

## **EXPLORATION OF HEARD ISLAND BETWEEN 1947 AND 1971**

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### **ABSTRACT**

Although nineteenth-century sealers had discovered and roughly mapped the main features of Heard Island, and four scientific expeditions had briefly investigated the Atlas Cove area between 1874 and 1929, much remained to be learned. Exploration of the island was continued in two distinct periods between 1947 and 1971. In the first period the Australian National Antarctic Research Expeditions (ANARE) landed in December 1947 and built a scientific station at Atlas Cove. Successive expeditions occupied it continuously until March 1955 as an 'A Class' meteorological station, a seismic and magnetic observatory, and a base for other scientific studies and for exploration of the island.

In the second period four summer expeditions and one wintering expedition worked on the island between 1963 and 1971. The summer expeditions were an ANARE expedition in 1963, an Australian private expedition (The South Indian Ocean Expedition to Heard Island) in 1965, and ANARE expeditions in 1969 and 1971 associated with United States and French expeditions. An expedition of the United States Coast and Geodetic Survey wintered from March 1969 to April 1970. There were no further expeditions until 1980.

The years 1947-1971 were ones of substantial achievement. Expedition members recorded seven years of uninterrupted synoptic meteorological observations and four years of seismic and magnetic observations. They developed empirical techniques of work, travel, and survival that shaped the character of ANARE and were later applied in Antarctica. Despite difficult terrain and consistently bad weather, and the accidental deaths of two men in 1952, unsupported field parties of two or three men travelling on foot explored and mapped the heavily glaciated island, and documented its topography, geology, glaciology and biology. They (1) made three overland circuits of the island, the first ascent of Big Ben (2745 metres), and the first recorded landing on

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the nearby McDonald Islands; (2) bred and trained dog teams for later use in Antarctica; (3) reported the commencement and subsequent progress of massive glacier retreat caused by regional warming, and of the island's recolonisation by king penguins and antarctic fur seals; and (4) reported measurements of glacier flow and thickness, the palaeomagnetism of Heard Island rocks, behavioural studies of giant petrels and other birds, and the cold stress and acclimatisation experienced by humans working in Heard's wet-cold climate. In addition, Heard Island served as a testing ground for men, equipment, scientific programs, huskies, general administration, and logistics, without which Mawson station could not have been established as successfully as it was in 1954. The American wintering expedition and the French summer expedition contributed to major international geodetic and geophysical investigations. All told, the expeditions between 1947 and 1971 added much to our knowledge of Heard Island, and they laid down a solid foundation for the work of later expeditions.

**Key words.** Heard Island, McDonald Island, Antarctic expeditions; Antarctic exploration; sledge dogs; glacier travel; mapping; geology; glaciology; vulcanology; biology; human responses to cold; birds; seals.

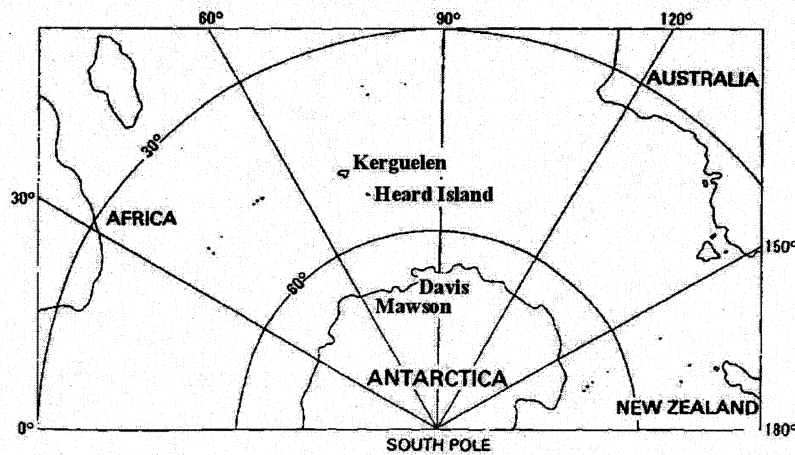
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## INTRODUCTION

Heard Island lies in the South Indian Ocean in latitude  $53^{\circ}$  S and longitude  $73^{\circ}$  E, 1650 km north of Antarctica and 465 km south-east of Kerguelen (Map 1).

Map 1. Location of Heard Island.



Discovered by Captain John Heard in 1853 (Downes 2002), it was occupied by successive gangs of sealers from 1855 to 1877 (Downes 1996) and thereafter was infrequently visited by sealers until the early 1930s (Law and Burstall 1953). The island is 43 km long, 21 km wide, and 2745 m high. Most of it consists of a massive volcano called Big Ben (Map 2; Figure 1). The ancient caldera of the volcano, breached on the western side, is filled with ice and snow and forms a plateau at an elevation of 2285 m, from which the more recent cone of Mawson Peak rises to 2745 m. Vapour is continually emitted from the summit and sometimes from lower vents, and the summit periodically experiences eruptions and lava flows (Quilty and Wheller 2000).

Because of the island's height and its position within the zone of Antarctic surface waters about 80% of it is glaciated, and much of the coast consists of ice cliffs 30 m or more in height and washed by the sea. The climate is cold, cloudy, and windy, with frequent gales. In the three years 1948-1950 the mean annual temperature was  $0.7^{\circ}$  C and the average wind speed was 7 metres per second (Law and Burstall 1953). Rain or snow fell on 300 days of the year, and the average duration of sunshine was 1.7 hr per day. Vegetation in the ice-free areas consists mainly of azorella (a cushion plant), tussock grass, and mosses; there are no trees or shrubs. Large populations of seals, penguins, and other birds breed on the island.



Map 2. Heard Island (1949 map), showing places mentioned in the text.

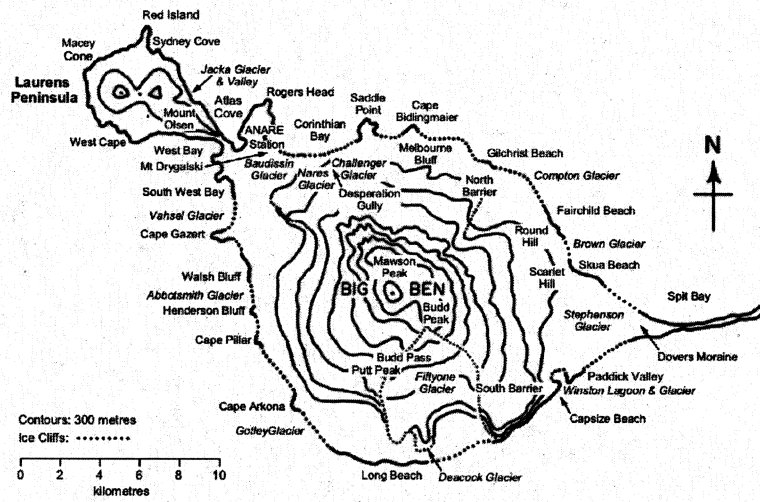


Figure 1. Big Ben from the south-east on 13 December 1947. Orientation cross on left border lies over Fifty-one Glacier, from whose western side Budd Pass leads to the Gotley Glacier beyond. Above the pass Budd Ridge rises to Budd Peak, where it merges with the rim of the old crater of Big Ben. The crater rim encloses the summit plateau and the cone of Mawson Peak. Below the same orientation cross is the ridge of South Barrier and, in left foreground, the Winston Glacier. [ANARE photo No. 621 by P. Swan]

In 1947 much remained to be learned about Heard Island. The knowledge gained by sealers in the 19th century had not been published in a readily accessible form, and the most authoritative map in existence was the Admiralty's copy of a sealer's sketch map given to a member of the *Challenger* expedition in 1874 (Law and Burstall 1953). The available knowledge of the island's geology, glaciology, and biology, acquired in four brief visits between 1874 and 1929 (Tizard et al. 1885; Drygalski 1908; Aubert de la Rue 1929; Price 1962), was confined to the limited area bounded by Corinthian Bay, Atlas Cove, West Bay, and South West Bay — the 'Four Bays Area'.

The expeditions to Heard Island between 1947 and 1971 explored the rest of the island and published reports of its topography, geology, glaciology, and biology, as well as its meteorological and geophysical environments. The expeditions were undertaken in two distinct periods. In the first period the island was continuously occupied by seven successive wintering parties of the Australian National Antarctic Research Expeditions (ANARE) between December 1947 and March 1955. In the second period, the island was visited by four summer expeditions between 1963 and 1971 and was continuously occupied by a United States expedition between March 1969 and April 1970. After 1971 there were no further expeditions until 1980.

The present paper summarises the aims, activities, and achievements of the 136 men who were the members of these 12 expeditions, focusing on their field work because no comprehensive account of it has previously been published. Only a few of the numerous publications reporting their scientific findings can be cited in this paper; some of the others are listed on the web site of the Australian Antarctic Division (<http://www.aad.gov.au/default.asp?casid=5161>).

Most wintering parties left Australia in late December or early January, and returned to Australia some 15 months later. Thus they embraced parts of two or three calendar years and are often identified in such terms as 'the 1947/49 expedition'. To avoid such awkward terminology I have identified each wintering party by the year of the winter it spent at Heard Island, for example 'the 1948 expedition'.

General accounts of the years 1947 to 1955 are provided by Law and Béchervaise (1957), Munro (1994), Bowden (1997), and Ralston (1993, 1998). Law and Burstall (1953) provide a comprehensive summary of the island's history and geography, and of the work of ANARE expeditions from 1947 through 1952. Participants' accounts of the 1948, 1952, and 1953 expeditions, respectively, have been published by Scholes (1949), Brown (1957), and Dalziel (1955).

Sources for the years 1963 to 1971 are cited in the text dealing with those years. A useful source of information for the whole period from 1947 to the present is *Aurora*, the journal of the ANARE Club, which has been published quarterly since 1951.

Much of the information presented here has been taken from the log books and reports of the expeditioners in each year, microfiche copies of which are held in the library of the Australian Antarctic Division at Kingston, Tasmania. Unattributed quotations, in what follows, are from the original reports.

Unless otherwise stated, place names are those which appear on the 3rd Edition map of Heard Island (December 1985, NMP 85/072, Division of National Mapping, Canberra) and have been approved, or bestowed, by the Antarctic Names and Medals Committee of Australia. At the time of the events reported here many features were unnamed or else had different names, noted in parenthesis, that were subsequently changed by the Committee.

## **THE WINTERING PARTIES, 1947-55**

In December 1947 ANARE established a station at Atlas Cove. The background to its establishment is discussed elsewhere (Law 1957; Munro 1994; Bowden 1997; Ralston 1993, 1998). Until March 1955 the station was continuously occupied by seven successive parties of 9-15 men, who expanded and improved it, developed the scientific program, and explored the island. The expedition members and their occupations are listed in Table 1. Their work is briefly summarised by Law (1957), and is described in some detail in an excellent monograph by Munro (1994), which is held in the library of the Antarctic Division.

### **Establishment of the ANARE station**

The pioneer party, led by Group Captain Stuart Campbell, Executive Officer of ANARE, arrived at Heard Island on 11 December 1947 in the Royal Australian Navy's Landing Ship (Tank) LST 3501 (later renamed HMALST *Labuan*), commanded by Lieutenant Commander George Dixon. After two attempts to land at Spit Bay had been defeated — the first by a sudden change in the weather, the second (next day) by heavy surf which almost sank a landing barge and a dinghy — the plan to establish the station there was abandoned in favour of the partially sheltered anchorage at Atlas Cove, which offered the most reliable conditions for landing and for the future annual resupply of the station.

The following two weeks were anxious ones. On 13 December a small party landed at Wharf Point (Fig. 7), a favoured site for the station,

and occupied the nearby Admiralty Hut — a refuge for shipwreck survivors that had been erected in 1929. Campbell and another group camped at a possible alternative site on the low isthmus between Atlas Cove and West Bay. On the same day the *Labuan's* Walrus amphibian made a flight around two-thirds of the island, obtaining a valuable series of aerial photographs that included views of Big Ben's summit plateau and Mawson Peak (Fig. 1).

However, attempts to land the expedition's stores, hut sections, and heavy equipment over the following days showed that the expedition's plywood pontoons, landing barges, and launches, plagued by mechanical breakdowns and cumulative damage, were not up to the job. Progress was slow, and the ship had insufficient fuel to remain for very long.

On 17 December Captain Dixon resolved the problem by running the ship's bows ashore on the steep boulder beach at Wharf Point, and by evening the D4 tractor, 300 drums of fuel, and many tons of stores had been unloaded. At 2000 hr the ship backed off, but then swung and went aground broadside to the beach. All efforts to refloat her failed, and bad weather was forecast. Then at 2300 hr the light wind briefly shifted to the east and the ship swung free. Half an hour after she had anchored safely in Atlas Roads a westerly gale began, which would have wrecked the ship had she still been aground.

On 21 December the ship put to sea to ride out a storm in which the wind averaged 140 km/hr and gusted to 200 km/hr. The Walrus amphibian, tied down on shore, was rolled over twice and wrecked. The party in the Admiralty hut fared well, but Campbell and his companions, camped on the isthmus between Atlas Cove and West Bay, had a difficult time. Campbell's experience gave the name 'Windy City' to the isthmus, and yielded a firm decision to establish the station at Wharf Point.

By 28 December, after two more beachings, all the cargo was ashore and the ship sailed for Kerguelen, leaving Campbell to be picked up in March or April by HMAS *Wyatt Earp*. But *Wyatt Earp's* visit was cancelled, and on 3 January 1948 the *Labuan* returned to Heard Island. Campbell appointed Aubrey Gotley as Officer in Charge (OIC) of the wintering party, and next day sailed for Australia. On 31 December 1948 Campbell resigned from ANARE and was succeeded by Dr Phillip Law, who served from 1949 to 1966 as Director of the Antarctic Division and Leader of ANARE.

Table 1. Wintering parties, 1948-54. Secondary jobs in italics. Unfilled positions are shown by a dash (—). Source: Law and Béchervaise 1957.<sup>#</sup>

Year	1948	1949	1950	1951	1952	1953	1954
OIC	<i>AV Gotley</i>	<i>RW Allison</i>	<i>JW McCarthy</i>	<i>FT Hannan</i>	<i>LF Gibbney</i>	JM Béchervaise	<i>GM Budd</i>
MO	AR Gilchrist	RW Allison	S Udovikoff <sup>1</sup> AM Gwynn OR Rec	OR Rec	J Faulkner	AM Gwynn	GM Budd
Engineer	JA Abbottsmith	AR Burton	TF Keating	P Lawson	J Russell	J Hughes	LG Gardner
Cook	AN Jones	CW Du Toit	—	J Starr	P Teyssier	RG McNair	DP Sweetensen
Ass't cook/Storeman	—	—	EHJ Thornton PR Wayman	K Cleary <sup>2</sup>	PL Brown	—	—
Meteorologist	AV Gotley	A Garrtrock	JW McCarthy	FT Hannan	R Borland	PJR Shaw	—
Met observers	AT Carroll KW York	RG Smith OE Warden	MJ Bruer PJ Marron JE Walsh	KF Bott AJ Giese WRJ Dingle	KC Hall L Atkinson RG Frost	LR Welch F Elliott B Izabelle	MW Henderson JE Walsh V Cleland
Radio Supervisor	LE Macey	RG Oatt	JH Gore	NT Lied	A Perriman	KE Dalziel	JH Gore
Radio operators	A Campbell-Drury AW Scholes GS Compton	HC Burnett JH Paddock	LJ McGarrigle JH Vause	KJ Johnston DJ Cheffins	R Hoseason <sup>3</sup> J Carr	RV Parsons CF O'Brien	GE Delahoy

<sup>#</sup> OIC, Officer in Charge; MO, Medical Officer.  
(Continued on next page)

Table 1 (continued). Wintering parties, 1948-54.

