feet.

Naturalized lantana (*Lantana camara*), a large rambling shrub with fleshy fruits dispersed by birds, formed impenetrable tangles in the drier marginal parts of the rain forest and occupied small clearings in the forest. It had also spread into the open forest. A bad feature of lantana is that it will burn in the dry season. Fire in it is carried into the rain forest, and, in the aggregate, a considerable amount of rain forest must be killed in this way in North Queensland every unusually dry year. The rain-forest margins of much of the area near Cairns were badly infested with lantana. It was not observed in any of our collecting localities north of the sixteenth parallel.

RUSSELL RIVER AND MT. BELLENDEN KER

APRIL 1 TO 8

For a base camp in this very wet area, we were fortunate in having the use of the cane-cutters' vacant barracks on a sugar farm abutting on the rain forest. It was conveniently located as a starting point for the ascent of Mt. Bellenden Ker. Average annual rainfall was around 170 inches on the lowlands and probably much greater on the mountain slopes. Messrs. Giddens' cane farm was at an elevation of about 100 feet and 5 miles from the coast on Junction Creek, a tributary of the Russell.

Collecting on the lowlands was chiefly zoological. For trapping in the rain forests and canefields, we had good results in Muridae (*Hydromys*, *Uromys*, *Melomys*, *Rattus*). Above an altitude of about 200 feet the mountain slopes came within the boundaries of a national park in which permission to collect was restricted to plants and insects.

With two local men, who knew the trail up the mountain and had camped on its summit only two weeks before, George Tate and I spent two and a half days on a climb of Centre Peak on Mt. Bellenden Ker. Rain began to fall the morning we left the cane farm base camp and much to our discomfort continued all the time we were on the mountain. Each of us carried a pack of about 30 pounds containing, besides food, photographic and collecting gear, one blanket and a change of clothing. The trail up through the forest was very steep and not always well marked.

Climbing in mist as well as rain above an altitude of about 2000 feet and greatly pestered by leeches, we reached an old camping place called Tick Camp in about four hours of actual travel time from the foot of the mountain. This was at an altitude of 3050 feet by aneroid. Working in hard rain, we enlarged and re-roofed with palm leaves a little lean-to shelter standing there, covered the oozing, rather peaty ground with more palm leaves for a floor, and at length succeeded in getting a fire going. Tick Camp was at the base of Centre Peak on a fairly level bit of ground that dropped off precipitously to the east and from which a spur ridge trended southerly to the South Peak of the mountain. Small pools in the coarse granite sand of a gully head provided the only permanent water on the trail between about the 2200-foot level and the summit. Rising over a plentiful tall undergrowth of *Helmholtzia acorifolia*, graceful *Orania* palms and tree ferns crowded the gully.

Next day we climbed to the 5220-foot summit of Centre Peak¹ in three hours, and returned to the leaky shelter of Tick Camp. Bellenden Ker is usually called a mountain, but actually it is a short mountain range. The Centre Peak is exceeded in altitude in Queensland only by the South Peak of Mt. Bartle Frere, which rises to 5287 feet, 10 miles to the south. We were an hour and twenty minutes on the summit. Mist and rain limited visibility to a few yards, and we were all too wet and cold for a longer stay. Besides plants, a few small insects were collected in moss and conspicuous big salmon-pink slugs from the leaves of the stunted trees.

Mixed rain forests, changing gradually in composition but not greatly in general appearance, occupied the mountain slopes from the edge of the canefields up to about 100 feet in altitude below the summit of Centre Peak. Below about 1350 feet, lawyer canes, and especially a climbing bamboo (?*Bambusa moreheadiana*, the flowers of which are unknown) with hard green stems hanging from the trees and looped on the ground entangled the more open parts of the forest. Above about 1750 feet the ground on the sharp

¹ The plants collected were incorrectly labeled South Peak, which has an altitude of only 3972 feet.

crests of spur ridges became somewhat peaty, and matted with a springy covering of small surface roots. In contrast to most other parts of the forest above the lower slopes, a plentiful undergrowth of small palms (*Linospadix minor*, *L. palmerianus*) and tree ferns, and tall shrubs including *Randia* 18335, with heavily fragrant big white flowers, developed on these spurs. Mosses were nowhere very prominent.

