The Voyage of HMS *Erebus* and HMS *Terror* to the Southern and Antarctic Regions

Captain James Clark Ross, R.N. 1839–1843

The Journal of Sergeant William K. Cunningham, R.M. of HMS *Terror*

Transcribed and edited by Richard Campbell

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ABBREVIATIONS

BL	British Library, London
DNB	*Dictionary of National Biography*
NMM	National Maritime Museum, Greenwich
OED	*Oxford English Dictionary*
SPRI	Scott Polar Research Institute, Cambridge
TNA	The National Archive, Kew
UKHO	United Kingdom Hydrographic Office, Taunton, www.ukho.gov.uk

GLOSSARY OF NAUTICAL TERMS

Definitions of terms are, in general, taken from Admiral W. H. Smythe, *The Sailors Word-book*, London, 1867.

A'TAUNTO. or All-a-Taunt-o. Every mast an-end and fully rigged.

AN-END. The position of any spar when erected perpendicularly to the deck. The top-masts are said to be *an-end* when swayed up to their usual stations and fidded. To strike a spar or plank *an-end* is to drive it in the direction of its length.

ATHWART...*Athwart hawse*, a vessel, boat, or floating lumber accidentally drifted across the stem of a ship, the transverse position of the drift being understood.

BATTENING THE HATCHES. Securing the tarpaulins over them. (*See* Battens).

BATTENS OF THE HATCHES. Long narrow lathes, or the straightened hoops of casks, serving by the help of nailing to confine the edges of the tarpaulins, and keep them close down the side of the hatchways, in bad weather.

BELAYING PIN. Small wooden or iron cylinder, fixed in racks in different parts of the ship for belaying [securing] running ropes to.

BLACKING DOWN. The tarring and blacking of rigging; or the operation of blacking the ship 's sides with tar or mineral blacking.

BOBSTAYS. Ropes or chains used to confine the bowsprit downward to the stem or cut-water. .. Their use is to counteract the strain of the fore-mast stays, which draw it upward.

BOLT-ROPE. A rope sewed all round the edge of a sail, to prevent the canvas from tearing. The bottom part of it is called the foot-rope, the sides leech-ropes, and if the sail be oblong or square the upper part is called the head-rope; the stay or weather rope of fore-and-aft sails is termed the luff.

BORROW, TO. To approach closely either to land or wind; to hug a shoal or coast in order to avoid adverse tide.

BRACE. ... In shipbuilding, braces are plates of iron, copper or mixed metal, which are used to bind efficiently a weakness in a vessel; as also to receive the pintles by which the rudder is hung.

BREAST-HOOKS. Thick pieces of timber, incurvated into the form of knees, and used to strengthen the fore-part of a ship, where they are placed at different heights, directly across the stem internally, so as to unite it with the bows on each side, and form the principal security, supporting the hawse-pieces and strain of the cables.

BUM-BOAT. A boat employed to carry provisions, vegetables, and small merchandise for sale to ships, either in port or lying at a distance from the shore; thus serving to communicate with the adjacent town. The name is corrupted from bombard, the vessel in which beer was formerly carried to soldiers on duty.

CAP. A strong block of wood having two large holes through it, the one square, the other round, used to confine two masts together, when one is erected at the head of the other, in order to lengthen it. The principal caps of a ship are those of the lower masts, which are fitted with a strong eye-bolt on each side, wherein to hook the block by which the top-mast is drawn up through the cap. In the same manner as the top mast slides up through the cap of the lower mast, the topgallant-mast slides up

through the cap of the top-masts.

CAPE HEN. Molly-Mok or Molly-Mawk. A bird which follows in the wake of a ship rounding the Cape. It is a small kind of albatross.

CAPE PIGEON, or Cape Petrel. A sea-bird which follows a ship in her passage round the cape; the Procellaria capensis.

CAT'S PAW. A light air perceived at a distance in a calm, by the impressions made on the surface of the sea, which it sweeps very gently, and then passes away, being equally partial and transitory.

CAT-HEAD. The cat-head passes through the bow-bulwark obliquely forward on a radial line from the fore-mast, rests on the timbers even with the water-way, passes through the deck, and is secured to the side-timbers. It is selected from curved timber. Its upper head is on a level with the upper rail; it is furnished with three great sheaves, and externally strengthened by a cat-head knee. It not only is used to lift the anchor from the surface of the water, but as it "looks forward," the cat-block is frequently lashed to the cable to aid by its powerful purchase when the capstan fails to make an impression. The cat-fall rove through the sheaves, and the cat-block furnish the cat-purchase. The cat-head thus serves to suspend the anchor clear of the bow, when it is necessary to let it go: the knee by which it is supported is generally ornamented with carving.

CHAINS. properly Chain-wales or Channels. Broad and thick planks projecting horizontally from the ship's outside, to which they are fayed and bolted, abreast of and somewhat behind the masts. They are formed to project the chain-plate, and give the lower rigging greater outrig or spread, free from the topsides of the ship, thus affording greater security and support to the masts, as well as to prevent the shrouds from damaging the gunwale, or being hurt by rubbing against it.

COCKPIT. The place where the wounded men are attended to, situated near the after hatch-way, and under the lower gun-deck. The midshipmen alone inhabited the cockpit in former times, but in later days commission and warrant officers, civilians &c. have their cabins there.

COMING HOME. Said of the anchor when it has been dropped on bad holding ground, or is dislodged from its bed by the violence of the wind and sea, and is dragged along by the vessel, or is tripped by insufficient length of cable.

CREEPER. A small grapnel (iron instrument with four claws) for dragging for articles dropped overboard in harbour.

CRUTCHES. A crooked timber inside the after-peak of a vessel, for securing the heels of the cant or half-timbers [timbers which rise obliquely from the keel].

DAVIT. A piece of timber or iron, with sheaves or blocks at its end, projecting over a vessel's quarter or stern, to hoist up and suspend one end of a boat. [They were normally used in pairs, one for each end of the boat.]

DEEPSEA LINE. Usually a strong water-laid line. It is used with a lead of 28 lbs., and adapted to find bottom in 200 fathoms or more.

DOLPHIN STRIKER. A short perpendicular gaff spar, under the bow-sprit-end, for guying down the jib-boom, of which indeed it is the chief support, by means of the martingales.

DRIVER. A large sail formerly used with the wind aft or quartering. It was a square sail cut like a studding-sail, and set with a great yard on the end of the spanker boom, across the taffrail. The name latterly has been officially applied to the spanker, both being the aftermost sails of a ship, the ring-tail being only an addition, as a studding or steering sail.

FLEMISH, To. To coil down a rope concentrically in the direction of the sun, or coil of a watch-spring, beginning in the middle without riders; but if there must be riding flakes, they begin outside, and that is the true *French coil*.

FLUKES.... Flukes, or palms, are also the broad triangular plates of iron on each arm of the anchor, inside the bills or extreme points, which having entered the ground, hold the ship.