Year	1948	1949	1950	1951	1952	1953	1954
Physicists	FJ Jacka JE Jelbart	—	—	—	—	—	—
Geophysicist	—	—	—	H Doyle	L Ingall	JA Brooks	K Lodwick
Biologists	AR Gilchrist	RG Chittleborough EHM Ealey	LF Gibbney PS Young AM Gwynn	KG Brown MC Downes	LF Gibbney PL Brown	AM Gwynn RG McNair	GM Budd DP Sweetensen
Geologist	AJ Lambeth	—	—	—	—	—	—
Surveyor	RG Dovers	—	—	—	—	—	—
Ass't surveyor	GS Compton	—	—	—	—	—	—
Carpenter	—	—	AD Riddell	—	—	—	—
Dog attendant	—	—	TF Keating JE Walsh	JE Walsh	A Forbes <sup>4</sup> PL Brown	LN Fox	JE Walsh
Number of men	14	11	15	15	14	13	9

<sup>1</sup> Until August. Repatriated in HMAS *Australia* with appendicitis, and replaced by Drs Gwynn and Rec.

<sup>2</sup> Until September. Repatriated in RRS *Discovery II*.

<sup>3</sup> Drowned 26 May.

<sup>4</sup> Died of exposure 26 May.

## Operation of the station

The *Labuan* left behind a party which, in Law's words, 'had first to create order out of chaos. From the jumbled stacks of stores piled in haphazard position along the beach they had to construct a camp. Huts had to be built, engines mounted, wireless masts erected, scientific apparatus assembled; and all this under extremely adverse weather conditions.'

Two months later there were 18 brightly painted huts, three of the four radio masts were standing, and all meteorological equipment except the radiosonde was operational. By the time of *Labuan's* return, in February 1949, with Law and the 1949 party a year's continuous weather observations had been made and radioed to Australia, cosmic rays had been recorded for 10 months, much of the island had been surveyed, a geological and glaciological program had been completed, and many biological observations and collections had been made. Law reported that 'the first year of operation of the Heard Island Scientific Station must be regarded as having been highly successful.'

Over the following years successive parties continued and expanded the scientific program. At the same time they enlarged and improved the station, so that by 1954 there were about 30 huts. They lived and worked in a place that was truly unforgettable.

### Station sights and sounds

The view from the station was one of baleful magnificence. Across Atlas Cove, to the north-west, were the black cliffs of the Laurens Peninsula, capped by snow slopes, hanging glaciers, and ice falls under the ever-present low cloud (Fig. 2). To the south-east, between the black sand of the Nullarbor Plain (the swampy isthmus between Atlas Cove and Corinthian Bay) and the low cloud hiding the mountain, were the ice falls and the crevasse-starred snowfields of the Baudissin Glacier (Fig. 3). Stretching away to the east were the blue ice cliffs and the rock bluffs of Corinthian Bay, the red volcanic cone of Saddle Point, and beyond them the almost permanent patch of blue sky over Spit Bay, itself remote and out of sight beyond the curve of the coast.

This sombre view was accompanied by the unceasing scurry and whistle of wind among hundreds of guy wires, and the deep organ tones of the slotted tubular radio masts. Each wind played its own music. Nor'easters progressively moaned, sang, and screamed as the wind increased, nor'westers drummed, droned and roared, sou'westers maintained a hoarse breathy whistle. Pitch and volume rose and fell with the gusts and lulls, and jumped to a discordant shriek as the williwaws — small tornadoes that weaved across Atlas Cove in



twisting columns of spray — came through the station, shaking the huts and flinging loose objects about.

Other background sounds were the distant roar of the surf in South West Bay, the clatter of the penguin colonies across Atlas Cove, the grunts and belches of the elephant seals, the sharp cries of gulls and skuas, the despairing cry of the light-mantled sooty albatross — and to sober the would-be traveller, the prolonged roar of an avalanche in the clouds on Big Ben, or the crash of an ice fall onto a beach.



Figure 2. Laurens Peninsula and Atlas Cove in typical weather, looking north-west from M.V. *Kista Dan* in January 1954. Break in cliff line encloses Jacka Glacier and Jacka Valley. Above them is the hanging glacier whose ice avalanches menaced field parties (see text) travelling to Red Island, itself out of sight beyond distant cliffs at right. [ANARE photo by G M Budd]



Figure 3. View east from Atlas Cove in typical weather, January 1954. In left and centre foreground is Wharf Point, with red roofs and radio masts of ANARE Station just visible behind it. In right foreground is the Nullarbor Plain. Beyond it, from right to left, are the Baudissin, Nares, and Challenger Glaciers, all of them descending to Corinthian Bay. [ANARE photo by G M Budd]



Yet the balefulness gave way to beauty when the clouds dispersed and the great cliffs and buttresses of the mountain appeared (Fig. 4); when snow covered the beaches and the drifts reached the eaves of the huts (Fig. 5); when sunshine alternated with snow showers in the winter westerlies; or when leopard seals sang on moonlit nights on the snowy beach of Corinthian Bay.

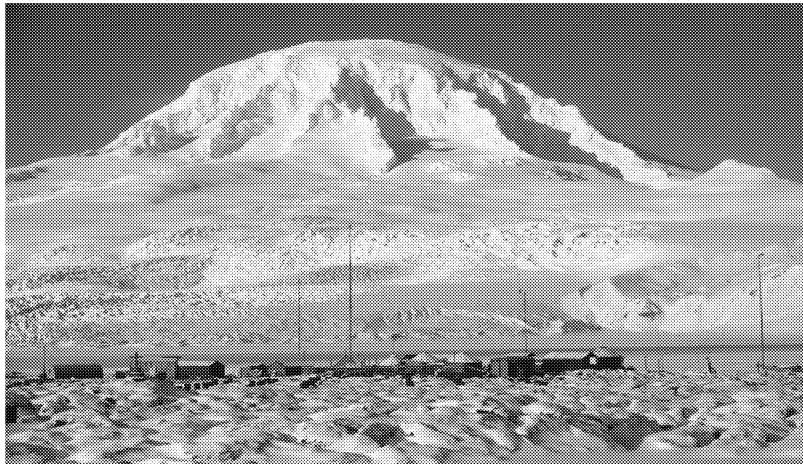


Figure 4. ANARE Station on a fine day in winter 1953, looking south-east, with Baudissin Glacier and Big Ben beyond. [ANARE photo by J M Béchervaise]



Figure 5. ANARE Station on a fine day in winter 1954, looking west, with Mt. Olsen (636m) beyond. Red-roofed huts, from left, are radio, mess, sleeping hut, and kitchen. [ANARE photo by G M Budd]

### **Landing operations**

The annual reliefs of Heard and Macquarie Islands were described by Law as the most dangerous and unpleasant of all the expedition work undertaken by ANARE. The anchorage in Atlas Roads, 1-3 km from

the landing beach, was swept by violent winds, rain, and snow storms, and ships readily dragged their anchors towards the lava cliffs or rocky beaches astern. The weather was often marginal for landing operations, and in most years the ship would have to put to sea for a day or two to ride out a storm.

Except for the first year when the *Labuan* was beached, cargo was landed by rubber pontoons towed by motor boats and unloaded by hand at the beach. This method was supplemented in some years by amphibious vehicles (army DUKWs or LARCs). Only in 1969 and 1971 was some limited use made of helicopters. Loading amphibious vehicles or pontoons at the side of a ship rolling in the swell was tense and dangerous work, and only the compulsory wearing of life jackets saved men from drowning in the freezing water (2°C) when they fell or were knocked overboard. All members of the expedition worked as long as daylight and the weather lasted, day after day until the operation was completed.

#### **Station maintenance**

All men were regularly involved in repairs and maintenance to cope with the damage to buildings and equipment that was continually inflicted by the violent winds and sand blast. They repainted the huts each year, and expeditioners revisiting the station in later decades would see different colours on each visit, as the annual layers of paint from the 1950s were progressively stripped away. Between January 1950 and January 1951 Alf Riddell, a skilled and energetic professional carpenter, thoroughly renovated and repaired all the huts. He improved the arrangements for collecting, storing, and reticulating rain water from the hut roofs, and erected many new huts. They included a recreation hut, located between the mess and the sleeping huts and connected to them to form a single covered living area; a seismograph hut behind the station; the two huts of the magnetic observatory at West Bay; and a small field hut which was landed by a DUKW at Saddle Point in January 1951.

#### **Food and drink**

For the first three years food was cooked on a kerosene stove, but in January 1951 an AGA slow-combustion stove was installed. The cook was helped by a rostered daily 'slushy', and on Sundays other expedition members took over the cooking. Although fresh fruit and vegetables lasted for two months, and eggs for eight months, most of the food was canned, dried, or otherwise preserved. Lumps of salt pork were fished out of brine in wooden casks, and beer came in wooden crates, each 750 ml bottle wrapped in its own straw jacket. Stone jars of Board of Trade lime juice ('battery acid' to the consumers) were

provided to ward off scurvy, although for the faint hearted there were also jars of vitamin pills.

There was no refrigeration, and attempts to store fresh meat in ice caves on the Baudissin Glacier failed because the temperate glacier was not cold enough. However, in each of the last three years a dozen sheep were landed. In 1953 some of them bolted across the Nullarbor and vanished among the ice chasms of the Baudissin Glacier, never to be seen again; but in 1954 they found adequate grazing on the Azorella Peninsula (Fig. 7), from which hunting parties brought back the monthly ration of fresh mutton. Seal and penguin meat was regularly eaten by some parties, and penguin eggs (one from the clutch of two laid by each bird) were enjoyed in season.

### **The health of the party**

The medical officer's job was to maintain the health of the party, and to refrain from becoming seriously ill or injured himself. Infections were uncommon, but the constant manual work outdoors in an aggressive climate resulted in frequent injuries, usually of a minor nature. Stress-related ailments were not uncommon, as conscientious expeditioners tried to maintain demanding work schedules under frustrating conditions. Dentistry was a regular part of the doctor's practice, and there was a certain amount of veterinary work with the sledge dogs.

The doctor's own vulnerability became apparent in July 1950 when Dr Serge Udovikov developed appendicitis, precipitating a month-long crisis that was resolved only when he was repatriated by the cruiser HMAS *Australia*. He was replaced by Dr Arthur Gwynn, who had recently wintered at Macquarie Island, and by Dr Otto Rec. Rec stayed on with the next year's party, and in October 1951 he successfully operated for appendicitis on the cook, Jack Starr, with the assistance of many other members of the party (Lied 1987a; Bowden 1997).

The 1950 crisis, and the costly damage sustained by HMAS *Australia* during her midwinter voyage, prompted a ministerial decree that henceforth all ANARE medical officers must have their appendixes removed before leaving Australia. Lesser ailments, however, could still cause trouble. Doctors found it difficult to drill their own carious teeth — they tended to drill the tooth's reflection in the dental mirror — and one doctor's dental abscess was incised by a patient he had recently treated for the same condition, who was happy to return the favour.

### **Engineer**

The station's power supply was provided by two Lister 15 KVA diesel alternators, one being run while the other was undergoing

scheduled or emergency maintenance. As a precaution in case of fire, a third Lister was kept in the spare engine hut and was wired to the emergency radio hut. To save fuel and extend engine life the operating Lister was shut down from 2300 hr to 0500 hr, and late workers used candles or pressure lamps. Great ingenuity and resourcefulness were required of the engineer, who had to operate and maintain — at times constructing his own spare parts, such as diesel injectors — the Lister alternators, D4 tractor, Ferguson tractor, outboard motors, marine engines, boats, and all other mechanical and electrical equipment and cables around the station.

### **Sledge dogs**

From 1950 onwards sledge dogs were bred and trained at Heard Island, in preparation for their use in Antarctica. The 1950 party brought with them 12 dogs, and additional dogs were brought by the 1951 and 1952 parties. They were descendants of the Labrador and Greenland huskies that had been taken to Adélie Land by Expeditions Polaires Françaises. Selective breeding from this stock steadily increased the population, which numbered about 60 in January 1954. In that month 27 dogs, trained as three working teams, were taken to Antarctica with the pioneer Mawson party, and the remaining usable dogs followed in 1955.

The accommodation, general care, health, feeding, and training of the dogs were onerous tasks that became progressively heavier as their numbers grew. In 1950 Frank Keating, the station engineer, undertook these tasks and was assisted by weather observer Jack Walsh. In 1951 Walsh stayed on as full-time dog attendant — he was one of the few ANARE members to winter for two consecutive years — and he looked after the dogs again in 1954 when he returned to Heard as a weather observer. After the death of Alastair Forbes in May 1952 Peter Brown, the assistant cook/storeman, took over, and was succeeded in 1953 by Leon Fox.

The unfavourable terrain of Heard Island made dog sledging impractical beyond the Vahsel and Baudissin glaciers, and variable snow cover at sea level often limited sledging even in the Four Bays Area. To alleviate this problem Peter Brown, in 1952, built a Greenland-type sledge which could cope better with stony ground than the Nansen sledge, and he also built a 'dogmobile' by fitting bogey wheels to a jeep trailer. These vehicles made it possible to train the dogs throughout the year, and also allowed the dogs to haul heavy loads of seal meat, their staple diet, to the station.

### **Meteorology**

On 27 March 1948, after three months of building huts, repairing and drying equipment and stores that had been damaged or wetted in landing, and setting up instruments, the Heard Island meteorological station became fully operational. From then until 31 October 1954 it operated continuously as an 'A Class' station. This entailed making systematic observations of air temperature, humidity, cloud cover, and other weather elements every three hours; maintaining continuous records of wind speed and direction, barometric pressure, and other variables; and making daily pilot balloon and radiosonde flights. The program was expanded in 1953 by the addition of daily 'rawin' flights, in which the radiosonde balloon was tracked by a radio-theodolite to determine wind velocities at high altitudes. After October 1954 limited meteorological observations were made until the station was closed in March 1955.

Securing the observations in blizzards and other extreme weather called for great determination, particularly in such tasks as climbing to the top of the 12 m Dines anemometer mast to clear ice or snow from its pressure tube. Maintenance of electronic and other equipment was a constant preoccupation in a damp environment of wind-driven sand, snow, rain, and saltwater spray.

The daily radiosonde flight was an exacting task. The large balloon had to be filled with hydrogen generated by a mixture of ferrosilicon and caustic soda, manoeuvred through the doorway of the balloon shed with the help of other expedition members, and launched without damaging the radiosonde and rawin transmitters that dangled beneath it. Strong winds sometimes tugged the balloon against the doorway and burst it, or bounced the transmitters along the ground in launching. Then the whole laborious process would have to be repeated. During the flight the observers monitored the continuously recorded signals from the radiosonde, and (from 1953) tracked the balloon with the rawin antenna. They then plotted and analysed the information obtained.

Weather observations and radiosonde data were immediately coded for radio transmission to Australia and other countries. Each evening the meteorologist collated the local observations with those radioed from many other stations to draw a synoptic chart of the regional weather, radioed it to Australia, and made a local forecast. The local forecasts were important for the safety of the ship during relief operations, and for the safety of the boats when landing field parties or making plankton hauls.