About 100 feet below the summit the trees began to diminish rapidly in height. They grew closer and closer together, woody undergrowth became more abundant, and many different species appeared, among them the first trees of the peculiar dracaena-like epacrid *Dracophyllum sayeri*. The limited narrow-ridge crest of the peak carried a very densely packed, rigid, low scrubby forest of elfin-wood type, fairly heavily mossed, in which the largest tree was gnarled, more or less sprawling and umbrella-topped *Lepto-*

spermum wooroonooran, 15 to 18 feet high. Other trees collected included *Austromyrtus metrosideros*, *Drimys* 18300, *Orites fragrans*, and *Hypsophila halleyana*. Small epiphytic ferns and orchids grew plentifully on the mossy trees. Red-fruited *Calyptrocalyx australasicus* occurred as a slender palm; *Hibbertia scandens* and *Smilax glyciophylla* as climbers. In small openings herbaceous *Dianella ensifolia* grew with shrubs such as *Trochocarpa laurina* and ?*Pentapanax* 18297, and an abundance of tall *Gahnia sieberiana*.

The presence of the *Leptospermum* and *Dracophyllum*, apparently endemic on Belenden Ker, gave the high-mountain scrub an appearance different from that of Mt. Finnegan, and the trees generally were less rigid and wind-clipped. A good proportion of the plants of the summit bore fruits, but *Dracophyllum* was the only woody plant seen in flower, and a number of species were in sterile condition.

NOTES ON THE MAMMALS OF CAPE YORK PENINSULA¹

G. H. H. TATE

THE NUMBER OF DISTINCT FORMS of mammals known to exist on the Cape York Peninsula, including the Atherton Tableland, has now reached 90. Excluding the dingo, which is perhaps not indigenous to Australia but more probably was taken there by aboriginal man, the 88 native forms represent the four orders of mammals that are widespread in other parts of Australia, namely, the egg-laying monotremes, the marsupials, the bats, and the rodents. The first order contains

Platypus
Spiny anteater or "porcupine"
Godman's marsupial mouse
Brown marsupial mouse
Lumholtz' marsupial mouse
Narrow-footed marsupial mouse
Cape York native cat
Ramsay's native cat
Narrow-headed bandicoot
Papuan bandicoot
Larger broad-headed bandicoot
Smaller broad-headed bandicoot
Lonnberg's brush-tailed possum
Brown brush-tailed possum
Common brush-tailed possum
Australian brown cuscus
Australian spotted cuscus
Cape York striped phalanger
Smoky striped phalanger
Dormouse phalanger
Yellow-bellied glider or "flying squirrel"
Sugar glider
Northern pygmy glider
Cook's ring-tail
Ashy ring-tail
Herbertvale ring-tail
Mt. Spurgeon ring-tail
Green ring-tail
Soft-furred ring-tail
Northern great glider
Least rat-kangaroo
Brush-tailed rat-kangaroo
Rufous rat-kangaroo
Queensland rock wallaby
Northern nail-tailed wallaby
Leichardt's hare wallaby
Bennett's tree kangaroo
Lumholtz' tree kangaroo

only two species, the platypus and the echidna or spiny anteater. The second includes 43, distributed in four families: the phascogales and "native cats," Dasyuridae; the bandicoots, Peramelidae; the phalangers, possums, and gliders, Phalangeridae; and the wallabies and kangaroos, Macropodidae. The bats include 27 forms, distributed in five families. The rodents are represented by 16 native rats and mice of the family Muridae.

A list of the Cape York mammals follows:

Ornithorhynchus anatinus phoxinus
Tachyglossus aculeatus aculeatus
Antechinus flavipes godmani
Antechinus flavipes adustus
Sminthopsis rufigenis lumholtzi
Sminthopsis murina murina
Satanellus hallucatus predator
Dasyurops maculatus gracilis
Perameles nasuta pallescens
Echimypera rufescens australis
Isodon macrourus torosus
Isodon obesulus peninsulae
Trichosurus vulpecula eburacensis
Trichosurus vulpecula johnstoni
Trichosurus vulpecula vulpecula
Phalanger orientalis peninsulae
Phalanger maculatus nudicaudatus
Dactylopsila trivirgata picata
Dactylopsila trivirgata infumata
Eudromicia macrura
Petaurus australis reginae
Petaurus breviceps longicaudatus
Acrobates pygmaeus frontalis
Pseudocheirus peregrinus peregrinus
Pseudocheirus peregrinus incanens
Pseudocheirus herbertensis herbertensis
Pseudocheirus herbertensis cinereus
Pseudocheirus archeri
Pseudocheirus lemuroides
Schoinobates minor
Hypsiprymnodon moschatus
Betiongia penicillata
Aepyprymnus rufescens
Petrogale inornata godmani
Onychogalea unguifer
Lagorchestes conspicillatus leichardti
Dendrolagus bennettianus
Dendrolagus lumholtzi