FLYING DUTCHMAN. A famous marine spectre-ship, formerly supposed to haunt the Cape of Good Hope. The tradition of seamen was that a Dutch skipper, irritated with a foul wind, swore by *donner* and *blitzen*, that he would beat into Table Bay in spite of God or man, and that, foundering with the wicked oath on his lips, has ever since been working off and on near the Cape.

FLYING JIB-BOOM. A spar which is pointed through the iron at the jib-boom end. It lies beside it, and the

heel steps into the bowsprit cap.

FULL DUE. For good; for ever; completely; belay.

GAMMONING. Seven or eight turns of a rope-lashing passed alternately over the bowsprit and through a large hole in the cut-water, the better to support the stays of the foremast; after all the turns are drawn as firm as possible, the two opposite are braced together under the bowsprit by a frapping. Gammoning lashing, fashion, &c., has a peculiar seamanlike meaning. The gammoning turns are passed from the standing part or bolt forward, over the bowsprit, aft through the knee forward, making a cross lashing. It was the essence of a seaman's ability, and only forecastle men, under the boatswain, executed it. Now galvanized chain is more commonly used than rope for gammoning.

GOING LARGE. Sailing off the wind.

GUDGEONS. The metal braces with eyes bolted upon the stern-post for the pintles of the rudder to work in, as upon hinges.

GUEST-WARP BOOM. A swinging spar (lower studding-boom) rigged from a ship's side with a warp for boats to ride by.

HAWSE. This is a term of great meaning. Strictly, it is that part of a vessel 's bow where holes are cut for her cables to pass through. It is also generally understood to imply the situation of the cables before the ship 's stem, when she is moored with two anchors out from forward, one on the starboard, and the other on the port bow. It also denotes any small distance between her head and the anchors employed to ride her, as "he has anchored in our hawse", "the brig fell athwart our hawse" &c.

HAWSE ... "Clearing hawse," is untwisting or disentangling two cables that come through different holes, and make a foul hawse

HEAVE TO. To put a vessel in a position of *lying to*, by adjusting her sails so as to counteract each other, and thereby check her way, or keep her perfectly still. In a gale, it implies to set merely enough sail to steady the ship; the aim being to keep the sea on the weather bow whilst the rudder has but little influence, the sail is chiefly set on the main and mizen-mast; as hove-to under a close reefed main-topsail, or main-trysail, or driver.

HOLY-STONE. A sand stone for scrubbing the decks, so called from being originally used for Sunday cleaning, or obtained by plundering church-yards of their tombstones, or because the seamen have to go on their knees to use it.

HULK. Is generally applied to a vessel condemned as unfit for the risks of the sea used as a store-vessel and housing for crews while refitting the vessels they belong to.

ICE-PLANK. *see* Spike-Plank.

IDLER. A general designation for all those on board a ship-of-war, who, from being liable to constant day duty, are not subjected to keep the night-watch, but must go on deck if all hands are called during the night. Surgeons, marine-officers, pay-masters, and the civil departments, are also thus denominated.

IRON-BOUND. A coast where the shores are composed of rocks which mostly rise perpendicularly from the sea, and have no anchorage near to them, therefore dangerous for vessels to borrow upon.

JONATHAN. A name often applied to Americans in general, but really appropriate to the Quakers in America, being a corruption of John Nathan.

JURY-MAST. A temporary or occasional mast erected in a ship in the place of one which has been carried away in a gale, battle, &c.

KEDGE, or Kedger. A small anchor used to keep a ship steady and clear of her bower-anchor while she rides in harbour, particularly at the turn of the tide. The kedge-anchors are also used to warp a ship from one part of a harbour to another...

KNIGHT-HEADS. Two large oak timbers, one on each side of the stem, rising up sufficiently above it to support the bowsprit, which is fixed between them. The term is synonymous with *bollard timbers*. *Knight-heads* also formerly denoted in many merchant ships, two strong frames of timber fixed on the main-deck, a little behind the fore-mast, which supported the ends of the windless. They were frequently called the *bitts*, and then their upper parts only were denominated knight-heads, from having been embellished with a carved head...

LARGE. Sailing large: going with the wind free when studding-sails will draw.

LAY HER COURSE, To. To be able to sail in the direction wished for, however barely the wind permits it.

MARTINGALE. A rope extending downwards from the jib-boom end to a kind of short gaff-shaped spar, fixed perpendicularly under the cap of the bowsprit; its use is to guy the jib-boom down in the same manner as the bobstays retain the bowsprit. The spar is usually termed the *dolphin-striker*, from its handy position whence to strike fish.

MAST. A long cylindrical piece of timber, elevated perpendicularly upon the keel of a ship, to which are attached the yards, the rigging and the sails. It is either formed in one piece, and called a pole-mast, or composed of several pieces joined together and termed a made mast... The foot or keel of it rests in a block of timber called the step, which is fixed upon the keelson. - *Fore-mast*. That which stands near the stem, and is next in size to the main-mast. - *Main-mast*. The largest mast in a ship. *Mizen-mast*. The smallest mast, standing between the main-mast and the stern... - *Top-mast*. A top-mast is raised at the head or top of the lower-mast through a cap, and supported by trestle-trees. - *Topgallant-mast*. A smaller mast than the preceding, raised and secured to its head in the same manner.

MOTHER CARY 'S CHICKEN. The stormy petrel, Procellaria pelagica.

PATERERO. A kind of small mortar sometimes fired for salutes ...

PINTLES. The rudder is hung on a ship by pintles and braces. The braces are secured firmly to the stern-post by jaws, which spread and are bolted on each side. The pintles are hooks which enter the braces, and the rudder is then wood-locked; a dumb pintle on the heel finally takes the strain off the hinging portions.

POSTED. Promoted from Commander to Captain in the navy...

RAP FULL. Applies to a ship on a wind, when "keep her rap full!" means, do not come too close to the wind, or lift a wrinkle of the sail.

RATTLE DOWN RIGGING, To; or, To Rattle the Shrouds. To fix the ratlines in a line parallel to the vessel 's set on the water.

RIDERS. Timbers laid as required, reaching from the keelson to the orlop-beams, to bind a ship and give additional strength.

SCANT. A term applied to the wind when it heads a ship off, so that she will barely lay her course when the yards are very sharp up.

SCARPH, or Scarfing. Is the junction of wood or metal by sloping off the edges, and maintaining the same thickness throughout the joint. The stem and stern posts are scarfed to the keel.

SCRAPER. A small triangular iron instrument, having two or three sharp edges. It is used to scrape the ship's side or decks after caulking, or to clean the topmasts, &c. This is usually followed by varnish of turpentine, or a mixture of tar and oil, to protect the wood from the weather.

SCUD. The low misty cloud. It appears to fly faster than others because it is very near the earth's surface. When scud is abundant, showers may be expected.

SCUD, TO. To run before a gale under canvas enough to keep the vessel ahead of the sea.

SHACKLE. A span with two eyes and a bolt, attached to open links in a chain-cable, at every 15 fathoms; they are fitted with a movable bolt, so that the chain can be separated or coupled, as circumstances require. Also, an iron loop-hooked bolt moving on a pin, used for fastening the lower-deck port-bars.