**Radio**

A prominent feature of the station was the four Kelly and Lewis radio masts, 20 m high, that were erected by the 1948 party and were subsequently fitted with rhombic aerials beamed at Sydney, Perth, South Africa, Kerguelen, Amsterdam Island, and Marion Island. Radio staff regularly checked the masts and tightened their guys (anchored to 44 gallon drums filled with rocks), and often had to repair aerials and transmission lines that had been damaged by high winds or the accumulation of ice. Such work entailed long periods of exposure to cold winds, rain, and snow while high on the masts.

The radio operators worked an 18 hr day, from 0500 hr until 2300 hr, sending and receiving (always in Morse code) weather data, scientific and administrative traffic, and personal messages. The work was particularly demanding in 1954, when they were reduced from three men to two and the traffic was increased by the newly-established Mawson station. Nevertheless, at the end of a long watch some operators would remain 'on air' with their ham radio equipment, pursuing the elusive goal of '100 contacts'. Radio blackouts caused by sunspot activity made communication difficult and sometimes impossible, resulting in a backlog of delayed traffic when the blackout ended.

Other regular tasks included the maintenance and repair of the radio equipment (a major task in 1948 when one of the main transmitters was damaged in landing), and often the fabrication or repair of electronic or electrical equipment used by the meteorological and other sections. Regular radio schedules with field parties were sometimes maintained (for example in 1948 when the surveyors and geologist were camped high on Mt Olsen or at Saddle Point), but the weight, bulk, and limited range of the field radios then available made their use impractical for field parties operating beyond a line of sight. However, in 1954 John Gore, the radio supervisor, designed and built a small field radio weighing only 6 kg, which maintained Morse contact with that year's circuit party even at the most remote parts of the island.

**Geophysics**

In 1948 Fred Jacka and Jo Jelbart continuously measured cosmic rays for 10 months, and their experience led to improvements in the equipment subsequently used at Macquarie Island and Mawson. They and later observers made systematic observations of the aurora whenever it was not hidden by the prevailing cloud. In 1951 Hugh Doyle set up a seismic observatory behind the station at Atlas Cove, and began a program of measurements which continued until they were halted by battery failure in June 1954.

Following measurements of the absolute magnetism in 1947 and 1950, and a detailed variometer survey in February 1950, in 1951 Doyle established a magnetic observatory at West Bay, with one hut for absolute measurements and another for the variometers. The variometer measurements continued unbroken until 31 October 1954, and the absolute measurements until mid-January 1955. The site at West Bay was chosen because it experienced much less local magnetic disturbance than the other sites surveyed, but its location 3 km from the station required a long daily walk to change the recording traces and service the instruments by the geophysicist or the expeditioners who occasionally relieved him. Against a south-west blizzard it could be a challenging excursion.

### **Biology**

Comprehensive biological programs were undertaken from 1949 onwards. Almost all species of the island's flora and fauna were to be found in the Four Bays Area, Cape Gazert, or the Laurens Peninsula. Regular counts of elephant seals and antarctic fur seals at Red Island and the Four Bays Area yielded information on the size and trends of the local populations. Each year the biologists and their helpers banded the chicks of the black-browed albatross at Jacka Valley, and those of the giant petrel at Cape Gazert, Red Island, and the west coast of Laurens Peninsula. They also branded elephant seal pups in the Four Bays Area. In this way they established marked populations of birds and seals of known age, for long-term studies of their growth rates, life history, distribution, and migrations. They studied individual species in detail, and collected insects, arachnids, parasites, mosses, and lichens. Most members of the party assisted the biologists at one time or another, particularly in field work.

Biologists regularly sampled hydrology and made plankton hauls at two stations in Atlas Cove from March 1949 to July 1950, and from March 1951 to August 1952 – the interruptions to the program being caused by hull damage or engine failure in the cutter or dinghies used. The outermost station was in Atlas Roads, between Rogers Head and the Jacka Glacier, where an engine failure would put a boat's crew at risk of being swamped, blown out to sea, or wrecked against the lava cliffs. After 1952 the plankton hauls were discontinued because they were considered too hazardous.

### **Closing the station**

One of the arguments used by Phillip Law to persuade the Australian Government to support the establishment of Mawson, Australia's first permanent station on the Antarctic Continent, was that the Heard Island station could be closed and much of its equipment transferred to



Mawson. Mawson was successfully established in February 1954, and Heard Island was therefore scheduled for closure in March 1955.

On 31 October 1954 most scientific work on Heard Island ceased, and thereafter the island party was busy preparing scientific and other equipment for shipment to Mawson or return to Australia, and in dismantling six of the huts for shipment to Mawson. Taking down the huts was an exacting task. Identification codes were painted on all panels, and sketches were made to help the Mawson party reassemble them. The huts were then dismantled and their components stacked together for shipment. Finally, the nuts and bolts used in them were screwed through on taps and dies to clear their threads, in order to ease the task of those who would reassemble the huts in the cold winds of Mawson.

In January 1955 the huts, dogs, and other Mawson cargo were loaded aboard M.V. *Kista Dan* and taken south, while the Heard party mothballed the equipment and huts that were to remain. The medical officer (Grahame Budd) was directed to assemble and store enough surgical equipment and supplies to perform a typical operation, such as an appendectomy, and he left a note in the surgery to tell anyone who might need it where the equipment was stored. Oddly enough, he himself, eight years later, was the first person to need it. On the ship's return in early March all the huts were firmly sealed, *Kista Dan* sailed away, and Heard Island lapsed back into its customary solitude.

## Field work

### Getting about the island

A continuing task of ANARE wintering parties was to explore the island and document its main features. Naturally enough, the most accessible places — Laurens Peninsula and Cape Gazert — received the most attention, and each year they were visited on day-return trips or during field trips of up to a week. Journeys elsewhere on the island involved extensive glacier travel, usually carrying loads of 20-30 kg, and were made less often. Few men had ever walked on a glacier before they came to Heard Island, and their equipment and clothing were usually inadequate and often improvised. Learning from experience, they developed empirical techniques of work, travel, and survival that shaped the character of ANARE and were later applied in Antarctica.

Glacier travel was always uncertain because of monthly and yearly changes in the seracs and crevasses, in the reliability of the snow bridges over crevasses, and in the snow cover that concealed them. Consequently travellers could never be sure of using routes previously traversed. The uncertainty was magnified by the prevalence of low cloud and the accompanying white-out, which made navigation



difficult and in dangerous terrain could halt progress altogether. Some routes were menaced by ice avalanche and stone-fall. Tents were often damaged by violent winds, or buried by drifting and falling snow. As depressions passed over the island, travellers would first be soaked by the driving rain of northerly gales, then chilled as the wind backed to south and froze their wet clothing.

Table 2. The longer journeys on Heard Island, 1948-54.

Year	Main places visited	Team members	Dates <sup>#</sup>	Dur'n (days)	Main aims	Comments
1948	Spit Bay	Dovers, Compton	Nov 1-28*	28*	Topographic survey, geology	Manhauled sledge
1949	Spit Bay, Winston Lagoon	Ealey, Chittleborough, Paddock	Oct 24-Nov 4	11	Biological survey, seal census	Crossed Winston Glacier
1950	Spit Bay	Gibbney, Young, Rec	Nov 3-15*	13*	Seal census	Repaired Spit Bay hut
1951	Spit Bay, South Barrier	Brown, Downes, Giese	July 21-Aug 4	15	Winter attempt on Long Beach	Reached crest of South Barrier
1951	Long Beach, Spit Bay	Brown, Dingle, Lied	Nov 21-Dec 6	16	Biological and topographic survey	First circuit of island
1953	Upper Abbot-smith Glacier	Bécher-ervaise, Elliott, Shaw	Nov 2-18	17	Attempt to climb Big Ben	Reached 1500 m
1954	Spit Bay, Long Beach	Budd, Henderson, Walsh	Dec 13-24	12	Condition of field huts, seal census	Second circuit of island

<sup>#</sup> Dates shown are those of absence from the ANARE station at Atlas Cove, except for those marked with an asterisk which refer to dates of absence from Saddle Point. Dur'n, duration.

Table 2 lists the longer journeys that were undertaken, always by unsupported parties of two or three men travelling on foot, between 1947 and 1955. As knowledge of the island accumulated, the objectives of field work changed. Successive aims were to produce a topographical map and to survey the geology and glaciology (1948); to survey the flora and fauna, particularly elephant seals (1949-1954); to explore and survey the Long Beach area (1951); to climb Big Ben (1953); and to ascertain the condition and contents of the field huts at Saddle Point and Spit Bay on the eve of abandoning the island (1954).

The planned trip to Spit Bay in 1952 was cancelled after the accident, described below, in which two men died. Tragic though it was, this accident nevertheless highlights the fact that it was the only serious accident to occur in those years, despite such extensive field work.

In what follows the main journeys of each year are outlined, and other field work is summarised. The chief sources of information have been the microfiche copies of each year's 'Field Trip Logs' (not available for 1948, and possibly incomplete for 1952 and 1953), together with published narratives or summaries in the books and journal articles which are cited in the individual years. In addition, George Compton and Max Downes have kindly provided comprehensive accounts of the field work undertaken in 1948 and 1951.

#### 1948: Topographical and geological survey

##### *Overview*

Throughout 1948 Bob Dovers and George Compton spent most of their time in the field (Scholes 1949), surveying with theodolite, subtense bar, and plane table, and were often accompanied by Jim Lambeth who investigated the geology and glaciology (Fig. 6). They surveyed all the island except the western and southern regions between the Abbotsmith Glacier and Spit Bay. After Dovers had surveyed those regions from the *Labuan* their results, together with photographs from the ship and from the Walrus amphibian, yielded the first accurate map of Heard Island.



Figure 6. Lambeth, Compton, and Dovers leave the ANARE Station to survey Laurens Peninsula, 1948. [ANARE photo by Alan Campbell-Drury]

#### *Four Bays Area and Laurens Peninsula*

In the Four Bays Area Dovers and Compton took repeated astro-fixes to establish the exact position of the island, measured a long baseline, and occupied survey stations on the windy hilltops of Corinth Head, Mount Drygalski, and other vantage points. They mapped the depth of Atlas Cove, working with other men taking soundings from the dinghy; and they constructed and operated a tide gauge which required many repairs, adjustments, and long night watches. While surveying the Laurens Peninsula they camped for periods as long as ten days at Jacka Glacier, Red Island, and the west coast, and on the high snowfields and glaciers of Mt Olsen. During coastal field work they (and later parties) sometimes cooked on driftwood fires, and supplemented their rations with penguin and seal meat.

The survey called for patience, stoicism, and endurance. Most of their equipment was inadequate for the severe weather, particularly when they were camped on snow beside the Aiguilles, high on the weather side of Mt Olsen. In the constant gales tent poles broke and guys tore off. Igloos dripped and soaked their clothing and sleeping bags. Air temperature oscillated above and below freezing, rain alternated with snow, and the field party repeatedly had to return to the station to dry out — once even to thaw a frozen theodolite. They made two new tents, the second of which was a standard polar pyramid with a tunnel entrance. Made of strong canvas, it was robust but heavy, more suited to sledging than to back-packing. Subsequent years saw many further attempts, even now not wholly successful, to make tents of acceptable weight that could withstand the Heard Island climate.

#### *Cape Gazert and Abbotsmith Glacier*

In mid-September Dovers, Compton, and John Abbotsmith spent 10 days surveying at Cape Gazert and at the northern moraine of the Abbotsmith Glacier. They found, as Alan Gilchrist and Fred Jacka had done on a day's ski reconnaissance in June, that the Abbotsmith Glacier was heavily crevassed and presented a formidable barrier to travel down the western side of the island.

#### *Problems of getting to Saddle Point*

A similar barrier opposed the first stage of any trip along the northern and eastern sides of the island. Between Atlas Cove and Saddle Point lay the Baudissin, Nares (Little Challenger at the time), and Challenger glaciers (Figs. 3, 7), all of which ended in high (30-40 m) ice cliffs standing on narrow beaches. The seracs and open crevasses of their lower slopes presented daunting obstacles to field parties inexperienced in glacier travel. Yet travel above their ice falls, where the terrain was less chaotic, was impeded by restricted visibility in the



Figure 7. View east from summit of Mt Olsen, January 1955. Behind the ice axe are Atlas Cove, the Nullarbor Plain, Corinthian Beach, and Corinthian Bay, with Saddle Point, Cape Bidlingmaier, and Melbourne Bluff beyond. To the left of the ice axe are Wharf Point, the ANARE Station, and the Azorella Peninsula. [ANARE photo by G M Budd]

almost permanent low cloud and this route was used only twice, both times in 1951.

Another way to get to Saddle Point was to use the expedition's 3 metre dinghy (Fig. 8) and its unreliable outboard motor, but suitable conditions of weather and sea were rare and brief. Launching and loading the dinghy in Atlas Cove, beside the station, was convenient but it entailed a long and dangerous passage around Rogers Head and its off-lying reefs. Conversely, the use of Corinthian Beach entailed hauling the boat and its cargo a kilometre overland. Surf and wide fields of heavy brash ice at Saddle Point, and sometimes at Corinthian Beach, usually hindered landing and embarkation and often made them impossible.



Figure 8. The 1948 party's 3 metre dinghy in Atlas Cove, with snow-covered station and wrecked Walrus amphibian in background. [ANARE photo by Alan Campbell-Drury]

### *Spit Bay*

Engine failure, weather, surf, or brash ice defeated numerous attempts to land field equipment and stores at Saddle Point between April and October, but eventually enough supplies were ashore and on 15 October Dovers and Compton were landed at Saddle Point, where they pitched and occupied the army tent they had left there. Until 23 October they surveyed around Saddle Point, and sledged a load of supplies forward to the moraine behind Cape Bidlingmaier. Surveying was then halted by a week of wind, rain, and low cloud, during which they improved the habitability of the army tent at Saddle Point by flooring it with beach sand, pebbles, and rock slabs.

On 1 November, wearing their home-made snowshoes and hauling the 3 metre sledge Abbotsmith had built, they walked to the Cape Bidlingmaier moraine and camped there in their home-made pyramid tent. Completing their observations on 2 November, they moved camp on 3 November to the bluffs above Gilchrist Beach, at the seaward end of North Barrier. After weathering a north-west gale for two days they completed their observations on 6 and 7 November, Compton making geological observations and collecting rock samples as well as working with Dovers on the survey. On 8 November they sledged onwards to Fairchild Beach and camped below Round Hill. Over the next five days they completed the local survey, including stations at 400 m above sea level on Round Hill, although hampered by strong winds, rain, and snow. On 14 November they sledged two loads to Skua Beach 'in a blinding wet snowstorm'.

For the next ten days winds too strong for outdoor work alternated with rain, wet snow, and low cloud. Surveying on Scarlet Hill and elsewhere during brief breaks in the weather, they completed the work at Skua Beach (feelingly referred to by Compton as 'Lovechild Beach') by 25 November and then reconnoitred the route south over the Stephenson Glacier, whose crevasses proved to be impassable below the 150 m level. On 26 November they sledged a load to the Dovers Moraine above Spit Bay, travelling well inland to clear the crevasses.

At Spit Bay they explored the area, took bearings and photographs, established a depot of food, fuel, and some equipment, and returned to Skua Beach the same day. On 27 November they sledged back from Skua Beach to the Compton Glacier, and the following evening, very tired, they reached Saddle Point in time for the evening radio schedule with Atlas Cove. After waiting 12 days for suitable weather, they returned to Atlas Cove by dinghy on 10 December.

### *Attempted return to Spit Bay*

Accompanied by Lambeth, Dovers and Compton returned to Saddle Point on 18 January and on 21 January set off for Spit Bay – only to

find that the snow bridges had melted and the open crevasses were too wide to cross with the sledge. They retreated to Saddle Point where, unable to contact the station because their radio had failed, they waited a fortnight until the relief ship picked them up on 5 February.