¹ For an extended treatment of the mammals of Cape York Peninsula and their distribution, see Tate (1951

and 1952b). For a list of the weights of mammals, see Tate (1952a).

Queensland pademelon	<i>Thylogale stigmatica stigmatica</i>
Cape York pademelon or scrub wallaby	<i>Thylogale stigmatica coxeni</i>
Cape York sand wallaby	<i>Protemnodon agilis jardinei</i>
Pretty-face wallaby	<i>Protemnodon parryi</i>
Swamp wallaby	<i>Protemnodon bicolor apicalis</i>
Red-gray wallaroo	<i>Macropus robustus erubescens</i>
Great gray kangaroo	<i>Macropus canguru canguru</i>
Australian large-footed mouse-eared bat	<i>Myotis adversus macropus</i>
Papuan pipistrelle	<i>Pipistrellus papuanus</i>
Rogers' lobe-lipped bat	<i>Chalinolobus rogersi</i>
Australian little brown bat	<i>Eptesicus pumilus caurinus</i>
Sanborn's broad-nosed bat	<i>Scoteinus sanborni</i>
Queensland long-eared bat	<i>Nyctophilus bifax</i>
Pallid long-eared bat	<i>Nyctophilus geoffroyi pallescens</i>
Temminck's bent-winged bat	<i>Miniopterus schreibersii blepotis</i>
Little bent-winged bat	<i>Miniopterus australis</i>
Eastern little mastiff bat	<i>Nyctinomus norfolcensis</i>
Loria's mastiff bat	<i>Nyctinomus loriae</i>
White-bellied tomb bat	<i>Taphozous mixtus</i>
Common Australian tomb bat	<i>Taphozous australis</i>
De Vis' tomb bat	<i>Taphozous nudicluniatatus</i>
Common Australian horseshoe bat	<i>Rhinolophus megaphyllus megaphyllus</i>
Allen's horseshoe bat	<i>Rhinolophus megaphyllus ignifer</i>
Roberts' bat	<i>Rhinolophus maros robertsi</i>
Least horseshoe bat	<i>Hipposideros bicolor albanensis</i>
Fawn horseshoe bat	<i>Hipposideros galeritus cervinus</i>
Wart-nosed horseshoe bat	<i>Hipposideros muscinus semoni</i>
Diadem horseshoe bat	<i>Hipposideros diadema reginae</i>
Gould's flying fox	<i>Pteropus alecto gouldii</i>
Spectacled flying fox	<i>Pteropus conspicillatus</i>
Little flying fox	<i>Pteropus scapulatus</i>
Spinal-winged flying fox	<i>Dobsonia moluccensis magna</i>
Tube-nosed flying fox	<i>Nyctimene robinsoni</i>
Least flying fox	<i>Macroglossus lagochilus nanus</i>
Dingo	<i>Canis dingo</i>
Dugong	<i>Dugong australis</i>
Greater water rat	<i>Hydromys chrysogaster reginae</i>
Lesser water rat	<i>Hydromys chrysogaster beccarii</i>
Delicate native mouse	<i>Leggadina delicatula delicatula</i>
Fat-tailed mouse	<i>Zyzomys argurus</i>
Long-haired tree rat	<i>Mesembriomys gouldii rattoides</i>
Cape York Melomys	<i>Melomys cervinipes capensis</i>
Atherton Melomys	<i>Melomys cervinipes eboreus</i>
Grass Melomys	<i>Melomys lutillus australis</i>
Queensland mosaic-tailed rat	<i>Uromys caudimaculatus caudimaculatus</i>
Northern allied rat	<i>Rattus assimilis coracius</i>
Spiny rat	<i>Rattus leucopus leucopus</i>
McIlwraith spiny rat	<i>Rattus leucopus mcilwraithi</i>
Cooktown spiny rat	<i>Rattus leucopus cooktownensis</i>
Cape York short-tailed rat	<i>Rattus gestri apex</i>
Cooktown short-tailed rat	<i>Rattus gestri conatus</i>
Neuhäuser's rat	<i>Rattus lacus</i>