SHEET-ANCHOR. One of four bower anchors supplied, two at the bows, and one at either chest-tree abaft the fore-rigging; one is termed the sheet, the other the spare anchor ...

SIGHT THE ANCHOR, TO. To heave it up in sight, in order to prove that it is clear, when, from the ship having gone over it, there is suspicion that it may be fouled by the slack cable.

SKIDS. Massive fenders; they consist of long compassing pieces of timber, formed to answer the vertical curve of the ship's side, in order to preserve it when weighty bodies are hoisted in or lowered against it.

SKY-LARKING. In olden times meant mounting to the mast-heads, and sliding down the royal-stays or back-stays for amusement; but of late the term has denoted frolicsome mischief, which is not confined to boys, unless three score and ten includes them.

SLEEPERS. Timbers lying fore and aft in the bottom of the ship, now generally applied to the knees which connect the transoms to the after timbers on the ship's quarter. They are particularly used in Greenland ships, to strengthen the bows and stern-frame, to enable them to resist the shocks of ice.

SLINGS. *Yard-slings*. The rope or chain used to support a yard which does not travel up and down a mast. The slings of a yard also imply that part on which the slings are placed.

SLOPS. A name given to ready-made clothes, and other furnishings, for seamen, by Maydman, in 1691. In Chaucer 's time, *sloppe* meant a sort of breeches. [Maydman, *Naval Speculations*. p.129. The Slop-seller is a person crept into the Navy, I mean to monopolize the vending of cloathing solely... Ibid. p.144. Advice to the Slop-seller, That if he will sell as cheap as others, and take the Purser's Bills, and Ballance his Acompt with him, and not crave Imprest Money of the Navy Board, to pay him in part before-hand, then I believe he may sell a great deal of cloaths and be a Gainer enough....]

SLUDGE. ... Also, in polar parlance, comminuted fragments of brash ice.

SPANKER. A fore-and-aft sail, setting with a boom and gaff, frequently called the *driver*. It is the aftermost sail of a ship or bark.

SPIKE-PLANK. In Polar voyages, a platform projecting across the vessel before the mizzen-mast, to enable the ice-master to cross over, and see ahead, and so pilot her clear of the ice. It corresponds with the bridge in steamers.

SPRING....*To spring*. To split or break.

START. To start a tack or sheet. To slack it off, as in tacking or manoeuvring.

STAY .. *To stay*. To tack, to bring the ship 's head up to the wind for going about... *In stays*, or *hove in stays*, is the situation of a vessel when she is staying, or in the act of going about.

STEEP-TUB. A large tub in which salt provisions are soaked previous to being cooked.

STEM. *To stem.* To make way against an obstacle.

STUDDING-SAILS. Fine-weather sails set outside the square-sails; the term "scudding-sails "was formerly used. - *Topmast and top-gallant studding-sails*. Those which are set outside the top-sails and topgallant-sails. They have yards at the head, and are spread at the foot by booms, which slide out on the extremities of the lower and topsail yards, and their heads or yards are hoisted up to the topsail and top-gallant yard-arms.

SWING SHIP FOR LOCAL ATTRACTION AND ADJUSTMENT OF COMPASSES. This is done by taking the bearing of a very distant object at each point of the compass to which her head is brought; also, by using a theodolite on shore, and taking its bearing from the ship, and the observer's head from the theodolite. [See also Appendix 10.]

TIER. A regular row of anything. Also, a range in the hold; hence the terms ground tier, second and upper tier, &c., of casks or goods stowed there - *Cable tier*. The space in a ship where hempen cables were coiled.

TRACKING. Hauling any vessel or floating body along a canal or river by a rope dragged along the bank by men or horses.

WARP. A rope or light hawser, employed occasionally to transport a ship from one place to another in a port or road... *To warp*. To move a vessel from one place to another by warps, which are attached to buoys, to other ships, to anchors, or to certain fixed objects on shore.

WHALE BIRDS. A beautiful little bird seen hovering in flocks over the Southern Ocean, in search of the small crustaceans which constitute their food.

WHEEL-ROPES. Ropes rove through a block on each side of the deck, and led round the barrel of the steering-wheel. [They are used to move the tiller, which is connected to, and turns, the rudder.]

WHISKERS. Two booms, half-yards, or iron spars projecting on each side before the cat-heads; they are for spreading the guys of the jib-boom instead of having a spritsail-yard across.

PREFACE

Acknowledgements

I am grateful to the Deputy Keeper of the Records, Public Record Office of Northern Ireland and Mrs J. Herwegh Hellwitz for permission to publish the Journal of Sergeant Cunningham; to Mrs Herwegh Helwitz for the copy of Sergeant Cunningham's portrait and other information; to the United Kingdom Hydrographic Office for permission to publish charts, a view and other items from their collection; to the British Library, and to The National Archive for permission to publish items from their respective collections; to the Scott Polar Research Institute, University of Cambridge for permission to publish excerpts from MS 367/22 by C. J. Sullivan and MS 1556 by James Clark Ross; to Dr S. M. Ross for permission to quote from her father, Admiral M. J. Ross's book *Ross in the Antarctic* and to Mrs P. Hunt for agreement to the use of her late husband, Commander G. W. G. Hunt's pictures.

I am also grateful to the staffs of the above establishments and to those of The British Association for the Advancement of Science, London; the Naval Historical Branch, Ministry of Defence, Portsmouth; the Public Library, Taunton; the Royal Marine Museum, Southsea and the York Probate Registry for help in my researches, which has been invaluable. I have also had help from various ecclesiastical authorities and from Mr P. W. Denny, Archivist of the Yeomen of the Guard, tracing Sergeant Cunningham's career, and from Lieutenant Commander Andrew David, RN, Captain Michael Barritt, RN, and Dr Ann Savours Shirley on various different aspects of the work for which I am again grateful. In addition I am indebted to Ray Howgego, who has prepared this work for publication in the *Journal of the Hakluyt Society*. I apologise to anyone who I have missed from the above, but would add that I am none the less grateful for their help.

Names

Names are given in the text and the various documents quoted in the form in which they appear in those documents. Elsewhere names are given in the form used by the nation having sovereignty over the area in which they appear, except where a direct reference is being made to a name appearing in one of the quoted documents, when the name in that document is used.