After re-embarking the 1948 party *Labuan* cruised down the unsurveyed western side of the island in clear weather (Fig. 9), enabling Dovers to obtain the necessary observations to complete his survey.



Figure 9. Abbotsmith Glacier (centre) and western side of island from HMALST *Labuan*, February 1949. On skyline (left to right) are the summit plateau, Mawson Peak, Budd Peak, Budd Ridge, Budd Pass, and Putt Peak. [ANARE photo 233 by Alan Campbell-Drury]

## 1949: Biological survey

### *Overview*

Field work in 1949 focused on biological surveys by Tim Ealey and Graham Chittleborough, assisted when necessary by other expeditioners. They made three visits to Cape Gazert, the last of which was via a happily uneventful 45 min walk each way along the beach under the sea cliffs of the Vahsel Glacier. Although they made four visits to the Jacka Valley to study the black-browed albatross colony they did not venture past the Jacka Glacier. Their April visit to Red Island was made by cutter and dinghy, and they walked back by way of the west coast. On a later dinghy trip to Red Island in October they were unable to land because of surf and outboard-motor trouble. Their longest journey was a visit to Spit Bay and Winston Lagoon.

### *Spit Bay*

On 24 October Ealey, Chittleborough, and John Paddick landed at Saddle Point after an uneventful voyage of 45 minutes from Corinthian Beach. They hauled the dinghy well above high-water mark to await their return from Spit Bay, and spent the rest of the day surveying the fauna of the area (Paddick 1992, 1993). The following day, in fine

weather, they hauled the previous party's sledge to Skua Beach in 8 hr of mostly easy travel over a good snow surface and firmly bridged crevasses; surveying the fauna at Fairchild and Skua beaches as they went.

On 26 October they sledged across the Stephenson Glacier to the northern beach of Spit Bay in two hours and pitched the large army tent that had been left there, together with food and fuel, by the *Labuan* in February. After a disturbed night in which the tent walls were twice blown from their anchorages and driving snow soaked their clothing and blankets, they anchored the tent firmly on 27 October and counted the elephant seals along the length of the Spit. On 28 October, in the continuing gale, they counted the seals in the remainder of the area, obtaining a total of 37,230 elephant seals.

*Attempt to reach Long Beach.* During a low tide on 29 October they made an unladen reconnaissance along the southern beach to Paddick Valley and Winston Lagoon, walking under the low ice cliffs of the Stephenson Glacier for the middle 1.5 km. Access to the Winston Lagoon spit and the beaches beyond was blocked by the outlet from the lagoon and by the heavily crevassed Winston Glacier at its head. They estimated the numbers of seals on the spit through field glasses, then returned to camp across the moraine of the Stephenson Glacier.

They lay up during a blizzard on 30 October, and on 31 October they set out for Long Beach against a rainy south-west gale that steadily worsened, gusting to 173 km/hr at Atlas Cove. After a few hours they could make no further headway and returned to Spit Bay. On 1 November, in better weather, they tried again but were blocked by crevasses half way across the Winston Glacier at a height of about 600 m. After completing the crossing without the sledge they considered the alternatives of travelling up the south-western stream of the Winston Glacier to a high crossing of South Barrier, or of traversing steep snow slopes to reach the beach beyond Winston Lagoon, from which they could perhaps travel onward beneath the sea cliffs of South Barrier. Concluding that neither option was feasible at the time, they returned to Spit Bay. During the night wind-driven snow filled one end of the tent and again wet their blankets and clothing, and the blizzard continued for most of the next day.

On 3 November they sledged back to Saddle Point in 12 hours, despite a difficult snow surface and a blizzard beyond the Compton Glacier, and next day returned to Corinthian Beach in the dinghy.



## 1950: Elephant seal census

### *Overview*

The 1950 biologists — Les Gibbney, Peter Young, and (after August) Arthur Gwynn, as always assisted by other members of the party — continued the work at Jacka Valley and Cape Gazert, visiting each place four times. On one of their three walks to Red Island they pioneered the direct route past the Jacka Glacier. They made two reconnaissances of the Abbotsmith Glacier, in hopes of finding routes to Long Beach and to the summit of Big Ben; and they pioneered a route over the glaciers between Atlas Cove and Saddle Point.

### *Red Island*

Red Island can be reached by walking along the beaches and scree slopes of the east coast of Laurens Peninsula (Fig.2), or by a longer route around the western side that involves negotiating numerous ridges of unstable and sharp-edged lava, often in fog. Some hazards of the convenient eastern route were discovered in November 1950 by Gibbney, Pat Marron, Alf Riddell, and John Gore.

After traversing a narrow beach below the low sea cliffs of the Jacka Glacier they were obliged to cross a steep secondary glacier that was scored by the tracks of ice avalanches from a hanging glacier above the rock cliffs, and while traversing the slopes beyond they were threatened (and were once hit) by intermittent falls of rock or ice fragments. During their return next day they found that the secondary glacier had been swept by an avalanche and was now littered with huge ice boulders; and another large avalanche fell about 20 min after they had crossed the glacier. In his report Gibbney speculated whether this route might be safer in midsummer, and suggested that 'someone with very strong nerves might try it out.' The nerves of the next year's party were duly tested, as will be seen.

### *Abbotsmith Glacier*

In late August and mid-October Gwynn, Frank Keating, and Young made two overnight trips, assisted by dog sledge and (on the first trip) by Jack Walsh, Leo McGarrigle, and Otto Rec, to reconnoitre the northern edge of the Abbotsmith Glacier. They established a depot at the 500 m level, at the junction of what appeared to be likely routes to Long Beach and to the summit of Big Ben, but in the prevailing low cloud and frequent blizzards they could find no crossing of the heavily crevassed glacier.

### *The campaign at Saddle Point*

Establishing this year's Spit Bay party at Saddle Point, the starting point for their journey, developed into a campaign at sea and on land



that involved 11 men, lasted for nine days, and was eventually resolved by finding an overland route between Atlas Cove and Saddle Point. It highlighted the problems of boating and the dangers of walking under ice cliffs.

*Problems of boating.* The campaign began on 24 October, when Gibbney, Young, and Rec — the Spit Bay party — took the dinghy with two outboard motors (one a spare) to Saddle Point but could not land because of heavy surf. Next day Mike Bruer and Gibbney reconnoitred a beach route under the sea cliffs of the Baudissin Glacier, but retreated to Corinthian Beach after being drenched and almost carried away by the surf.

On 26 October the Spit Bay party, together with Jim McCarthy, Keating, and Peter Wayman, took the heavily laden dinghy from Corinthian Beach to Saddle Point. The outboard broke its shear pin on the heavily packed brash ice, but the party managed to row ashore. Keating and McCarthy then tried to return to Corinthian Beach, but despite rowing for three hours they could not get through the 50 m of brash ice at Saddle Point. Next day there was no ice but the dinghy was swamped in the surf, drenching the outboards and the men, and the attempt was abandoned for the day.

On the 28th the dinghy was hauled further up the beach to avoid heavy surf, but nevertheless an exceptionally large wave almost carried it away. By mid-afternoon the seas had moderated and the dinghy was successfully launched. The outboard motor failed almost at once, but the boat party (McCarthy, Keating, and Wayman) continued with oars against a choppy sea and a strong south-west wind. Halfway across the bay they abandoned the attempt and rowed back to Saddle Point, where they capsized in the surf while landing.

*Overland routes.* Clearly, there was a need for an overland route between Saddle Point and Atlas Cove. On 29 October Young, Keating, and Wayman set off at 0700 hr to look for one, hoping to bring back from the station more climbing equipment and spare parts for the outboard motors. This would seem to have been the first serious attempt to cross the glaciers of Corinthian Bay since the sealing era of the nineteenth century. Whether the sealers had crossed them is not known, although in 1874 it was reported that they did travel over some of the island's glaciers, and that a boat's crew had been crushed by an ice fall while travelling along the beach under the ice cliffs of Corinthian Bay (Tizard et al. 1885, page 377).

Because of a firmly frozen snow surface Young and his companions were able to cross the Challenger Glacier by a low route close to the coastal seracs, and thus avoided traversing the avalanche-threatened scree slopes beyond. After crossing the Nares Glacier close behind its

sea cliffs they arrived at Little Beach (between the Nares and the Baudissin glaciers, nowadays the western end of Hoseason Beach), less than two hours after leaving Saddle Point. They continued their journey along the 2.5 km beach under the cliffs of the Baudissin Glacier, only to be caught by the surf and almost carried away when they were within a few hundred m of Corinthian Beach. After retreating to Little Beach, they pioneered a circuitous route up through the Baudissin's crevasses and ice falls to about the 300 m level and thence to Mt Dryglaski, reaching the station at 1430 hr.

Young retraced his route to Saddle Point on 30 October with Bruer and Harry Thornton, accompanied on the Baudissin by Walsh and Gwynn with a dog team; and on 2 November McCarthy, Bruer, and Thornton returned this way to Atlas Cove. On the Baudissin Glacier Thornton fell 5 m down a crevasse, and was belayed by McCarthy for an hour while Bruer went on to the station and returned with help.

Finally, on 15 November Wayman, Walsh, and McGarrigle returned to Saddle Point with a replacement oar for the dinghy. Because of an exceptionally low tide they walked without incident under the sea cliffs of both the Baudissin and the Nares Glaciers, and reached Saddle Point just a few hours before the returning Spit Bay party. The following day all six men took advantage of calm weather and a mild surf to row across Corinthian Bay, landing uneventfully after a voyage of two hours.

### *Spit Bay*

On 3 November Gibbney, Young, and Rec had left Saddle Point for Spit Bay, with the aim of completing their census of the elephant seals on the northern side of Heard Island. Seven hours later they camped at Fairchild Beach. Shortly after midnight a severe blizzard commenced, and 12 hr later the snow turned to heavy rain which rapidly soaked the party and all its equipment through tears that had developed in their small japara tents. Leaving their tents and skis behind they travelled onwards, in strong wind and restricted visibility, to Spit Bay, where they arrived at 1800 hr and gratefully occupied the hut — a large aero-engine packing case — that had been placed there during the changeover in January and contained dry clothes, food, and fuel.

During the next five days they counted the seals in the Spit Bay area, and worked on the hut to make it more weather-proof. On 10 November they set out at 0600 hr for Saddle Point (without a tent, it will be recalled), but returned an hour later because of deteriorating weather. On both the 11th and the 12th they turned back from about the same place because of limited visibility in the wind-driven snow, and were then confined to the hut by heavy snowfalls on the 13th and 14th.

On 15 November they set out at 0800 hr in calm, clear weather, reached their camp site at Fairchild Beach three hours later, and arrived at Saddle Point at 1700 hr — a few hours after Walsh, Wayman, and McGarrigle had arrived from Atlas Cove. The next day, as noted above, they returned to the station by rowing across Corinthian Bay.

### **1951: First circuit of Heard Island**

#### *Overview*

The 1951 biologists were Ken Brown and Max Downes. Their work at Red Island developed into a campaign comparable to the 1950 party's troubles at Saddle Point. They pioneered a high route between Saddle Point and Atlas Cove, and made a midwinter trip to Spit Bay and South Barrier. They and others laid siege to the Abbotsmith Glacier and, having at last found a way across it, went on to explore Long Beach and make the first overland circuit of the island.

#### *Laurens Peninsula and Cape Gazert*

Between February and April Downes and Brown, usually accompanied by one or two other men, made six field trips to band chicks of the giant petrel and undertake other biological work at Red Island, Macey Cone, and Cape Gazert. This work established a cohort of giant petrels of known age, and provided the baseline for surveys of their nesting colonies in the following years — one of the more important continuing biological programs at Heard Island. To facilitate future work they decided to establish a depot of food and fuel at Red Island, and to build a wooden platform there which would provide a dry floor for a tent. Like the previous year's operations at Saddle Point, this apparently simple task developed a life of its own.

#### *The campaign at Red Island*

On 27 April Brown, Downes, Arthur Giese, and Jack Starr, with Frank Hannan, Nils Lied, and Peter Lawson as boat's crew, visited Sydney Cove (the landing beach for Red Island) by sea. Because the cutter had recently been blown off its slipway and damaged, the party travelled in a large dinghy known as 'the whaleboat', which was powered by an outboard motor and towed a smaller plywood dinghy that carried the stores and equipment.

While approaching the beach both boats were swamped in the surf, the outboard stalled and could not be restarted, and the whaleboat became immovably stranded on a sand bar. Eventually the dinghy was got ashore and the whaleboat's painter was made fast on the beach. The field party then camped, while the boat's crew walked back to the station — a difficult journey in sea boots, particularly on the steep ice slopes of the avalanche-threatened secondary glacier at Jacka Valley.

Next day the field party were able to drag the whaleboat, now lighter since it had partly emptied itself through a damaged plank, to an apparently safe place on the beach. They then built a tent platform from the abundant driftwood on the beach, established the depot under a protecting rock ledge, collected insects, and counted seals. The following day they walked back to the station via the east coast. Like the boat's crew they found it difficult to cross the secondary glacier without crampons, ice axes, or climbing rope, but fortunately no ice falls occurred during their 90 minutes on the glacier.

On 10 May Brown, Downes, and Bob Dingle walked back to Red Island to repair the whaleboat. While traversing the beach below the secondary glacier they were caught in a large ice avalanche from the hanging glacier above. They took what cover they could but the ice crashed all around them, and they were extremely lucky to escape uninjured. Next day they repaired the whaleboat, confirmed that it was in a safe place on the beach, and completed their biological work. On the third day they walked back to the station, uneventfully crossing the secondary glacier with the help of crampons and ice axes.

Some days later nine men took the cutter, now repaired but still leaking badly, to Sydney Cove to retrieve the whaleboat and dinghy. Otto Rec and Brown swam ashore through a fairly heavy surf and loaded the dinghy with all the gear that had been left on the beach. While they were doing so the cutter's engine stalled, and it could not be restarted until the cutter was close to the rocks. Concerned about the cutter's unreliable engine and its leaking hull, the crew hauled the dinghy and its occupants out through the breakers and returned to the station, leaving the whaleboat to be retrieved another day. But a period of heavy gales and high seas intervened, and when they returned some weeks later they found nothing but fragments of the whaleboat scattered along the length of the beach.

The depot and tent base established with such difficulty were put to good use the following January, when Brown, Downes, Dave Cheffins, and Starr made a biological survey of the Laurens Peninsula and Red Island, banding giant petrel chicks, collecting insects and other specimens, and counting seals. The depot and tent base were also used by a biological survey party in April 1952.

#### *Saddle Point*

On 18 June Brown, Lied, and Hugh Doyle were landed by cutter and dinghy at Saddle Point, where they spent six days making a biological survey of the winter populations, examining the start of the route to Spit Bay, and climbing to about 1000 m to look for a high route back to Atlas Cove. They returned by cutter from Mechanics Bay, on the eastern side of Saddle Point, which they found could provide calm

water and an easy landing if surf or brash ice made the customary landing on the western side unusable.

#### *Long Beach and South Barrier*

Four years after the establishment of the ANARE station the large ice-free areas at Long Beach and South Barrier were still unvisited, despite their great interest to the biologists. Downes and Brown, assisted by many other men, made a determined effort to visit these areas — first by way of Spit Bay, and then via the direct route across the Abbottsmith and Gotley glaciers (Fig. 10).