Collecting expeditions by their very nature allow few opportunities for observations on the life histories and behavior of mammals. The following brief notes are offered:

Antechinus flavipes godmani and *A. f.*

adustus: Nocturnal. Highly predaceous "marsupial insectivores." Females found with five and seven young attached to the pouch area in September. Thoroughly scansorial but probably do not actually live in trees.

Satanellus hallucatus: Nocturnal to semi-diurnal marsupial carnivores. Food: insects, small vertebrates. Easily trapped in dingo meat sets. Two females with eight and four young, respectively, attached, in September. Hide by day in hollow fallen logs and in developed areas in old houses, stoves, beached boats, wharves.

Perameles nasuta pallescens: Insectivorous bandicoots, chiefly found in rain forest but also in *Casuarina* open forest. Two well-grown young in pouch in September.

Isodon: Both the large species, *macrourus*, and the small species, *obesulus*, seem to range freely in the same environment—open forest. Probably omnivorous. The crushing type of molars suggests the diet is at least partly vegetation.

Trichosurus: The brush-tailed possums of the race *T. vulpecula eburacensis* live in holes in trees in open forest. At Cooktown they are accustomed to hide by day in the roofs of houses. A female with one pouch young at Wenlock in July.

Phalanger orientalis peninsulae: Nocturnal cuscuses known only in areas of heavy rain forest at Iron Range and the upper Peach River. Female with one young at Iron Range in June.

Phalanger maculatus nudicaudatus. Nocturnal, spotted cuscuses from dense rain forests of Lockerbie, Iron Range, and McIlwraith Range. As in other races the males only are spotted, the females perfectly plain.

Dactylopsila trivirgata: Nocturnal. The northern race *D. t. picata* is common in isolated patches of rain forest and occasionally in open forest near Lockerbie. It was also collected in dense rain forest on the summit of McIlwraith Range and again in gallery woods along the Annan River. The race *infumata* occurs in the rain forests about Cairns. A female of the race *infumata* with one young in April at Cairns.

Petaurus breviceps: This "flying squirrel" is common in open forest virtually throughout the Peninsula. It is strictly nocturnal, living by day in knot-holes or other tree cavities. At Newcastle Bay two females each had two pouch young in May.

Acrobates pygmaeus frontalis: The northern pygmy glider had been previously known only as far north as the Atherton Tableland.

Capture of two specimens extended the range to the Peach River and to Newcastle Bay, at the extreme tip of the Peninsula.

Pseudocheirus peregrinus: Strictly nocturnal ring-tails, hiding by day in hollow trees in open forests. At Croll Creek, near Coen, two females each with two young and two more each with one young in August. At McLeod River two females of the race *oralis*, each with one young in October.

Petrogale inornata godmani: This rock wallaby occurred in moderate numbers at the gorge of the Annan River and at Black Mountain near by. A rock wallaby, probably of the same species, was known in the Wenlock area. In each case the habitat was rocky and precipitous. Female with one pouch young in September at Annan River falls, near Helenvale.

Dendrolagus bennettianus: Bennett's tree kangaroo is known to inhabit the rain forests of the Bloomfield River and the Mt. Finnegan area. It sometimes descends to the ground, but is equally at home in trees. Two found (one collected) at upper levels of Mt. Finnegan at about 2800 feet, September.

Thylogale stigmatica: These red-legged pademelons or "scrub" wallabies occur all through the rain forests from west of Townsville to the extreme tip of the Cape York Peninsula. They hide by day and move about from dusk to dawn. Only one in pouch in following cases: four females at Lockerbie, April-May; one at Portland Roads, June; one at Iron Range, June-July; one on lower slopes of Mt. Finnegan, September.

Protemnodon agilis jardinei: Sand wallabies are nearly as nocturnal as the red-legged pademelon. Instead of rain forest, they inhabit open forests and grasslands. One only in pouch: two females at Lockerbie, April-May; one at Newcastle Bay, May.