INTRODUCTION

The Antarctic expedition, under the command of Captain James Clark Ross in HM Ships *Erebus* and *Terror* has been described 'as one of mankind's greatest expeditions of geographical and scientific exploration'[1] and Captain Scott said it was 'among the most brilliant and famous that have been made.'[2] An account of the voyage was published by Captain Ross himself[3], in 1847, shortly after the voyage was completed. Another account was given by Robert M^{c}Cormick, the surgeon and scientist in *Erebus*, in 1884[4], and J. E. Davis, the second master of *Terror*, wrote a long letter to his sister, Emily, which was not published until 1901[5]. The botanic work was produced by Joseph D. Hooker[6], the assistant surgeon to M^{c}Cormick in *Erebus*, 1844 to 1847, (his father William J. Hooker published notes from his letters in 1843[7]), and the zoological was edited by John Richardson and John E. Gray[8], who did not serve on the voyage, between 1844 and 1875; Edward Sabine published a number of papers on the Magnetic and Meteorological observations made at the observatories and during the voyage between 1843 and 1868[9]. Davis also did a number of very fine views, and other scenes in water-colour. A letter was written by C. J. Sullivan for James Savage, sailor on board HMS *Erebus*, which gives little information except for a description of the collision on 13 March 1842. It is dated 19 June '43 and addressed to 'My friend James.'[10] There are also a number of modern accounts, of which Admiral M. J. Ross's is probably the most useful.[11]

Captain Ross's account is 'generally devoid of the personal impressions of expeditionary life,'[12] M^{c}Cormick's tends to be personal and full of accounts of shooting birds, Davis covers only November 1841 until May 1842[13]. It does however fill in quite a lot of interesting personal detail. Sergeant Cunningham's journal covers virtually the entire voyage, and, while it adds nothing, or very little, to the scientific aspects of the voyage, is a very human document, probably intended for his family, and provides a very real complement to the official accounts, with details of life on board, places visited and the general routine of a mid-nineteenth century expedition.

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[1] Rosove, *Antarctica*, p. 323.

[2] Scott, *Voyage of the Discovery*, I. p. 22.

[3] Ross, *Discovery.*

[4] M^{c}Cormick, *Voyages.*

[5] Davis, *Letter.*

[6] Hooker, *The Botany*, and Hooker, *The Cryptogamic Botany.*

[7] Hooker, William Jackson, *Notes on the Botany of the Antarctic Voyage, Conducted by Captain James Clark Ross, R.N., F.R.S., &c. &c. in Her Majesty's Discovery Ships Erebus and Terror, With observations on the Tussac Grass of the Falkland Islands*, London, 1843.

[8] Richardson and Gray, *The Zoology.*

[9] See Rosove, Antarctica, pp. 330–4. A number of reports were also published in the *Philosophical Transaction – Royal Society*, 1843, pp. 145–232; 1844, pp. 87–224; 1846, pp. 337–432; 1868, pp. 371–416.

[10] SPRI. MS.367/22. The letter contains a prose account (14 pages), extracts from which were published in *Polar Record*, Vol 10, No. 69, pp. 597–604, September 1961, and verse on various topics, including the collision (26 pages).

[11] Ross, *Ross in the Antarctic.*

[12] Rosove, *Antarctic*, p. 323.

[13] The letter is dated April 11th, off Cape Horn, but the last remark is dated May 2nd.

The Journal and Text

The Journal of Sergeant William Cunningham, RM, is held at the Public Record Office of Northern Ireland, in Belfast. Its number is D 869. It is written in a book about 7½ inches by 4½ inches (19 cm by 11½ cm) hinged along the shorter side with the text parallel to the hinge. Thus none of the text is lost in the binding. There are also a number of loose pages which would appear to have been a rough draft from which the book was written up.

Sergeant Cunningham 's writing is not easy to read and although every effort has been made to copy his spelling it is frequently impossible to tell which letters were intended. His Ts are frequently uncrossed and capital letters appear at random, sometimes in the middle of a word. It is particularly difficult to tell when an initial capital R is intended. Where practicable Sergeant Cunningham 's spelling has been used but where it is not possible to tell if it differs from current usage the latter has been used. He is also prone to leaving out words. Where practicable these have been supplied, in square brackets, to assist reading, however it is frequently impossible to tell what has been omitted, in which case nothing has been added. Where words have been inserted in the original, above the normal text, they have been subsumed in the text. Virtually no use is made of the long S, although it occurs on a couple of occasions, so that when trying to decipher a word it cannot be eliminated entirely. Where words come at the right-hand edge of the page they are frequently compressed and trailed down the edge of the paper. He also deleted a number of words and phrases and these have been excluded from the text, without comment.

The original punctuation is problematic and consists largely of dashes with a number of full stops and commas with capital letters inserted in irregular places. Where practicable the original punctuation and capital letters have been retained, but both have been modified to make the text more easily understandable. The dashes have been largely eliminated and replaced by full stops or colons and capital letters have been inserted at the start of new sentences.

The pages are numbered up to 60 (45 and 46 are not used), thereafter no numbers appear.

There are a number of nautical terms used which are not in use today, or have changed their meaning slightly, and these have been defined, where possible, from *The Sailors Word-book*, 1867, by Admiral W. H. Smyth, a friend and contemporary of Captain Ross, and are given in the Glossary of Nautical Terms. Where blanks have been left for names they have been supplied in the notes from Captain Ross 's narrative, and one or two incidents have been enlarged upon in the notes from Captain Ross 's and the other accounts of the voyage.

Sergeant Cunningham

Fig. 1. Quartermaster Sergeant W. K. Cunningham, RM. Courtesy Mrs S. Herwegh Hellwitz.
(He is wearing his Long Service and Good Conduct medal.)

'His Majesty's Marine Forces' were first raised on 26 April 1755, and became a permanent standing force with companies based at Portsmouth, Plymouth and Chatham[1].

William Keating Cunningham, the son of Alexander Cunningham[2], was born in Holborn, London[3] on 1 July 1809. He was a clerk when he enlisted in the Royal Marines on 17 December 1829, at Chatham. He was attested on 19 December the same year, when he was described as height 5'10¾", complexion sallow (fair on a different document), eyes grey and hair brown[4]. His first embarkation, on 21 May 1831, was in HMS *Prince Regent* (120), Captain J. W. D. Dundas, flag ship of Rear Admiral William Parker, who was invested with the chief command on the Lisbon station on 1 May 1831. He remained in the *Prince Regent* nineteen days (as a supernumerary, presumably for passage) and was then transferred, together with nineteen other marines, to HMS *Revenge* (78), Captain James Hillyar[5], who was relieved, 7 November 1831, by Captain Donald Hugh Mackay[6]. The *Revenge*[7], which carried three marine officers and a large detachment of

[1] See Appendix 2.

[2] Described in the Frindsbury Parish Church register of Cunningham's marriage, as 'Redifier', an old form of Re-edifier, one who re-builds, a rebuilder. OED.

[3] See Attestation Papers Appendix 1. The Muster List of HMS *Revenge* (TNA ADM 37/8312) gives his place of birth as Snowhill, Holborn, London, while that of HMS *Terror* (TNA ADM 38/9162) has London . The 1881 Census record, however, has Dublin, and gives his age as 69. The family had strong Irish connections and it is possible that by 1881, (three years before his death), his health had broken down and the form was filled in by his wife, who did not know the correct details.

[4] TNA ADM 157/21, Items 282, 283 & 284, ADM 158/9, & ADM 158/18 p. 90. See Appendix 1.

[5] TNA ADM 37/8231, HMS *Prince Regent* muster list.

[6] Captain Mackay was relieved by Captain William Elliott on 14 March 1834. *Navy List.*

[7] With 78 guns the *Revenge* was rated as a Third Rate, the first class standard war complement of which was 650 Men and 125 Marines.