Figure 10. Lied, Brown, and Downes on Baudissin Glacier, 1951. [ANARE photo by M C Downes]

#### *The winter trip to South Barrier*

On 21 July Brown, Downes, and Giese were landed by cutter and dinghy at Mechanics Bay. The following day they walked to Spit Bay in 14 hours, arriving just before midnight after a difficult high crossing of the heavily crevassed Stephenson Glacier by moonlight. Over the next three days, in bad weather, they counted the seals and made a short reconnaissance towards Winston Lagoon.

On 26 July they set out to find a route to Long Beach via the southwest stream of Winston Glacier, which descends behind the rocky uplands of South Barrier. After a hard climb in knee-deep snow they camped at a height of about 800 m. Their stove would not light, and after a meal of frozen canned meat they spent an uncomfortable night at a temperature of  $-8^{\circ}\text{C}$ , in a gusty wind which blew out the ends of the tent. In the morning they woke to find their sleeping bags half outside the tent, and their boots frozen and filled with snow.

After a cold breakfast, still with nothing to drink, they resumed the climb and at 1400 hr reached the crest of South Barrier, at an estimated height of 1100 m. In a temperature of  $-12^{\circ}\text{C}$  and frequent snow showers they looked down on a broad glacier, which they named the 'Fiftyone Glacier', and at Long Beach beyond. However, they were unable to continue because of their useless stove, inadequate tent, broken crampons, and general exhaustion. They returned to Spit Bay, which they reached at 1900 hr after travelling the last two hours in darkness.

Two days later they returned to Saddle Point, camping overnight at Gilchrist Beach, in a journey plagued by high winds, snow showers, poor visibility, deep soft snow, wide crevasses, and sodden clothing and sleeping bags. Contact with the station by signalling lamp on 1 August revealed that they could not be picked up by boat. After waiting two days for the necessary clear weather, on 4 August they climbed straight up to about 700 m, and from there traversed down through the crevasses and ice hummocks to Mt Drygalski, taking less than four hours for the journey.

#### *The siege of the Abbottsmith Glacier*

The approach to Long Beach now focused on the direct route, and on 26 August Dingle, Walsh, and Downes reconnoitred the northern edge of the Abbottsmith Glacier. To provide an advance base, Downes constructed a field hut from six radiosonde packing cases, which he mounted on sledge runners. On five days between 12 and 24 September successive teams of up to 10 men, assisted by tractor and dog team, sledged the hut and its supplies, in stages, to its destination at a height of 500 m beside the Abbottsmith (Figs. 11,12), where it was firmly guyed down and marker poles were set out to help men find it in bad weather. They could find no trace of the depot established the previous year.



Figure 11. Sledging Downes's field hut to Abbottsmith Glacier, September 1951. [ANARE photo by M C Downes]



Figure 12. Establishing Downes's field hut on northern edge of Abbotsmith Glacier, September 1951. Sledge dogs turn their backs to the drifting snow. Bamboo poles, marker flag, and ice cliffs close behind helped later parties to find the hut, which was soon snowed under. [ANARE photo by M C Downes]

*First attempt to cross the Abbotsmith.* On 27 September Walsh, Dingle, Downes, Brown, and a dog team sledged 250 kg of stores to the hut, where they waited for eight days in hopes of travelling to Long Beach when the weather improved. Walsh returned to the station with the dog team on 30 September. Over the next three days the rest of the party reconnoitred the edge of the Abbotsmith to as high as 1000 m, continually hampered by poor visibility and crevasses, into which they frequently fell hip deep. Downes fell to a depth of 6 m, and it took more than an hour for Dingle and Brown to haul him out. The following day, feeling that they had learnt a lot about crevasses, they returned to the station.

*Second attempt.* On 21 November Brown, Dingle, and Lied walked to the Abbotsmith and dug an entrance to the completely buried hut (Brown 1951; Lied 1987b). Unfortunately Downes, who had contributed so much to all the attempts to reach Long Beach, was ill and could not leave the station. After a day confined to the hut by heavy drift and poor visibility, the field party retrieved the packs they had left at 1000 m in September. On 24 November the weather cleared and their final attempt, this time at the 300 m level, proved successful. By 1030 hr they had crossed the Abbotsmith, and were at last travelling towards Long Beach.

#### *First circuit of Heard Island*

From the south side of the Abbotsmith the party descended into a snow valley, climbed up over an ice-cored moraine, and then travelled in cloud among crevasses until early afternoon, when they descended from 550 m to 200 m to avoid an impenetrable barrier of crevasses and came out of cloud just north of Cape Arkona. After a 'dangerous and



difficult' crossing of the Gotley Glacier, which involved climbing to about 450 m, they reached the moraine at 1700 hr and camped on grass and azorella in a sheltered valley.

For the next three days, in perfect weather, they explored the Long Beach area, although suffering at first from painful snow blindness. Dingle and Brown took panoramic photographs from a height of 500 m on the bluffs overlooking Long Beach, while Lied made annotated panoramic sketches of the whole area. They recorded the distribution and numbers of the penguins and other birds, counted the seals, and collected insects and geological specimens.

Early on 28 November they left for Spit Bay. They had rationed their food and fuel so as to allow two days to get there — and also, in case they were blocked and could not find a route under or over South Barrier, to allow them to return to the hut on the Abbotsmith Glacier. In the event, they reached the Spit Bay hut in twelve hours. After an easy crossing of the Fiftyone Glacier they walked under the sea cliffs of South Barrier and crossed the Winston Glacier at about 300 m. Except for a brief interlude of calm and sunshine on the north-east moraine of the Winston Glacier, beyond the Fiftyone Glacier they travelled in strong wind and rain and, for the final 90 minutes, negligible visibility, reaching the Spit Bay hut 'soaked to the skin' at 1830 hr.

They remained at Spit Bay for three days, counting elephant seals and giant petrels, collecting insects, and surveying the colonies of penguins and other birds. At 0620 hr on 2 December they set out for Saddle Point in fine weather, counting seals and recording the distribution of vegetation and birds as they went, and had easy crossings of all glaciers to North Barrier. Thereafter they travelled in wind and rain, with poor visibility, a soft surface, and troublesome crevasses, until they reached Saddle Point, 'wet and frozen', at 1720 hr.

After two days of work at Saddle Point they set off for Atlas Cove on 5 December by way of the new high route, but dense cloud and crevasses made it impassable and they returned to the hut. The following day the weather was perfect, the high route proved excellent, and they reached the station in five hours.

This journey, the culmination of four years of effort, filled a major gap in our knowledge of Heard Island. The Long Beach area had at last been surveyed. The circuit party's photographs and sketches yielded an improved map of the area, and their biological survey showed that the area contained the island's largest colonies of macaroni penguins and giant petrels. They discovered an excellent boat-landing beach, which was later put to good use by the 1963 expedition. Moreover, they showed that it was possible to walk from the Vahsel Glacier to

Spit Bay, via Long Beach and the beaches and scree slopes under South Barrier. Their observations throughout the journey yielded the first distribution map (included in Downes et al. 1959) of the birds breeding on Heard Island. They made extensive collections of insects and other invertebrates, collected geological specimens, and found seven branded elephant seals. Finally, they made the first whole-island census of elephant seals, establishing a valuable baseline for evaluating the serious decline in numbers that was to be observed in later decades (Burton 1986).

### **1952: Deaths of Hoseason and Forbes**

#### *Overview*

This year's field work was shadowed by the deaths in May of Dick Hoseason and Alastair Forbes during a trip to Saddle Point (Brown 1957; Bowden 1997). All but one of the trips recorded in the field trip log were undertaken by Peter Brown, often solo although usually accompanied by Jim Carr, Ken Hall, or other expeditioners. Their aims included banding giant petrels on Laurens Peninsula and at Cape Gazert, and finding routes to Saddle Point and to Long Beach via the Abbotsmith Glacier. In addition, a biological survey at Red Island was made in late April by Lindsay Ingall, Paul Teyssier, and Jeff Faulkner. Plans to visit Spit Bay were abandoned after the deaths of Forbes and Hoseason.

#### *Abbotsmith Glacier*

In a one-day trip on 28 March Brown and Carr found an unexpectedly easy crossing at about the 430 metre level, benefiting from firm snow bridges that had survived the summer thaw, and returned after reaching the far side. They also found and examined Downes's 1951 hut, which was completely buried.

Accompanied by Hall, Brown and Carr returned to the Abbotsmith on 20 May in hopes of travelling to Long Beach. However, they found that their March route was now impassable because of changes in the glacier. Reconnoitring higher, they found Gwynn's 1950 depot and Downes's 1951 hut, and moved rations, skis, and a tent down to the moraine, where they camped. Although they were mostly confined to the tent by dense cloud or blizzard for the next three days, during some brief improvements in the weather Brown and Carr reconnoitred the ice-free ground below them. From the cliffs of Walsh Bluff they saw what appeared to be a route across the Abbotsmith along a narrow terrace between the glacier's great coastal ice fall and its sea cliffs, and also a way onto that terrace from a beach that looked as though it might be accessible via a steep gully from Walsh Bluff. They returned to the station on 23 May.

On 5 November Brown and Carr made a day-return trip to Walsh Bluff and abseiled down a stream bed in the gully, but had insufficient rope for the steep last 25 m of the descent to the beach. In his report Brown correctly emphasised how useful it would be to find a low-level crossing of the Abbottsmith, below cloud base and thus independent of the weather — but it would be December 1954 before this route was again considered.

#### *Saddle Point*

On a one-day reconnaissance in late March Brown and Carr, apparently unaware of the field reports and route maps left at the station by the 1950 party, tried to find a way across the Baudissin Glacier. Travel at 400 m was plagued by breakthroughs into numerous hidden crevasses, and attempts at 270 m and 120 m were blocked by seracs and ice falls near the far side of the glacier.

On 14 April Brown and Carr found the crossing they had been seeking. At first they tried to travel above the ice falls of all three glaciers, but were blocked by crevasses at about 500 m on the Challenger. Retracing their steps, they found a way down to Little Beach and then crossed the Nares Glacier without difficulty. After a hard struggle on steep slopes of loose scree beneath rock cliffs running inland beside the Challenger Glacier, threatened by ice fall and stone fall from the edge of the Nares Glacier above — a place which Carr aptly named 'Desperation Gully' — they retreated and camped on the Challenger moraine. On 15 April they traversed Desperation Gully, found a way onto and across the Challenger Glacier, and occupied the hut at Saddle Point. Next day they reconnoitred towards Melbourne Bluff for a few hours, but finding the way blocked by unbridged crevasses they returned to the hut.

On 17 April they left the hut at first light and reached the Nares Glacier two hours later. Instead of crossing the glacier they walked along the 700 m of beach beneath its terminal cliffs, where they were knocked over and drenched by the surf and narrowly escaped drowning. After resting at Little Beach they climbed up through the Baudissin ice falls, in strong wind and drift, and reached the station without further incident.

#### *Deaths of Hoseason and Forbes*

On 26 May Alastair Forbes, Dick Hoseason and Laurie Atkinson set out at 0800 hr to visit Saddle Point for a few days' recreation. A support party consisting of Brown, Faulkner, and Ray Borland led them across the Baudissin Glacier above the ice falls, and returned to the station after seeing them heading down safely towards Little Beach.

Shortly afterwards the Saddle Point party were overwhelmed by the surf while traversing the beach beneath the Nares Glacier's ice cliffs. Hoseason was swept away and drowned, but Forbes and Atkinson managed to struggle onwards to the Challenger moraine. They attempted to continue to the hut at Saddle Point but could not cope with Desperation Gully, so they returned across the Nares to Little Beach, where Atkinson collapsed. They had discarded their packs and ice axes in the surf and so had no food or survival equipment. Leaving Atkinson at Little Beach, Forbes set out to retrace their steps across the Baudissin to get help from the station — but did not arrive. That night there was a 50 km/hr wind and an air temperature of  $-6^{\circ}\text{C}$ . Atkinson survived the night at Little Beach, and next morning he walked, waded, and at times swam to Corinthian Beach beneath the cliffs of the Baudissin Glacier. He stumbled into the station, soaking wet and exhausted, at 1100 hr.

At 1230 hr Brown, Carr, and Hall, with camping equipment and three days' food and fuel, set out to search for Forbes. Three hours later they found his frozen body among the Baudissin ice falls at a height of 240 m. His tracks showed that he had climbed too high in trying to get through the ice falls, and had then found the previous day's track before succumbing to exposure. Light was fading, so the search party marked his body with tent poles and returned to the station, unsuccessfully searching Corinthian Beach for Hoseason's body on the way. Next day Brown, Faulkner, Ingall, and Hall brought back Forbes's body on a ski sled, and on 31 May he was buried behind the station.

On 1 June Brown, Hall, and Ingall travelled overland to Saddle Point, where for the next five days they unsuccessfully searched the beaches for Hoseason's body. On 6 June they returned to the station.

### **1953: Big Ben**

#### *Overview*

The main trips logged in 1953 were the attempts to climb Big Ben in August and November (Béchervaise 1954, 1962). Only two of the several other trips that were made are logged — a trip to Red Island via the west coast in March, and an unsuccessful attempt to visit Spit Bay in September.

#### *First attempt on Big Ben*

On 20 August John Béchervaise, Fred Elliott and Peter Shaw, accompanied by a support party consisting of Arthur Gwynn, Ken Dalziel, and Jack Hughes, carried packs and hauled a ski-sled to the Abbotsmith Glacier and camped at 450 m on its north side. Next morning the support party returned to the station and the mountain

party slowly climbed up beside the Abbotsmith in deteriorating weather, carefully probing for crevasses after Béchervaise had broken through to the waist, until they camped at 1600 hr in a thick blizzard at nearly 900 m.

On 21 August the blizzard continued, with 100 km/hr winds at  $-11^{\circ}\text{C}$ . The party dug a snow cave and moved into it. The entrance became buried, and the inadequate ventilation caused an episode of hypoxia and carbon monoxide poisoning while they were cooking supper. The primus burned badly, candles went out, matches would not strike — the men lunged for the entrance and clawed an opening. Two of them were left with 'nauseating headaches'.

Next day the blizzard showed no sign of abating. Believing that they had missed their chance to climb rapidly to a level, around 1800 m, that was thought to be above the cloud layer, the party returned to the station. Béchervaise summarised the lessons they had learned in an informative memorandum entitled 'Notes for future high expeditions on Heard' (Béchervaise 1954), and over the next two months they made many improvements to their clothing and equipment.

#### *Second attempt on Big Ben*

On 2 November, carrying packs and hauling a sledge with their camping gear and 12 days' food and fuel, Béchervaise, Elliott and Shaw climbed beside the Abbotsmith to 900 m and camped, in snow showers and a temperature of  $-8^{\circ}\text{C}$ . The bamboo markers they had left in August were almost buried under 1.5 m of compacted snow, which firmly bridged the crevasses.

Over the next eight days (3 to 10 November) they climbed diagonally across the Abbotsmith, often travelling over wide but well bridged crevasses. Their procedure was to reconnoitre without loads, marking the route with bamboo poles, and then move camp at the next break in the weather. They were confined to the tent for a total of nearly five days of strong blizzard, dense cloud, and freezing mist, in temperatures down to  $-11^{\circ}\text{C}$ .

On the evening of 11 November they camped at 1500 m, beyond the Abbotsmith at last. The weather cleared and they found themselves above the clouds, with superb views of the summit and the apparently unbroken snow slopes leading to it. It was the tenth day of the climb and they were now on reduced rations.