Macropus robustus erubescens: The large short-legged kangaroos or "wallaroos" are open-country animals that seem to prefer rolling and even rocky country. They can be seen feeding from late afternoon to early morning. One only in pouch at Wenlock, July, and Coen, August.

Macropus canguru: The great gray, or "Captain Cook's," kangaroo can still be found within 20 miles of Cooktown. We noted them also between Laura and Coen and col-

lected one at Wenlock, the northernmost record. The build is more slender and the legs longer than those of the wallaroo. One young in pouch: 3 miles southwest of Helenvale, September.

Myotis adversus macropus: The long-footed *Myotis* was found only in the floor joists of a house near Cairns.

Eptesicus pumilus: This common little bat occurs throughout the open-forest country. It was collected in caves at Chillagoe, and elsewhere in the roofs of houses and in mine tunnels at Iron Range, Black Mountain, and Alderbury.

Nyctophilus bifax: The long-eared bat was collected commonly at Shipton's Flat, where it apparently spent the day hiding in the roof of the sawmill shed. On the summit of the McIlwraith Range it was netted in a fly-way in dense rain forest.

Miniopterus schreibersii blepotis: This "bent-winged" bat was common on Thursday and Possession Islands, at Shipton's Flat, Cairns, Chillagoe, Mt. Spurgeon, and Walter Hill Range. It seems to prefer open-forest country. The small species *M. australis* has substantially the same range on the mainland of the Peninsula but was not taken at Thursday Island or Possession Island.

Nyctinomus norfolcensis: Collected at Shipton's Flat, Mossman (in crack in a telephone pole), Cairns.

Nyctinomus loriae: Shot at dusk at Helenvale, flying above the partly dry bed of the Annan River.

Taphozous mixtus: Flying at dusk in open country close to a creek fringed with gallery woods, near Brown's Creek.

Taphozous australis: Very common. In caves and mine tunnels at Wenlock, Portland Roads, Possession Island, Coen, Chillagoe. It likes rocky outcrops close to the sea, e.g., at Newcastle Bay and north of Cairns.

Rhinolophus megaphyllus: This horseshoe bat is common everywhere: Portland Roads, Iron Range, Brown's Creek, Wenlock, Camp Oven Pocket, crest forest of McIlwraith Range, Laura, Shipton's Flat, Julatten, Cairns, and southward. The red phase (or ?subspecies) *ignifer* seemed concentrated near Coen.

Hipposideros bicolor albanensis: This little species flew into our "boys" tent at Lockerbie.

Hipposideros galeritus cervinus: Abundant at Jardine house, Somerset, where both gray and red phases intermingle. Also at Thursday Island, Iron Range, and Coen.

Hipposideros muscinus semoni: This seems to be a solitary bat. One was found in a closet in an empty house at Coen in August. Another was presented to us by Dr. H. L. Kesteven of Cooktown, who had found it hanging from his car door; also found at Iron Range and McIlwraith Range.

Hipposideros diadema reginae: Cairns, Coen, Iron Range. The fine series from Iron Range (in mine tunnel) comprises many red individuals. The animal from Cairns is gray.

Pteropus alecto gouldii: One embryo found in two instances at Brown's Creek in July. Species also collected at Lockerbie, Portland Roads, Coen.

Pteropus conspicillatus: Three single embryos at Peach River in August. Localities: Julatten, Cairns, Clohesy River, Shipton's Flat.

Pteropus scapulatus: One embryo at Peach River in August. Localities: Wenlock, Coen, Hann River, Annan River, Shipton's Flat. Two large "camps" observed: one at Hann River, the other at Annan River above the falls.

Dobsonia moluccensis magna: This is a cave- and mine-inhabiting species. Localities: Iron Range, Coen, Peach River. It was generally shot by jacklight while feeding on eucalypt blossoms.

Nyctimene robinsoni: At Portland Roads, in open forest, a single specimen was attracted by the hunting light and settled first on my chest and afterward fluttered to the ground.

Macroglossus lagochilus nanus: Collected about 9 o'clock at night at Seagren's Farm, 10 miles west of Cooktown, while circling the blossoms at the tops of the great flower stalks of century plants.

Canis dingo: Common. Both the clear sandy yellow dingoes and those with the dorsal area much darker were observed. Not easily trapped, even with multiple sets. Often left footprints at night within a few feet of camps.