Marines (about 140[1]), was employed attached to the force at Lisbon and was paid off early in 1834. When Cunningham first joined her in June 1831 she was at Spithead[2] and sailed for The Downs and then Cork (24 September–15 October) before returning to Spithead where he was discharged to Head Quarters, Portsmouth. During this period in the *Revenge* (9 June to 24 October), Cunningham was shown, together with fifty-three other marines, as a supernumerary, born for victuals and pay only. He subsequently rejoined the *Revenge*, as part complement, on 26 November 1831, again at Spithead. The *Revenge* sailed for Portugal at the end of December and then spent some time anchored in the river Tagus, off Belem Castle[3] and patrolling off the coast, anchoring in Cascaes Bay before returning to Spithead in November 1832. They left England again in January the next year for Gibraltar where they embarked troops from the 67th Regiment, 17 officers, 506 non-commissioned officers and privates, 35 women and 55 children, and carried them to Carlisle Bay, Barbados[4]. The ship called at Martinique[5] before returning to Plymouth Sound in May 1833. After a visit to Cork they returned to the Tagus and were back at Portsmouth in February 1834 to pay off. Cunningham returned to his depot on 25 March 1834. He was promoted corporal 5 November 1834, and sergeant (and colour sergeant according to his record) 24 October 1836.

He joined HMS *Terror* from Head Quarters, Chatham on 15 June 1839, aged thirty, and was discharged to HQ Woolwich 23 November 1843[6]. After his service in *Terror*, Captain Crozier presented him with his watch, inscribed 'Presented by Captain F. R. M. Crozier, R.N. to Sergt W. K. Cunningham R.M. as a mark of esteem.'[7] and Captain Ross wrote to the colonel commandant at Chatham praising his conduct during the expedition[8]. He was promoted quartermaster sergeant on 12 August 1846 and did not serve at sea again. He was invalided from the 57 Company, Chatham, on 21 June 1854, having joined from Quarters on 12 August 1846[9]. He received the Long Service and Good Conduct medal[10] on 19 January 1852, and the

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[1] TNA ADM 37/8312, HMS *Revenge* muster list.

[2] The anchorage off Portsmouth in the Solent.

[3] Belem Castle is in Lisbon on the north bank of the river Tagus in Latitude 38°40'N, Longitude 9°14'W, six miles within the northern entrance point. Cascaes Bay is four miles west of the same point in Latitude 38°40'N, Longitude 9°25'W.

[4] Carlisle Bay is off Bridgetown (Latitude 13°05'N, Longitude 59°36'W) the capital of Barbados.

[5] Latitude 14°30'N, Longitude 61°00'W.

[6] TNA ADM 38/9162 HMS *Terror* Muster list.

[7] The watch, No. 1844, made in Chester in 1829–30, is in a silver case 75x51x20 mm. It is now in the National Maritime Museum, Greenwich; Number JEW9221. It was presented to the Admiralty by Cunningham's widow, Elizabeth, in 1885, whence it went to the Royal Naval Museum, Greenwich, which was transferred in its entirety to the National Maritime Museum in 1934. Private letter Registrar of NMM Greenwich, 27.6.2008.

[8] See note to Journal for 9 April 1843.

[9] TNA ADM 183/112.

[10] The Long Service and Good Conduct Medal, with gratuity, was instituted by Order in Council dated 19 July 1830 (which was not published at the time, but copies were sent to the fleet, Douglas-Morris *The Naval Long Service Medals*, p.6) and details appeared in the *Navy List* of October (correct to 20 of September) 1830 and subsequent volumes to January 1845, under Greenwich Out Pensions, Article 12. From 1831 it quoted Order in Council of 24 August 1831. It reads: 'As a further encouragement to good Men to continue in the Service, and to behave with propriety, His Majesty has been pleased to command, that at the expiration of every three years any of His Majesty's Ships shall have been in Commission, the Captain or Commander of such Ship may send to the Admiralty the name or names of any Petty-Officer or Seaman, or Non-Commissioned Officer or Private of Marines (not exceeding in number one for every hundred of the Crew) who may be on board such Ship, having served *above twenty-one years*, who shall have behaved invariably well in such Ship, and be in possession of Certificates of good conduct throughout his former service, and be in the Captain's opinion in every respect deserving to be so rewarded; when the Person or Persons so reported by the Captain or Commander shall be paid a Gratuity, in addition to all other allowances, of Fifteen Pounds, if a 1st Class Petty-Officer, or Sergeant of Marines, ... and to entitle the 1st Class Petty-Officer to the Fifteen Pounds he must have served as such Ten years...And all men receiving the said Gratuity will be afterwards entitled to wear a Silver Medal the size of a half-crown... ' *Navy List*, Dec. 1830, p. 163.

Meritorious Service Medal[1], with annuity, on 15 February 1854[2].

Fig. 2. Sergeant Cunningham's Meritorious Medal. Courtesy P W Denny.

In 1857 he became a Yeoman of the Guard of the Queen's Bodyguard[3]. He married Elizabeth Bailey[4], widow, and daughter of John Collins Hailes, on 22 April 1845, at Frindsbury Church[5] and is recorded as living with her at 18 Robert Street[6], Chelsea, in the 1861 Census and at 35 Robert Street in 1871 and

[1] The Meritorious Service Medal was an honorary distinction awarded to Non-Commissioned Officers of the Army from 1845. It was instituted for the Royal Marines by Admiralty Circular No. 47 of 16 January 1849, which stated 'A sum not exceeding two hundred and fifty pounds a year is to be distributed in granting annuities, as rewards for distinguished or meritorious service, to Sergeants who are now, or who may be hereafter, in the service, and such annuities are to be enjoyed either while the Sergeants are serving on shore, or after their discharge to pension, in sums not exceeding twenty pounds per year. The Sergeants selected for this honorary distinction shall be entitled to wear a silver medal having on one side Her Majesty's effigy, and on the other the words 'For Meritorious Service', and the name of the Sergeant, with the date of its grant; and will not be liable to forfeiture of the annuity and medal, except by sentence of Court-martial, or by conviction of felony by a Court of Civil Judicature.' A further circular of 6 February 1849 stated ... 'No Sergeant in the Royal Marines shall be considered eligible to the Annuity ... who has not served in the Corps with a perfectly irreproachable and meritorious character for, at least 24 years, fourteen consecutive years of which shall have been served as Sergeant...' The annuity granted was normally Ten Pounds so that no more than 25 Sergeants were in receipt of it at any one time. Quartermaster Sergeant Cunningham was awarded this honour when Bk. Mr. Sgt. James Snape (one of the original holders of the honour) died in 1854. Bilcliffe, *Irreproachable Character*, pp. 4 & 186.

[2] The medal is inscribed on the edge 30 Jan. 1854 (McInnes, *Yeomen*, p. 107) which is presumably the date it was awarded, while the date in his papers that on which it was presented to him.

Career details from Record of Service and Attestation Certificate, TNA. ADM 157/21, Items 282, 283 and 284. Ships, Commanding Officers and station from *Navy Lists* 1831–35, and O'Byrne, *A Naval Biographical Dictionary*.