Early on 12 November they were about to move up when a warm front arrived, with heavy rain and a temperature of  $+2^{\circ}\text{C}$ . It was followed by a severe southerly blizzard with heavy snowfall. They shovelled snow off the tent three times during the night. Next morning they allowed the tent to become buried, while pressing outwards against the walls

to consolidate the snow. With the entrance and both ventilators now buried, ventilation was inadequate when the primus was burning.



Figure 13. Attempt on Big Ben, 1953. Elliott emerges from igloo above partially-excavated tent, 15 November 1953. [ANARE photo by J M Béchervaise]

To improve matters they dug an entrance tunnel and built an igloo over it. Thereafter one man sat in the igloo by day to relieve crowding, and they cooked their meals there although continuing to sleep in the tent. Throughout 14 and 15 November the blizzard and snowfall continued. Space in the tent continued to shrink from the pressure of snow, and the duralumin ridge pole developed a dip of 13 cm. On 15 November, in the continuing blizzard, they spent the day digging out the tent from under 2 m of snow (Fig. 13) and re-pitched it beside the igloo, relieved to be on the surface of the mountain once again.

The decision to descend was unavoidable, and next morning they prepared to move down. By the time they had dug out the tent from under a further metre of fresh snow the wind and snowfall had lessened, and they traversed downwards on a compass course. Snow showers alternated with calms, and three brief clearings in the mist revealed the only bamboos they had left, during the ascent, to mark their route of several km through the crevasses.

Fifty metres from the third bamboo Béchervaise fell 6 m and Shaw 4 m into the same crevasse, leaving only Elliott on the surface to belay them both. Over the next hour they managed to climb out, and they camped in a temperature of  $-15^{\circ}\text{C}$ . Their food was by now down to little more than half a day's rations.

On 17 November there was heavy snowfall and dense cloud. They got ready to reconnoitre the route through the remaining 400 m of the Abbotsmith, but the weather made it impossible and they sat all day in the tent, fully clothed but feeling very cold, waiting for a break in the weather. At 1730 hr they set out on their delayed reconnaissance. After travelling 100 m in 45 minutes they found they had been moving parallel to an insecurely bridged large crevasse, which threatened a repetition of the previous day's mishap. Returning to the tent, they ate a small supper and tried to sleep. Béchervaise wrote 'It was one of the coldest and most restless nights imaginable.'

Next morning revealed 'a grey, comfortless dawn', the weather worse than ever. Then around 0730 hr the wildly swaying shadow of a guy rope appeared on the tent roof — the sun was out! In clear weather above lower cloud they got across the final crevasses and descended, with some minor breakthroughs, just ahead of a descending cloud base. Near the site of their first camp they met a search party consisting of Arthur Gwynn, Ken Dalziel and Jim Brooks, and together they returned to the station.

#### *Spit Bay attempt*

On 6 September Arthur Gwynn, Jim Brooks, and Dick McNair crossed the Baudissin and Nares glaciers without difficulty, but were delayed in Desperation Gully and camped nearby for the night. Next morning they renewed the attempt, hampered by sea fog and thawing snow, but an ice avalanche fell across the route ahead and they decided it was unjustifiable to continue. They returned to Little Beach, intending to climb up to join the 1951 high route to Saddle Point, but low cloud and rain intervened and they returned to the station.

### **1954: Second circuit of Heard Island**

#### *Overview*

Field trips were restricted in 1954 by the small size of the party (9 men), which allowed little relief from watch-keeping and other station duties. However, visits to Red Island for bird banding and seal counts were made by Dick McNair, Leon Fox, and Grahame Budd in February while most of the 1953 party were still present; and again in late December by Dan Sweetensen, George Delahoy, and Lin Gardner. In mid-August Budd, Murray Henderson, and Keith Lodwick tried to reconnoitre the Abbotsmith Glacier but were defeated by a blizzard



lasting three days, which they spent in an igloo. As described below, on 5 December a low route to Saddle Point was found, and it was followed a week later by a clockwise circuit of the island.

#### *The Sunday stroll to Saddle Point*

On Sunday 5 December Jack Walsh, Budd, and Henderson left the station at 0900 hr, in calm weather, to test Walsh's hunch, based on his previous experience at Heard, that a route across the Baudissin Glacier might be found at a lower level than the routes of previous parties. The hunch proved correct. Travelling parallel to and within a few hundred metres of the coastal ice cliffs, the party traversed the Baudissin for 1.7 km at an elevation of about 60 m, descended through a gap in the seracs to 30 m, and had completed the crossing by 1100 hr. Yielding to the temptation to examine the route ahead, they crossed the Nares Glacier without difficulty, found a way onto the Challenger Glacier after only 20 minutes in Desperation Gully, and arrived at the Saddle Point hut — 'Grannie's Hieland Hame', as it said on the door — at 1300 hr, only four hours after leaving the station.

After lunch they listed the hut stores, counted and photographed the adults and chicks in the cormorant colony, and climbed the Saddle Point crater to inspect the route onwards towards Spit Bay. Leaving for home at 1615 hr they bypassed the scree slopes of Desperation Gully by traversing instead the broken and crevassed margin of the Challenger, stepping off near the northern end of the Gully through the debris of a large ice avalanche that had fallen across their outward path an hour after they had passed. They arrived back at the station at 2000 hr, just in time for dinner, after an enjoyable and wholly unexpected Sunday stroll to Saddle Point.

#### *Second circuit of Heard Island*

Between 13 and 24 December Budd, Walsh, and Henderson walked around the island. Their main aims were to report on the condition and contents of the field hut at Spit Bay (last visited three years earlier, in December 1951), make any necessary repairs, and count the elephant seals on the Spit. A secondary objective was to attempt a return via Long Beach, which would extend the biological observations and might provide information about two fumaroles whose vapour plumes had been intermittently seen throughout the year over the south-west slopes of Big Ben. A disadvantage of such a clockwise circuit was that the worst obstacle, the Abbotsmith Glacier, was left to the last, and if it proved impassable a long return journey would have to be made.

On 13 December the party walked to Saddle Point in 3.5 hr, following their previous route but avoiding Desperation Gully altogether by

climbing straight onto the Challenger through its lateral seracs. On 15 December they walked to Spit Bay in 12 hours, frequently falling to the hip or shoulder in crevasses until North Barrier but thereafter having easy crossings of the flat, uncrevassed, and snow-free Compton Glacier, and of the Brown and Stephenson Glaciers about 150 m behind their sea cliffs.

During the next four days they worked at Spit Bay. In mostly bad weather they repaired the hut, which was leaking badly; sorted, dried, and listed all equipment and stores, and discarded spoiled food; and counted the elephant seals during walks to the south beach and the end of the Spit.

On 20 December they walked to the east end of Long Beach in 11 hours, in a moderate south-west wind and snow showers. Like the Compton, the southern part of the Stephenson Glacier was flat and free from crevasses or snow. After a difficult crossing of the heavily crevassed Winston Glacier within 100 m of its terminal cliffs they continued along the beaches and scree slopes under South Barrier, crossed the Fiftyone Glacier at a low level, and camped on a hillside just beyond it. Next day they moved camp to the Gotley's eastern moraine.

On 22 December they took more than five hours to negotiate some 800 m of difficult seracs in the middle of the Gotley Glacier, at a height of about 120 m. From Cape Arkona they continued on a rising traverse above the coastal moraines and seracs, over a smooth surface of calf deep snow with crevasses no wider than 0.6 m. In cloudless weather they photographed trenches alongside the upper reaches of the Abbotsmith and Gotley glaciers that were later attributed to snow-covered recent lava flows, although no fumaroles were seen. They also saw what appeared to be a promising all-weather route from Long Beach to Mawson Peak, through a pass north of Peak 4100.

Late in the day they passed through some high black seracs, descended a steep scree slope into a snow valley, and crossed an uncrevassed snow slope to the jagged southern edge of the Abbotsmith Glacier. Cloud was approaching from the west, and the fine weather was clearly coming to an end.

They made two attempts to cross the Abbotsmith, first at 450 m and then at 750 m, before the weather broke, but each time the lead man fell to hip or shoulder in perfectly concealed crevasses and they were forced to retreat. Tired from more than 11 hours of strenuous travel, they were in no condition to mount a crevasse rescue and they decided to call it a day. They walked down the uncrevassed slope to Henderson Bluff and camped on a gravel flat at the edge of the ice. A

few hours later a rainy north-east gale arrived and blew all night, wetting their sleeping bags.

On 23 December there was a strong west wind and low cloud. From the headland the party saw that the ice ridges of the narrow terrace behind the Abbottsmith's sea cliffs, whose potential as an all-weather crossing had aroused Peter Brown's interest in 1952, seemed to be negotiable and could be reached from a scree slope near their camp. But they could not see a way up onto Walsh Bluff on the far side, and throughout its 1.5 km length the terrace was swept by frequent avalanches from the great icefall above it. Though sorely tempted, they decided the route was too dangerous. They counted a previously unknown colony of 110 black-browed albatross on the grassy southern slopes of Henderson Bluff. They then reconnoitred a couple of ice ridges in the cloud shrouding the top of the icefall, but soon retreated and spent the rest of the day in their wet sleeping bags.

At 0730 hr on 24 December they moved onto the Abbottsmith at 250 m, in a freshening wind and decreasing visibility. Their tortuous route through the maze of crevasses, seracs, and ice towers, often in cloud and snow showers, took them up to about 450 m. Needing to get across before the weather could halt progress they mostly moved together on a tight rope without fixed belays, often over slumped crevasse bridges 4-6 m wide which fortunately proved to be firm. In other places belaying was required, particularly after one or other of them had fallen to the waist.

They reached the north Abbottsmith moraine at 1015 hr, and one minute later a 100 km/hr north-east gale burst upon them. They crossed the Vahsel Glacier in calf-deep wet snow, driving rain, and prolonged wind gusts from the North West Cornice that exceeded 200 km/hr. They reached the station at 1330 hr, six and a half hours after leaving Henderson Bluff.

Besides achieving its primary objectives of reporting on the condition and contents of the field huts and counting the seals at Spit Bay and Long Beach the journey yielded some useful findings. Practical findings were that the Baudissin Glacier could be crossed at a low level and Desperation Gully bypassed, that Long Beach offered a promising route for climbing Big Ben, and that the route across the Abbottsmith behind its sea cliffs was extremely hazardous. Scientific findings were that there had been recent lava flows beside the upper Abbottsmith and Gotley glaciers, that there was a large colony of black-browed albatross at Henderson Bluff, and that macaroni penguins breed several weeks earlier at Long Beach than elsewhere on the island (Downes et al. 1959, page 13). Six branded elephant seals were found and their brands recorded. Finally, the photographs of the glaciers,

together with the fact that no king penguins or fur seals were sighted, provided a baseline for the remarkable changes in all three that were to be discovered in 1963.

## THE EXPEDITIONS OF 1963-71

Between 1963 and 1971 four summer expeditions and one wintering expedition worked on Heard Island. The summer expeditions comprised an ANARE expedition in 1963, an Australian private expedition in 1965, and ANARE expeditions in 1969 and 1971 associated with United States and French expeditions. Among other objectives, the first two expeditions aimed to make the first ascent of Big Ben, and the last three sought to record the further progress of the massive glacier retreat, and of the island's recolonisation by king penguins and antarctic fur seals, that had been discovered by the 1963 expedition (Budd 2000). The last three expeditions also aimed to land on the hitherto unvisited McDonald Islands 44 km west of Heard Island, a potential source of the fur seals. In addition to the four summer expeditions, a United States expedition wintered from March 1969 to April 1970. The activities of these five expeditions are outlined below.

### 1963: ANARE summer expedition

Observations between 1947 and 1955 had yielded suggestive evidence of minor glacier recession, and hints of a slight increase in the numbers of non-breeding king penguins and fur seals that were visiting the island. In March 1960, during a brief visit to Heard Island by the wintering parties returning from Mawson and Davis, Budd's interest in the island was rekindled and he approached Law with a proposal (Budd 1962) that ANARE should support an attempt by a small party to climb Big Ben, and to survey the glaciers, king penguins, and fur seals, as part of a broad scientific program.

Law agreed, and in January 1963 ANARE landed six men on Heard Island during the annual relief voyage to Mawson and Davis, led by Law, of M.V. *Nella Dan* (Captain G. Bertelsen). It re-embarked them on the return voyage six weeks later (Budd 1964a, b). The expedition members were Grahame Budd (leader, physiology and biology), Warwick Deacock (botany and photography), Max Downes (biology), Alan Gilchrist (medical officer, biology), Nils Lied (meteorology and radio), and Jon Stephenson (geology and glaciology).

On 28 January Lied, Downes, and Gilchrist (the Atlas Cove party) were landed at the unoccupied ANARE station; on 29 January a depot of food and fuel was landed at Spit Bay; and on 30 January Budd, Stephenson, and Deacock (the mountain party) were landed at Long

Beach, using the boat-landing beach discovered in 1951. All three landings were hampered by high winds and heavy surf.

#### *Atlas Cove Party*

Over the next three weeks the Atlas Cove party accomplished a great deal of work. Lied made three-hourly synoptic observations of the weather, and transmitted them to Australia and the Antarctic in regular radio schedules with Kerguelen, Mawson, and *Nella Dan*. Downes ranged widely over the Four Bays Area and the west coast of Laurens Peninsula, and camped alone at West Cape, during his work on penguins, giant petrels, and other birds (Downes *et al.* 1959). Gilchrist looked after the health of the party, and collected botanical specimens and pumice from high on Mount Olsen, Jacka Valley, and elsewhere; he also identified a rare visiting Weddell seal. The three men banded 1200 giant petrel chicks at Laurens Peninsula and Cape Gazert, and recaptured several adults that Downes had banded in 1951. They also renovated several of the station huts, damaged by weather and the incursions of elephant seals, to provide comfortable living quarters. Like the mountain party, they made frequent records of their clothing and thermal comfort as part of a study of cold stress and acclimatisation.

Throughout this period they heard nothing from the mountain party, whose radio transmitter had failed (unknown to them) immediately after their landing at Long Beach. In their untiring efforts to make radio contact the Atlas Cove party travelled far from the station on many occasions, sometimes at night, to sit on hilltops for hours in wind and freezing rain. As the weeks passed they became increasingly concerned, and began to make plans for a search expedition.

#### *Mountain party*

Meanwhile the mountain party had experienced mixed fortunes (Stephenson 1963). Their aim was to establish a camp on the summit plateau, from which they could make the first ascent of Big Ben and carry out their planned studies of the summit geology, vulcanology, and glaciology. The studies required snow-sampling tubes, thermometers, and other scientific equipment, in addition to camping and climbing gear and 12 days' food and fuel to allow for bad weather. All this added up to a sizeable load for three men to carry to the plateau, 2285 m in vertical height and a horizontal distance of 13 km from the beach.

For eight days they relayed loads up the Deacock and Fiftyone glaciers and through the pass beside Peak 4100 that had been seen during the 1954 circuit trip; these two features were subsequently named Budd Pass and Putt Peak. Most of the time they were in a hard gale with

intermittent heavy drift, thick mist, and temperatures around  $-4^{\circ}\text{C}$ , although at times they had fine views of the peaks above with the cloud and drift pouring over them. On 7 February they camped on the summit plateau with all the scientific equipment and fuel but with only four days' food, confident that if bad weather caused delay they could readily bring up another eight days' food from a conspicuous depot they had left at 1830 m.

Over the next five days they could do no useful work because of a prolonged gale with drifting and falling snow, dense cloud, and temperatures between  $-13^{\circ}$  and  $0^{\circ}\text{C}$ . The tent was soon buried under the snow, clothing and sleeping bags became damp, and carbon monoxide absorbed while cooking caused weakness and breathlessness on exertion. Route markers vanished, defeating two attempts to retrieve the 1830 m depot.