Hydromys chrysogaster: The large, mainly inland race *reginae* was taken at Mt. Finnegan, Cooktown, Coen, Peach River, upper

Nesbit River, Archer River, Wenlock, Brown's Creek, Iron Range, Portland Roads. The small race *beccarii* was obtained at Russell River and is generally distributed in the streams of the Atherton Tableland.

Leggadina delicatula: This tiny native mouse was secured at Wenlock and at Seagren's Farm, 10 miles west of Cooktown. It likes to hide under objects in open country, and in sandy places burrows quite extensively.

Mesembriomys gouldii rattoides: A single specimen of this arboreal rat trapped at the foot of an open-forest tree at Brown's Creek.

Melomys cervinipes: A very common arboreal or at least scansorial rain-forest species occurring from the tip of the Peninsula in suitable places as far south as northern New South Wales. From two to four young hang onto the maternal nipples and are bumped along on the ground as the mother runs. This *Melomys* runs down trees and vines head first with the utmost ease.

Melomys lutillus: A much smaller species living in open brushy or grassy country and a generally drier environment. Habits similar to those of *M. cervinipes*.

Uromys caudimaculatus: A large scansorial rat related to *Melomys*. Prefers rain forest but ventures out into open forest. Often follows gallery woods. Reproductive habits as in *Melomys*. Ranges throughout the Peninsula

and south nearly to Townsville.

Rattus assimilis coracius, the northern race of *assimilis*, extends through the rain forests of the Cairns area as far north as Mt. Finnegan, where it is replaced by *Rattus leucopus*. This is an extremely common rat where it occurs. It is nocturnal and terrestrial.

Rattus leucopus: Typical of the rain forests of the extreme north of the Cape York Peninsula, this rat is recognized by its very spinous pelage. The channels of the spines often become filled with the red soil of the lateritic outcrops of the region. The rat is very common, and is only rare in collections because so little work in its area has previously been done. Terrestrial, rarely climbing even onto fallen logs, and nocturnal.

Rattus gestri: Belonging to a group of *Rattus* characteristic of the drier, more interior parts of Australia, and virtually never found in rain forest. Reproductive ability very high; mammae six pairs against five pairs in *leucopus* and *assimilis*. Extends through the grasslands of the Peninsula into the open country of southern New Guinea and the Port Moresby area. Old males may weigh as much as one-half a pound. The northern form, *apex*, is barely distinguishable from the southern form, *conatus*. A relative of *gestri* is the "plague-rat" of central Queensland, so named because it may become a rat plague, not because it harbors the disease.

RESULTS OF THE EXPEDITION

THE FOLLOWING is an approximate list of the collections, excluding those made by Mr. Vernon for the Queensland Museum:

Mammals	1504 specimens
Reptiles and amphibians	477 specimens
Fresh-water fishes	118 specimens
Larger insects and spiders	5400 specimens
Plants	2215 numbers

The plant collections averaged six herbarium sheets of each collection number of phanerogams and vascular cryptogams.

A total of 131 samples of plants of selected families were collected for the Council for Scientific and Industrial Research of Australia for pharmacological testing. Soil samples numbering 206 were collected for the antibiotics research project of Chas. Pfizer and Company of New York.

The zoological collections, other than those of Vernon, are deposited in the American Museum of Natural History. The mammals have been studied and reported upon by G. H. H. Tate (1951, 1952a, 1952b), the fishes by John T. Nichols (1949). The de-

termination of the reptiles and amphibians has been undertaken by Charles M. Bogert. Various invertebrate groups have been distributed to specialists for study.

The plant collections, with the exception of the first set which was presented to the Queensland Herbarium, are deposited at the Arnold Arboretum, Jamaica Plain, Massachusetts. The determination of most of the family groups has been undertaken by members of the staff of the Queensland Herbarium.

In the field, data were assembled on habits, ecology, and geographical distribution. A photographic record of the expedition comprised 1313 pictures in color and 611 in black and white, and all the plates in this paper are reproduced from photographs taken on the expedition.

Various reports on the expedition that have appeared up to August 15, 1952, are by Brass (1949), Lieftinck (1951), Nichols (1949), and Tate (1951, 1952a, 1952b), to which reference is made below in full.

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