[3] The Yeomen of the Guard were set up by Henry VII, in 1485. Their last action in the field was with George II at the battle of Dettingen, in 1743, thereafter they became a civilian organisation, paying for the privilege of holding the post. From 1823 the Yeomen were appointed from former senior Non-commissioned Officers of the Army and Royal Marines. The Guard, as distinct from the Warders, lived in their own homes and attended on the Sovereign on ceremonial occasions, e.g. Coronations, Receptions, State Opening of Parliament etc. They received an annual pension of £50 per annum. McInnes, *Yeomen*, p. xiii.

[4] The 1881 census records have the correct address, but show his wife as Lucy, which is incorrect (see note below), born in Lentissop, Kent in about 1819, which may or may not have been Elizabeth's birth place.

[5] Marriage certificate and register of All Saints Church, Frindsbury, p. 90, 1845, and TNA ADM 183/116, p. 12, No.56.

[6] Robert Street is no longer extant. It was situated close east of Chelsea Barracks, leading east off Commercial Road (now Ebury Bridge Road, running along the east side of Chelsea Barracks) between Gatcliff Road the south end of Ebury Bridge Estate. *Stanford's map of Central London*, 1897.

1881[1]. He was exempt from duty in 1882, most probably due to ill health[2] and moved to Barnfield House, Gillingham, Kent, where he died, from cirrhosis of the liver, on 28 November 1884[3]. He was survived by his wife, who died of bronchitis at 8 Waghorn Terrace, Chatham, on 2 February 1890[4]. There were no children.

Duties

Sergeant Cunningham was in charge of the Royal Marine detachment of one corporal and six privates, one of whom was discharged before sailing, one was detached to the observatory in Hobart and another invalided from the Falkland Islands. His duties included keeping watch on deck and acting as Principal of the Police[5] on board, which involved him very much in the maintenance of good order and naval discipline (the complement did not allow for a Master at Arms, with whom the Sergeant of Marines would have carried out these duties in a ship of the line), including the search for and recapture of deserters and closure and despatch of mail. He also attended the division of fresh meat in *Erebus*, when an animal was killed, which was divided between the two ships. He mentions doing a number of other tasks as well, like stuffing birds for Commander Crozier and copying the Master's log. He would also have attended all musters of the hands, making sure no one was missing, all punishments, the issue of spirits, splicing the main brace etc., and been present while bum boats were alongside.

In general Royal Marines were integrated into the ship's company and performed most of the duties of the sailors, but they were not required to go aloft, although they were not discouraged from doing so. Their specific duties normally involved acting as sentries on deck in harbour and at the cabin door and providing the guard whenever it was required, e.g. for the reception of visiting dignitaries.

MAGNETISM AND THE MARINER

> 'The Variation of the Compass (by which I mean the deflection of the Magnetical Needle from the true Meridian) is of that great concernment in the Art of Navigation, that the neglect thereof, does little less than render useless one of the noblest Inventions mankind ever yet attained to. '[6]

The attractive property of the lodestone was appreciated in antiquity, but it was not until much later that it was realised that it would produce, in iron, the property of pointing in a fixed direction. The Chinese were using this property at sea in a compass by 1090[7], but it was not until the 1180s that it is recorded in use at sea in Europe[8]. The earliest use mentioned in Islamic literature is in 1232[1]. It would therefore seem unlikely that

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[1] The 1881 Census shows him as married to Lucy, but since probate was granted on his will, dated 7 March 1857, on 24 January 1885, to his widow, Elizabeth Cunningham, this would appear to be either an error, or possibly a pet name for his wife. His estate was worth £4,785.

[2] Records of Service of The Yeomen of the Guard, St James's Palace, London, p. 97.

[3] Death Certificate, last Will and Testament with probate certificate. Bilcliffe, *Irreproachable Character*, pp. 172–3.

[4] Death certificate.

[5] Fordyce, *Outlines*, p. 198.

[6] Halley, Theory of Variation, p. 208. The variation was defined in 1581: 'The variation of the Needle or Cumpus, is properly the ark of the horizon contained between the true meridian of any place and the magneticall of the same, and is denominated to bee Easterly or Westerly, according to the position of the magneticall meridian to bee Eastwards or westwards of the true meridian.' Borough, *Discours of the Variation of the Cumpus*, Ch.1. Variation is the name used by seamen and, since this volume is concerned with a nautical voyage, is used throughout this work. It is known to scientists as declination.

[7] Needham. *Science and Civilization*, IV:3, p. 562.

[8] Alexander Neckam (1157–1217) who taught at Paris and subsequently became Abbot at Cirencester (1213), in his works, *De Naturis Rerum* and *De Utensilibus* gives an account of the occasional use of the compass needle. May. *History*, pp. 45 & 104–5. Waters, *Art*, p. 22.

its use came from China, and more likely that it was independently discovered in Europe. Sir Walter Raleigh thought it was first discovered among the Northern Nations[2], a view still held in the nineteenth century[3], however current scholarship appears to accept that the likelihood is that it was in the Mediterranean[4].

By the middle of the fifteenth century it was well known that the needle did not point towards the north geographic pole[5]. Columbus, in his writings, mentioned the change in variation as he sailed westward and is believed to have considered it a means of finding his longitude. It is mentioned by other writers as well[6]. That the variation changed with time was suspected and confirmed by Henry Gellibrand in 1634[7]. There were also concerns that the variation depended on the lodestone used and where the needle had been magnetised and adjacent land masses[8] – these were raised at the Royal Society in 1667[9] and answered by John Seller who was able to state he had made trial and that different lodestones and methods of touching made no difference to the pointing of the needle[10]. That the needle also pointed downwards (dip) was found out by Robert Norman in 1581[11], which gave rise to hopes that dip might be used to find Longitude. In 1666

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[1] In Jami 'l-hikayat (A comprehensive book of Stories), Tibbetts, *Arab Navigation*, p. 290.

[2] Raleigh, Invention of Shipping, p. 13.

[3] 'If the discovery is European, there is no people ... more likely to have made it than the early Norwegians; and as there is reason for believing that they were acquainted with the directive property of the loadstone at least half a century earlier than its use is supposed to have been known in other parts of Europe, it may be but justice to allow them the honour of having been the discoverers.' Hunter Christie, Report on the State, p. 105.

[4] Waters, *Art*, p. 21, Taylor, *Haven-finding*. p. 92, and May, *History*, pp. 45–7 & 51. The first actual reference to a compass-card is in 1380.

[5] Taylor, *Haven-finding*, pp. 172–3. Portable sundials, the oldest surviving one being dated 1451, carried a mark where the needle should be aligned so that the dial could be set correctly. Tiberius Cavallo, *A Treatise on Magnetism*, p.317, states that a letter by Peter Adsiger of 8 August 1269 remarks 'Take notice that the magnet (stone), as well as the needle that has been touched by it, does not point exactly to the poles.' Hunter Christie, Report on the State, p. 106, is sceptical about the authenticity of this letter, and I have not been able to verify it.