On 12 February they set out determined to bring up the reserve rations, but the depot had been snowed under and could not be found. They descended further to a snow cave they had dug at Budd Pass during the ascent, intending to return to the plateau next day after retrieving eight days' food from another depot below the pass. The cave's roof dripped continually and they were soon soaked to the skin.

After a sleepless night they cut a new entrance in the roof (the original horizontal one being choked with snow) and emerged into a severe blizzard, with heavy drift and a temperature of  $-3^{\circ}\text{C}$ . In gusts exceeding 200 km/hr it was impossible to negotiate the pass, and they returned to the snow cave with their clothing frozen and a few fingers frost-nipped. Throughout the day they periodically checked the weather in hopes of an improvement, wrung out water from their sodden clothes, and chewed pieces of pemmican and raw bacon; without fuel there was no water to drink.

At 2000 hr, in the last daylight, they discovered that within the past few hours 1.5 m of packed drift snow had accumulated above the cave entrance and was rapidly deepening; it had also irretrievably buried their ice axes. For the next six hours they shovelled in turn, trying to keep the entrance clear until daylight returned at 0400 hr, but the rising tide of snow could not be withstood. Around 0200 hr it became clear that they must abandon the cave immediately or be buried alive. With the small shovel as their only belay weapon they descended the pass, pausing at the bottom to thaw Budd's hands which had become frozen while strapping on his crampons. Dawn came, allowing them to distinguish between solid ice and the insecurely bridged crevasses running parallel to their course; and 7.5 hours after leaving the snow cave they arrived at Long Beach.

The gale continued, frequent squalls of rain and snow swept the beach, and their tent, sleeping bags, and personal gear were still on the summit plateau. But their Long Beach depot contained ample food, fuel, and a primus stove, and soon Deacock and Stephenson had built a makeshift shelter from fuel drums, ration boxes, and rocks, roofed with a waterproof sledge cover (Fig. 14). After a hot meal Deacock cleaned and bandaged Budd's frostbitten hands, and all fell asleep in their wet down suits.



Figure 14. Deacock outside makeshift shelter at Long Beach, 16 February 1963. [ANARE photo by P J Stephenson]

The first two days at Long Beach were mainly devoted to sleeping, eating, and maintaining their flimsy shelter. On 16 February Deacock changed the dressings on Budd's hands, which proved to be less severely damaged than their complete numbness had suggested and were unlikely to prevent travel. Over the next three days they surveyed the geology and topography of the area, took panoramic photographs of the glaciers, and made biological observations.

All efforts to radio Atlas Cove having failed, they decided to try and return there via Spit Bay, to allay any anxiety for their safety and to re-equip for a return to Long Beach and possibly up the mountain. Whether they could reach Atlas Cove, however, was uncertain because no long journeys had previously been attempted in late summer, when many of the snow bridges would have disappeared. Moreover, they had no ice axes, tent, or sleeping bags; Budd's hands were almost useless; and their climbing equipment was limited to a small shovel, two and a half pairs of crampons, a length of rappel line, and a bamboo pole Stephenson had found on the beach.

In the event, they encountered no insuperable problems. On 19 February they walked to Spit Bay, where they made biological



observations and retrieved an ice axe from their depot. On 21 February they walked to Saddle Point, and next day they reached Atlas Cove. Only two glaciers (Compton and the southern part of the Stephenson) had proved to be more difficult than in 1954, while the northern parts of the Winston and Stephenson, as well as the Brown and Nares, had retreated and been replaced by safe beaches. They arrived at Atlas Cove just in time to forestall a hazardous search expedition by Downes and Lied.

The journey from Long Beach had yielded evidence of massive glacier retreat (Budd and Stephenson 1970), of recolonisation and breeding by king penguins (Budd and Downes 1965), and of a large increase in fur seals (Budd and Downes 1969); the changes in all three between 1947 and 1999 are reviewed in Budd 2000. Stephenson had made a comprehensive geological survey, and had collected rock specimens for petrological study and for determinations of age and palaeomagnetism (Stephenson 1964, 1972; Irving et al. 1965). The party's survey results and photographs at Long Beach, together with observations made from *Nella Dan* during the landing operations, were subsequently incorporated in an improved map of the island (included in Budd 1964a).

#### *Combined parties*

The planned return to Long Beach after re-equipping had to be postponed (and eventually abandoned) when Deacock developed symptoms of appendicitis. With the help of the message Budd had left in 1955, he and Gilchrist located and checked the surgical equipment; but fortunately Deacock recovered without requiring an operation. In the first period of fine weather since the party's descent from the mountain, Stephenson and Lied completed a topographical and geological survey of the Atlas Cove area. Downes, Gilchrist, and Budd visited Red Island — by the eastern route which was now safe because the hanging glacier had retreated — and obtained the first evidence that fur seals were breeding; while Deacock collected botanical specimens. A visiting emperor penguin was measured and photographed.

On 28 February Stephenson, Downes and Lied set out for Spit Bay, camping *en route* at Melbourne Bluff and Gilchrist Beach. They made geological and biological surveys at Cape Bidlingmaier and other localities, photographed the glaciers to document their retreat, and thereafter worked in the Spit Bay area. Meanwhile, at Atlas Cove Gilchrist maintained the meteorological observations and radio schedules, and with Deacock and Budd banded the black-browed albatross chicks above Jacka Valley.

On 6 and 7 March Deacock and Budd walked to Spit Bay to complete the census of king penguins and fur seals. The vulnerability of such a

small party, without tent or radio, was emphasised on the first day when Deacock fell 6 m into a crevasse, and again next day when, travelling in bad weather, they were swept away in a flooded glacial stream and almost carried out into the surf. Nevertheless the census was successful and yielded further evidence of breeding fur seals.

*Nella Dan* arrived at Spit Bay on 9 March. During re-embarkation a heavily dumping surf almost capsized the pontoon and Dr Law was swept overboard. Swimming strongly, he soon regained the pontoon. After collecting Gilchrist and the scientific records from Atlas Cove the ship sailed to Kerguelen, where all members underwent a rigorous series of physiological tests culminating in a two hour exposure to 4°C in the ship's cold room, thus repeating a cold-tolerance test they had undergone before leaving Melbourne. The results showed that they had become significantly fitter and leaner, and had developed a degree of acclimatisation to cold that was consistent with earlier findings in Antarctica (Budd 1965, 1989). The expedition then sailed for Melbourne, having achieved all its objectives except the work on the summit plateau and the ascent of Mawson Peak.

#### **1965: South Indian Ocean Expedition to Heard Island (SIOEHI)**

Early in 1964 Deacock asked Law for ANARE support for another attempt on Big Ben. Law replied that it would be unlikely that he could obtain departmental support for the expense involved, but he offered to help any private expedition. In the event he was able to recommend to Deacock that the vessel *Patanela* (owned by a friend of his) should be chartered for the voyage to Heard Island.

Deacock thereupon organised the South Indian Ocean Expedition to Heard Island (SIOEHI). Between 5 November 1964 and 12 March 1965 the expedition sailed the 19 metre gaff-rigged schooner *Patanela* to Heard Island, made the first ascent of Big Ben, and carried out scientific investigations (Anon 1965; Temple 1966; Tilman 1966). The expedition was sponsored by *The Australian* newspaper, the Mount Everest Foundation, and the Trans-Antarctic Fund, and was supported by other commercial, private, and academic sources, together with contributions from the expedition members themselves.

The ten expedition members were Warwick Deacock (leader, botany, photography, ship's cook), Bill Tilman (skipper and navigator), Grahame Budd (medical officer, biology and glaciology), Colin Putt (surveyor and ship's engineer), John Crick (field assistant), Malcolm Hay (medical officer, photography), Anthony Hill (ship's mate), Russel Pardoe (medical officer, biology), Ed Reid (meteorology and radio), and Phil Temple (entomology).

### *The voyage*

*Patanela* sailed from Sydney on 5 November 1964, and after calling at Albany reached Kerguelen on 1 January 1965 (Fig. 15).



Figure 15. *Patanela* under reefed sail near Kerguelen, December 1964. [SIOEHI photo by Philip Temple]

Throughout the outward and return voyages the expedition occupied a total of 56 hydrology and 26 plankton stations, and made twice-daily synoptic weather observations. At Kerguelen the party watered ship and made final preparations in Anse du Jardin, lunched with a French summer party at Port Christmas, and sailed on 4 January. Their hopes of finding a safe anchorage in Winston Lagoon for the next month were dashed when on 8 January they found the entrance to be impassable. Preparations for landing on the open beach were interrupted by a gale which drove *Patanela* away to the east. When the wind moderated on 11 January they returned to the island and next morning disembarked the five men of the shore party — Deacock, Budd, Crick, Putt, and Temple.

### *The landing*

The shore party, wearing wet suits, landed on 12 January at Capsize Beach — so named because dumping waves at the water's edge, 2-3 m high yet invisible from seawards, had deposited their 5.5 metre inflatable boat and its 500 kg of supplies upside down on the beach with Budd pinned under water beneath it. Luckily the wash of the following waves lifted the boat enough to let him get free. Some hours later Deacock, Putt, and Budd returned to *Patanela* — after being

flung back onto the beach at their first attempt — and fetched the second load of supplies, once again being ejected on arrival at the beach. All men and supplies were now safely ashore, without serious injury or loss.

#### *The Patanela party*

Those remaining on the ship — Tilman, Hay, Hill, Pardoe, and Reid — reached Kerguelen, the nearest safe anchorage, on 16 January. After a warm welcome from the French expedition at Port-aux-Français they moored *Patanela* at the old whaling station of Port Jeanne d'Arc and remained there until 31 January. During this time two parties of the crew, in company with French climbers, made trips of 2-4 days to the lower slopes of Mount Ross (1850 m), the highest peak on Kerguelen.

On 1 February *Patanela* anchored in the lee of Pointe Molloy, 8 km west of Port-aux-Français. During the night, in a 100 km/hr wind and driving snow, the ship dragged her anchor and at 0400 hr grounded close inshore among kelp. They motored back to Molloy, where after many failures the anchor eventually held. When the wind eased on 3 February they moved to Port-aux-Français and made fast to a mooring buoy. Pardoe's inspection, in wet-suit and scuba gear, revealed that the hull was apparently undamaged.

After another anxious day and night at the mooring, in a strong gale with the rocky shore close astern, they sailed for Heard Island on 5 February. They covered half the distance on the first day but hove to for most of the next three days. On the night of 9 February they anchored off Skua Beach, and early next morning — a day early — they arrived at Capsize Beach.

#### *The shore party*

*The mountain.* After drying and sorting their gear on 13 January the shore party had carried 40 kg loads for several days over the volcanic uplands of South Barrier, across the upper snowfield of the Winston Glacier, and down a scree chute to the Fiftyone Glacier, where they camped on 17 January. A blizzard forced an unscheduled camp below Budd Pass while they were relaying loads through the crevasse fields, but by late on 21 January they were established in their polar pyramid tent above the pass at 1220 m, with ample food and fuel for a prolonged siege. Blizzards, rain, and dense cloud followed each other, while temperatures oscillated between  $-8^{\circ}$  and  $+10^{\circ}\text{C}$ . A break in the weather on 23 January allowed them to reconnoitre and mark the route to 2130 m.

Early on 25 January the weather cleared, and leaving the tent at dawn (0300 hr) they climbed steadily, pausing to lower thermometers into several crevasses, until at noon they reached the summit of Mawson

Peak. Their jubilation was immediately dampened by the onset of a north-west gale, which enveloped the party in dense cloud and driving sleet. With their camp more than 1500 m below them, this was an unsettling turn of affairs. An attempt to climb down into an ice-walled valley of fumaroles beside the summit, to measure temperatures and collect sublimates and rock samples, was defeated by steep unstable ice that was invisible underfoot in the whiteout. It was no place to linger, and they turned for home.

Steering a precarious compass course in almost zero visibility they found their way down to the plateau, and then followed their marker poles in strong wind and heavy rain, collecting the crevasse thermometers as they went, to reach the tent at 1730 hr. For the next two days a south-west blizzard, the strongest experienced so far, confined the party to the tent; but on 28 January they were able, in the continuing gale, to return all the way to Capsize Beach.

*The coastal work.* For the remaining fortnight Putt and Crick worked on the uplands of South Barrier, making a plane-table survey and collecting geological specimens and lichens — a laborious and frustrating task in the prevailing poor visibility, violent winds, and changeable weather. Budd and Deacock photographed the glaciers, counted the king penguins and fur seals, and searched for banded giant petrels and branded elephant seals. Temple collected insects and animal parasites, and Deacock collected plants and soil samples.

In the course of this work, between 30 January and 2 February Deacock, Temple, and Budd visited Paddick Valley and Spit Bay, and Deacock and Budd walked to the Compton Glacier. Between 5 and 9 February Deacock, Crick, and Budd walked under the cliffs of South Barrier to Long Beach, where the unceasing gales, low cloud, and showers of rain and snow hampered Crick's topographic survey and Deacock's filming.

*Re-embarkation.* *Patanela's* premature arrival on 10 February telescoped the shore party's plans for re-embarking next day, but they were reluctant to keep the short-handed ship waiting in such unsafe waters. The morning's surf, breaking offshore and dumping heavily inshore, was clearly unmanageable but preparations went forward in hopes of an improvement. Tense discussions revolved around risking the surf that day or waiting for better conditions on the next — which might turn out to be worse. At 1700 hr the boat was successfully launched, carrying only the men, the scientific results, and the most valuable equipment (Fig. 16).

Soon all were safely on board *Patanela*. In the freshening wind a return for the remaining equipment was considered unjustifiable and *Patanela* set sail for home, arriving in Albany on 28 February and in Sydney on

14 March. Big Ben had at last been climbed, and a comprehensive scientific program had been completed.

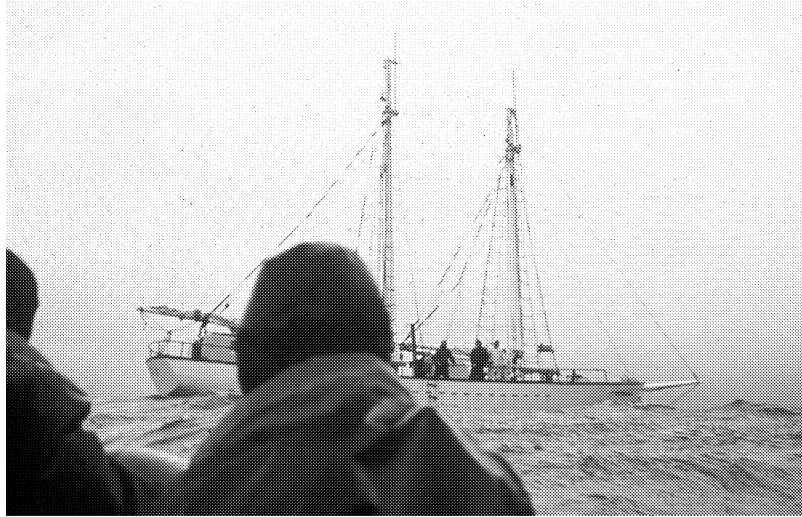


Figure 16. *Patanela* re-embarking shore party from Capsize Beach, 10 February 1965. [SIOEHI photo by Philip Temple]

### 1969-70: United States PAGEOS wintering party

From March 1969 to April 1970 the ANARE station at Atlas Cove was occupied by two successive parties of the United States Coast and Geodetic Survey. Their aim was to obtain photographs of the Passive Geodetic Earth-orbiting Satellite (PAGEOS) against a background of stars, simultaneously with photographs at other ground stations in a world-wide geodetic network, as part of the United States' National Geodetic Satellite Program. This program employed satellite triangulation to determine better estimates of the shape and size of the earth, and the location of camera stations relative to each other.

The first party landed from the US Coastguard Cutter *Southwind* between 11 and 17 March 1969. The members were G. Brannan, J.A. Joll, E. Kiehnau, S. Oldland, B.D. Roth, and J. Shaffery. In November they were relieved by a second party, which was landed from M.V. *Nella Dan*. Its members were S. Cofer, R. Cohen, K. Kerr, R. Kyle, D. Lawhon, and H.B. Milburn. They were re-embarked in April 1970 by the USS *Columbia Hawk*.

The prevailing cloudiness, together with equipment problems caused by the hostile environment, restricted the number of occasions on which the expedition could obtain satisfactory satellite photographs. Although opportunities to leave the station were limited, Ben Roth and Richard Cohen contributed useful observations of king penguin numbers in the Four Bays Area and at Red Island throughout the year.

The expedition members earned the gratitude of their successors for the large aluminium kitchen and mess hut they had built, and for their excellent work in renovating and seal-proofing many of the original ANARE huts, which the 1971 expedition found ready for immediate occupation as comfortable living quarters.

### 1969: ANARE summer expedition

On learning, in 1968, of *Southwind's* forthcoming visit to Heard Island Budd proposed to Don Styles, Acting Director of the Antarctic Division, that the United States authorities be approached to see whether he and two companions might accompany the ship. The result was that while *Southwind* was establishing the first PAGEOS party at Atlas Cove Budd, Deacock, and Robin Miller, guests of the U.S. expedition, photographed many of the glaciers and counted king penguins and fur seals (Budd 1969, 1970; Budd and Miller 1998).

Landing at Atlas Cove on 11 March, the party immediately set out to walk around as much of the island as possible before the ship's departure on 17 March. However, over the next eight hours they discovered that the Baudissin Glacier, the first obstacle of their journey, had readvanced and that the low route previously followed was now impassable (Fig. 17). In driving rain and a fresh gale they returned to the station at dusk, and the following afternoon one of *Southwind's* LARCs landed them at Saddle Point. During the next three days (13-15 March) they walked to Spit Bay and back. Delays



Figure 17. Climbing rope vibrates in the wind on ice ridges of Baudissin Glacier, 11 March 1969. Robin Miller in foreground, Saddle Point in background. [ANARE photo by W M M Deacock]



caused by unusually difficult ice on North Barrier and the Compton Glacier obliged them to camp at Fairchild Beach instead of Spit Bay, leaving no time for their planned inspection of the Winston Glacier.

Early on 16 March a LARC collected them from Saddle Point, and after a brief pause at the ANARE station it landed them at Sydney Cove. Accompanied by Lieutenant Bill Heineken from the *Southwind*, they surveyed the Red Island area and then walked to Macey Cone, where they camped. The following day they walked to the Vahsel moraine, and after counting the king penguins there they returned to Atlas Cove and re-embarked in *Southwind*. A week later they disembarked in Mauritius and flew back to Australia.

The expedition, small and brief though it was, discovered that the glaciers of Corinthian Bay had strongly readvanced while those elsewhere had continued to retreat, and that over the previous six years the numbers of king penguins and fur seals had increased fivefold and sixfold, respectively.

#### **1971: French-Australian summer expedition**

In 1970 Budd learned of a forthcoming French expedition to Heard Island and, as in 1968 and for the same reasons, proposed to Bryan Rofe, Director of the Antarctic Division, that the French authorities be asked whether he and two companions might accompany the expedition. The result was that in early 1971 five Australians took part, as guests of the French party, in a fourteen-man expedition which spent six weeks on Heard Island (Gendrin 1971; Budd 1971, 1972; Bowden 1997). The nine French members, representing Terres Australes et Antarctiques Françaises (TAAF), were Roger Gendrin (leader, geophysics); Claude Bercy, Serge Grandini, Dominique Morin and Roger Riguet (all four geophysics); Simon Gasverde (engineer), Gerard Jacot (radio), Medard Peter (cook), and Jacques Vienne (medical officer, biology). The five Australian members, representing ANARE, were Ian Allison (glaciology, meteorology), Grahame Budd (biology, glaciology, physiology), Iain Dillon (field assistant), Ian Holmes (field assistant), and Hugh Thelander (geophysics).

The main aims of the French members were to study geophysical phenomena in conjunction with parallel studies at Kerguelen and at conjugate stations in the Soviet Union, and to collect biological specimens. Those of the Australian members were to make glaciological, meteorological, biological, and physiological observations, and if possible to land on the McDonald Islands.

The French expedition ship, M.V. *Gallieni*, reached Heard Island on 25 January and remained until 28 January, during which time the expedition's equipment and stores were unloaded at Atlas Cove and four prefabricated metal huts ('Arbecs') were erected. On 27 January

*Gallieni* visited the McDonald Islands, where its Alouette helicopter landed Budd and Thelander for an informative 45 minute reconnaissance – a visit that unfavourable weather had prevented Budd from making on the 1965 and 1969 expeditions. The reconnaissance yielded the first detailed description of the islands and showed that fur seals were breeding there, although not in sufficient numbers to account for the population increase on Heard Island (Budd 1972).

During the next week the French members set up their equipment and began their observations, while the five Australians worked mainly on the adjacent glaciers. A reconnaissance as far as Desperation Gully showed that the low route across the Baudissin was again negotiable. However, the Baudissin was too broken to be suitable for Allison's glaciological measurements, which were transferred to the Vahsel. A line of stakes 2 km long was established and surveyed for velocity and ablation measurements, a 250 metre strain grid was set up, and gravity stations were established to estimate the bedrock profile. Budd, Dillon, and Holmes counted fur seals and king penguins at Red Island on two days when the weather was unsuitable for glaciology.

#### *Third circuit of Heard Island*

On 5 February Budd, Dillon, and Holmes began an anti-clockwise circuit of the island (Budd 1971; Holmes and Zwar 1972; Bowden 1997). Their aims were to make a whole-island census of fur seals and king penguins, to determine the status (retreating, stationary, or advancing) of each glacier and build paint-marked cairns as reference marks for future work, to collect botanical samples, and to record the thermal stress they experienced as part of a continuing physiology program.

On the morning of 6 February, in a north-east wind and heavy rain, they reconnoitred the northern edge of the Abbotsmith Glacier between 250 and 500 m but could find no way through the fields of invisible crevasses. They retreated, soaked and very cold, after three hours. In the early afternoon the weather improved and in three hours of difficult travel at about 200 m, intermittently in cloud, they reconnoitred a convoluted route through chaotic ice to the south side, then followed their tracks back to their camp on the northern moraine. Next morning they carried their loads across by the same route and camped at Henderson Bluff, where they found that the ice margin was readvancing after having retreated at least 800 m since 1954. On 8 February they walked to the Gotley Glacier, where they camped in the middle of the glacier at dusk after retreating from an area of high and unstable seracs near the south-east side.

The Gotley proved to be exceptionally difficult, and on the morning of 10 February, when they were almost across, Holmes broke his leg in

an otherwise minor and well-belayed crevasse fall. They camped beside the crevasse, splinted the fractured tibia and fibula with slats of bamboo, and made Holmes comfortable.

On 11 February Dillon and Budd found a way off the ice and visited the depot that the 1963 party had left at Long Beach. There they built a conspicuous paint-marked cairn containing a message and sketch map that would enable *Gallieni's* helicopter to locate the tent, if necessary, when the ship returned on 9 March. The message and its location were part of a pre-arranged safety plan; a radio was not carried because the ones available at the time were unreliable in Heard conditions. They returned to the tent with ample food and plaster bandages — but the plaster proved useless, spoiled by the damp.

Their inability to completely immobilise Holmes' fracture made it impractical to further consider the option, at best a hazardous one, of moving Holmes through the maze of seracs and crevasses to the moraine a few hundred metres away. Yet to remain in their present camp until *Gallieni's* return was inadvisable because it was on unstable moving ice among collapsing seracs. The wisest course seemed to be for Budd and Dillon to return to Atlas Cove and request a helicopter evacuation from one of the several ships known to be in the vicinity of Heard Island.

Leaving Holmes in the tent on 13 February with all necessary supplies within reach, Dillon and Budd returned to Atlas Cove via Spit Bay, a distance of 60 km over rough terrain. It was a precarious journey, as they were travelling in bad weather with no supplies or equipment except climbing gear and their wet sleeping bags. Budd was further handicapped by a stiff and painful back, which impaired his balance and made it hard for him to walk. Later X-rays revealed that these symptoms were due to 'hairline' stress fractures of the pelvis and hip joint, which he had sustained on 8 February as a result of jumping crevasses stiff-legged so as to favour a knee injured earlier in the expedition. They reached the station on the third morning after two 15-hour marches and a final 3-hour one, interspersed with a short night in the Spit Bay hut and a long one in the open beside the Baudissin Glacier.

#### *Evacuation of Ian Holmes from the Gotley Glacier*

Contrary to expectation, none of the ships in the vicinity carried a helicopter, and the nearest suitable ship proved to be *Nella Dan*, 2100 km away at Davis. Don Styles, the Acting Director of the Antarctic Division, ordered the ship to sail immediately to Heard Island. Under the direction of the voyage leader, Eric Macklin, the ship sailed to Mawson, took on board two Hughes 500 helicopters, and headed north (Macklin 1971). Dillon and Budd were unfit for an immediate return to

Holmes, but they loaded their packs for a prompt departure if the ship were to be delayed. Throughout this anxious period generous help and support were given by all expedition members at Atlas Cove.

Meanwhile, on the Gotley Glacier Holmes was stoically enduring a trying combination of pain, discomfort, boredom, anxiety, and uncertainty as to whether his companions had succeeded in reaching Atlas Cove. His splint worked loose, a tent guy pulled out and let the walls sag on him, his sleeping bag became sodden with thaw water, the temperature oscillated above and below freezing, nearby seracs collapsed with loud crashes, and the moving ice creaked and jerked alarmingly beneath him. He carefully rationed his food and fuel to last, if necessary, until the return of *Gallieni* on 9 March.

*Nella Dan* reached Atlas Cove in a south-west gale at 0100 hr on 21 February – the ninth day of Holmes’s lone vigil. At dawn a LARC collected Dillon, Allison, and Budd, in marginal conditions, and *Nella Dan* rounded Laurens Peninsula and moved down the west coast in a 70 km/hr wind and a heavy swell. The Army LARC detachment was alerted for a landing at Long Beach if these conditions persisted, but after Captain Hans Nielsen had felt his way to within 3 km of the Gotley Glacier the wind dropped to 18 km/hr and flying became possible. The first helicopter, piloted by Vic Barkell, took off at 1400 hr with Macklin, Dillon, and Dr Tony Graff and soon located Holmes’s tent. The second helicopter, piloted by Cliff Dohle, hovered above the tent while engineer Eckhardt Schneider, operating a winch he had borrowed from a barge at Mawson and fitted to the helicopter, lowered Budd down to the ice (Fig. 18).

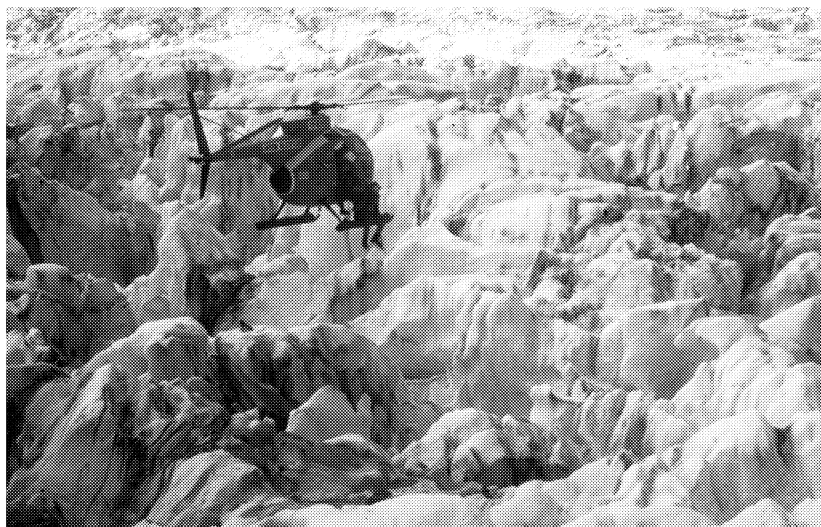


Figure 18. Helicopter over tent on Gotley Glacier with Budd sitting on skid, about to be winched down to Ian Holmes, 21 February 1971. [ANARE photo by A J Graff]

After examining Holmes, who had weathered his ordeal well and was in good condition, Budd fitted an inflatable splint, lashed Holmes into a Neill-Robertson stretcher, and attached it to the winch cable. Dohle flew Holmes, suspended horizontally beneath his helicopter, to a safe area beside the glacier. He was then transferred to Barkell's helicopter and flown to *Nella Dan*, where his leg was plastered. Dohle retrieved Budd, together with the camping and scientific equipment, and by 1545 hr both helicopters and all personnel were back on board. A difficult period for all concerned was safely concluded.

After landing Dillon, Allison and Budd at Atlas Cove *Nella Dan* returned to Mawson. Holmes returned to Australia with the ship and made an excellent recovery, while those remaining on Heard Island resumed the scientific program.

#### *The final fortnight*

In the final fortnight of the expedition the remaining four Australians completed the glaciology and biology programs, made a further census of fur seals and king penguins at Red Island and in the Four Bays Area, and then worked with the French party to prepare for re-embarkation. *Gallieni* arrived on 9 March, and after re-embarking the party next day cruised down the north coast to Spit Bay in clear weather. The cruise yielded detailed photographs of the glaciers, and records of the island's remarkable local variations in wind velocity and cloud cover. The expedition members disembarked at Ile de la Réunion on 23 March and flew back to Australia.

Most of the expedition's objectives were achieved, despite the disruption caused by Holmes's accident. The French party had obtained valuable geophysical results. The Australian party had made the first recorded landing on McDonald Island, completed the survey of the Vahsel Glacier, recorded the current status of many glaciers, and counted the increased numbers of king penguins and fur seals at Vahsel Moraine and Red Island.

## CONCLUSIONS

In summary, the years 1947-1971 were ones of substantial achievement. Expedition members recorded seven years of uninterrupted synoptic meteorological observations and four years of seismic and magnetic observations. They also (1) explored and mapped the island, and documented its topography, geology, glaciology and biology; (2) made three overland circuits of the island, the first ascent of Big Ben, and the first recorded landing on the nearby McDonald Islands; (3) reported the commencement and subsequent progress of massive glacier retreat caused by regional warming, and of the island's recolonisation by king penguins and antarctic fur seals;

and (4) reported measurements of glacier flow and thickness, the palaeomagnetism of Heard Island rocks, behavioural studies of giant petrels and other birds, and the cold stress and acclimatisation experienced by humans working in Heard's wet-cold climate. In addition, Heard Island served as a testing ground for men, equipment, scientific programs, huskies, general administration, and logistics, without which Mawson station could not have been established as successfully as it was in 1954 (Dr Phillip Law, personal communication, 2005). The American wintering expedition and the French summer expedition contributed to major international geodetic and geophysical investigations. All told, the expeditions between 1947 and 1971 added much to our knowledge of Heard Island, and they laid down a solid foundation for the work of later investigators.

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