[6] Taylor, *Regiment*, p. 210. '... bicause in long viages going far vnto the Wesrware or Eastward, the compasse doth varie.' ibid. p. 273. 'As touching the variation of the c[o]passe called the Northeasting or Northwesting, it is supposed that the Co[m]passe doth varie by proportion, in sayling to the Eastward or Westwardes: and ... if it varieth by proportion that the Northpoint is varied one poynt from the North at .22. degrees and a halfe, and so vntill the North point doth stande Northeast or Norwest. And that is, when you are .90. degrees from the Meridian that the compas was made at to the Eastwards or Westwards.' Bourne goes on to suggest, that, if it be true, that the variation is proportional to the distance travelled, it could be used to find the Longitude.

[7] Gellibrand states that in London in 1580 Mr Burrowes found the variation to be 11°17'30"E, in 1622 Mr Gunter got 6°15'E in the same place, a change in 42 years of 5° and he confirmed the change and in 1634 founding it 4°4'E in June and 4°in July. 'Hence therefore we may conclude that for the space of 54 years (the difference of time between Mr. Burrowes and these last observations of ours) there hath been a sensible diminution of 7 degrees and better.' Gellibrand, *Discovrse Mathematical*, p.19.

[8] See Waters, *Art*, p. 306–8, for remarks in Richard Polter's *The Pathway to Perfect Sailing*, London, 1605, on this subject.

[9] 'It was also propos,d, That it might be inquired into,
'1. Whether a *Needle* may be touched upon any Magnet, as not to point to the true *North* and *South*, to be tried in such places where there is no variation:
2. Whether different Load-stones will give different Directions: and whether fainter or stronger touches upon one and the same Magnet, will cause any Variation in the Direction; for which purpose as many Load-stones should be procured, as could be had, and a good number of Needles exactly made, of the same Metal, bigness, and figure.' Some Observations, pp. 413–4.

[10] Answer to some Magnetical Inquiries, pp. 478–9.

[11] Norman, *New Attractive*. Dedication p. Aiii. 'By occasion of my profession, making sundrie experiments of the Magnes stone, found at length among many other effects, the strange and newe propertie of Declinyng of the Needle.'
Ibid. p. 8. 'After I had touched the irons with the stone, that presently the north point thereof would bende or decline downwards under the horizon in some quantitie: in so much that the flye of the compasse which was before made equall, I was stil constrained to put some small peice of waxe in the south part thereof, to counterpoise this declining, and to make it equall againe.' Ibid. pp. 23–4.

the Royal Society advocated that 'Sea-men bound for far Voyages 'should, among other things, 'observe the Declination of the *Compass*, or its variation from the Meridian of the place, frequently; marking withal, the *Latitude* and *Longityude* of the place...carry *Dipping Needles* with them, and observe the Inclination of the Needle in like manner. '[1] These remarks were considerably enlarged the following year[2].

The mariners 'compass initially consisted of a needle in a straw floating in a bowl of water which was magnetised by a lodestone[3]. Later on, in 1380[4], there are records of a box with a needle in its centre on which rotated a flat disc marked with the points of the compass and controlled by a magnetised piece of iron attached to it. The binnacle, in which the compass was mounted is mentioned in ships' inventories in 1410–12[5]. William Barlow designed a new form of mariners' compass at the end of the sixteenth century which remained in use and largely unchanged until the eighteenth century. At the start of the century the compass was still basically a wooden box[6] with a detachable bottom so that the needle could be removed for retouching without breaking the watertight seal at the top. The card was mounted on a brass pivot and had one or two needles beneath it, the magnetism of which was weak. The first improvement came with the work of Dr Gowan Knight who found a better method of magnetising the needles and then designed a superior compass[7] which was adopted by the Royal Navy and continued in use until the Admiralty Standard Compass was produced in 1840.

In order to improve the dead reckoning[8] of ships and possibly find Longitude from variation a method of calculating the variation accurately from theory (confirmed by observation) and a compass that would give an accurate direction at sea were required. Neither was available.

Edmond Halley (1656–1742) was the first to try to produce a general theory[9] that would account for the variation of the compass[10]. He states, 'Now altho (through want of sufficient observations and some other difficulties which I shall shew anon) I cannot pretend perfectly to establish the numbers and rules of a *Calculus* which shall precisely answer to the Variations of all parts of the World: yet I suppose it will not be unacceptable to the curious to propose something of a light into this abstruse mystery; which, if no other, may have this good effect, to stir up the Philosophical *Genii* of the age to apply themselves more attentively to this

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'And although this variation of the needle be found in travaill to bee divers and changeable, yet at any lande or fixed place assigned, it remaineth alwaies one, still permanent and abiding. '

[1] Directions for Sea-men, p. 141

[2] Directions for the Observation, pp. 435–8.

[3] As described by Alexander Neckham.

[4] Francesco da Buti in his commentary on Dante. May, *History*, p. 51.

[5] See Waters, *Art*, pp. 21–9 for a fuller treatment of early compasses.

[6] Brass bowls appear in the middle of the seventeenth century, but due to expense, they were not common.

[7] A Description of a Mariner's Compass, pp. 505–12.

[8] This is keeping a record of a ship 's position by using the time passed, the course steered (corrected for variation), the speed travelled, the leeway made, together with an allowance for tide and current. It was known as the position by account, as opposed to the position by observation which involved observing the altitude of a heavenly body, generally the sun at noon, i.e. when it was at its greatest altitude.

[9] Halley, A Theory, pp. 208–21.

[10] Halley travelled to St Helena, leaving England in November 1676, on board the East India Company vessel *Unity*, on the recommendation of Charles II, to chart the southern sky, and returned in May 1678. During this period his interest in magnetism seems to have started, since Halley, A Theory, p. 211. contains a table with the value for the variation of the compass at St Helena in 1677 together with one for Ascension in 1678 which may be from Halley 's own observations.

useful speculation. [1] He then provides a table of variation for various places in the world together with the dates of observation, from which he draws the conclusion that 'The whole Globe of the Earth is one great Magnet, having Four Magnetical poles, or points of attraction, near each pole of the Equator[2] Two; and that, in those parts of the World which lye near adjacent to any one of those Magnetical poles[3], the Needle is governed thereby, the nearest pole always predominant over the more remote. [4]

He goes on to say 'There is yet a further difficultie, which is the change of variation, one of the discoveries of this last Century; which shews, that it will require some Hundreds of years to establish a compleat doctrine of the Magnetical System. From the foregoing Table it should seem, that all the Magnetical Poles had a Motion *West*-ward: but if it be so, tis evident that it is not a rotation about the Axis of the Earth; for then the Variations would continue the same, in the same parallel of *Latitude* (the *Longitude* only changed) as such is the motion of the Magnetical Poles, but the contrary is found by Experience. [5]

Halley returned to the subject in a second paper[6] in which he attempted to explain the difficulties 'one was that no Magnet I had ever seen or heard of, had more than two opposite Poles; whereas the Earth had visibly four, and perhaps more. And secondly, it was plane that those Poles were not, at least all of them, fixt in the Earth, but shifted from place to place as appeared by the great changes in the Needles direction within this last century of years ... whereas it is not known or observed that the Poles of a Load-Stone ever shifted their place in the stone. [7] He goes on to say that having despaired of accounting for these problems he stumbled on an Hypothesis and begs that, 'if I shall seem to advance any thing that looks like Extravagant or Romantick, the Reader [8] should suspend censure until he has studied it in full. He considers the globe and rejects the idea that a large part could move inside it since this would change the axis of rotation, alter the shape of the sea and cause all sorts of floods none of which were recorded. However this could be achieved if the earth were 'reckoned as the Shell, and the internal as a *Nucleus* or inner Globe included within ours, with a fluid medium between.... having the same common Centre and Axis of diurnal Rotation. [9] Then the inner globe would act as one magnet and the outer as the other and they could move relative to each other. 'I conclude, That the two Poles of the external Globe are fixt in the Earth, and that if the Needle were wholly governed by them, the Variations thereof would be always the same, with some little Irregularities ... But the internal Sphere having such a gradual transition of its Poles, does influence the Needle and direct it variously according to the result of the attractive or directive power of each Pole; and consequently there must be a period of the Revolution of this internal Ball, after which the Variations will return again as before. '[10] This however would be for future generations to determine, and Halley thought it might be 700 years. He goes on

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[1] Ibid. p. 209.

[2] This would appear to mean that near each geographical pole there are two magnetic poles.

[3] He placed the poles in the 'Meridian of the Lands end of *England* and not above 7 degrees from the Pole Arctic...in a *Meridian* passing about the middle of *California*, and about 15 gr. from the North pole of the World...The Two Southern Poles are rather farther distant from the South Pole of the World. The one about sixteen degrees therefrom is in the Meridian some twenty degrees to the Westward of *Magellans Straights*, or 95 degrees West from *London*:... The Fourth and last Pole ...being little less than 20 degrees distant therefrom, in the Meridian which passes through *Hollandia Nova* and the Island *Celebes* about 120 degrees East from *London*.' Halley, A Theory, p. 216.

[4] Ibid. pp. 215–6.

[5] Ibid. pp. 220–1.

[6] Halley, An account of the cause.

[7] Ibid. p. 564.

[8] Ibid. p. 564.

[9] Ibid. p. 568.

[10] Ibid. p. 569.

to hypothesis that in future it may be thought that there may be more than four poles required to account for the observed variation and that these can be accounted for in a similar way with a series of concentric shells separated by liquid round the solid core of the earth[1]. He includes a plea, (echoing the Royal Society in 1666) 'I must take leave to recommend to all Masters of Ships and all others, Lovers of natural Truths, that they use their utmost Diligence to make, or procure to be made, Observations of these Variations in all parts of the World, as well in the North as South Latitude (after the laudable custom of our *East-India* Commanders) and that they please to communicate them to the *Royal Society*. '[2]

Halley proposed, to the Royal Society, a voyage to test his theories and obtain more data. In due course the Royal Society approached the Lords of the Treasury who approved, Queen Mary gave encouragement and the Admiralty made the necessary arrangements for initially one voyage with Halley appointed 'Master and Commander. 'He carried out three voyages in the *Paramore,* 1698 to 1701. From these he published, in 1701, *A New and Correct Chart shewing the VARIATIONS of the COMPASs in the Western and Southern OCEANS as observed in y^e^ Year 1700, by His Ma^ties^ Command by Edm. Halley*. This showed the North and South Atlantic Oceans with lines of equal variation (isogonic lines) superimposed[3]. In 1702 Halley published *A New and Correct Sea Chart of the WHOLE WORLD shewing the Variations of the COMPASs as they were found in the Year MDCC*. This showed isogonic lines for the Atlantic and Indian oceans, leaving the Pacific void. Throughout his voyages Halley observed the variation of the compass, but not the dip - the angle at which the magnetic field acts relative to the horizontal. He was subsequently criticised for this, notably by William Whiston (1667–1752) who believed that Longitude could be found from the dip. Halley's charts were updated from time to time, but it became obvious that finding longitude by variation was not feasible. They did, however, serve the very useful purpose of providing the mariner with values for the variation for use in computing his position by account.

The fact that iron in the vicinity of the compass effected its accuracy had been appreciated for some time[4]; however, by the middle of the eighteenth century, the increased amount of iron was producing an inherent magnetism in ships, with its consequent effect on the compass. This is now known as deviation and its value and direction are dependant on the ship's structure, geographical position and heading. At the time it was quite unknown[5], and differences of direction generally were put down to the poor quality of the compasses.

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[1] It is surprising how similar this is to current theory. The observed earth 's magnetic field resembles that caused by a magnet which appears to be tilted to the axis by 11° away from the geographic North Pole at about 71° west of Greenwich. The mathematical description of this field is complex, and is usually done by multipole expansions, starting with a dipole, then quadrupole etc., located at the centre of the earth. When the field is described this way the dipole element accounts for more than 90 percent of the field.

Today it is believed the earth has a solid iron core surrounded by a layer of liquid iron with a solid crust on top of it. Heat is generated in the liquid layer by freezing onto the solid layer which results in movement of conducting material within the liquid layer, and due to pre-existent magnetism this has a dynamo effect giving rise to a magnetic field. This is the principal cause which gives rise to many subsidiary causes. In addition there are a number of external causes. The generation process is complex but it produces a self-sustaining magnetic field.

The field is subject to variation. The main field has two major disturbances producing reversal (the dipole component of the field appears to reverse direction at intervals varying between 40,000 and 35,000,000 years) and secular variation (changes over a short period, as opposed to those which take place in a geological time scale: observations of variation in London dating back to 1540 indicate that a cycle, with an amplitude of 30E is nearly complete). The ionospheric dynamo is subject to changes caused by the solar cycle, and solar and lunar tidal forces. The other factors are affected in different ways which also produce variations.

When surface observations are averaged over a number of years it is found that less than one percent of the surface field is due to external sources. McPherron, The magnetic field of the Earth.

[2] Halley, An account of the cause, p. 571.

[3] Thrower, *The Three Voyages.*

[4] 'That the Instrument thus furnished may truly performe his offic, there must iust regard be had to the Variation, as also of the diverse set of the Compasse: And likewise that it be not placed neare any loade-stone, yron or steele. 'Barlow, *The Navigators Svpply*, p. A2.

[5] There are a number of remarks, dating from the first half of the sixteenth century, on the effect of guns, anchors and other iron objects on the compass, but even the careful observations of William Wales on Captain Cook 's second voyage (1772–75) failed to identify the problem properly. Fanning, *Steady*, pp. xxii–xxiii.

The credit for first finding a logical explanation for this problem goes to Matthew Flinders (1774–1814). During his work in HMS *Investigator* off the Australian coast (1801–3) he worked out a theory of how the ship's magnetism was effecting the compass. In the front of his bearing book[1] he gives the method he used to correct magnetic bearings taken from the ship. His theory was basically that the deviation was zero when the ship's head was pointing North or South and reached a maximum at East or West, varying as the sine of the angle the ship's head deviated from Magnetic North in between. Thus if it were measured on any bearing, preferably due East or due West when it would be greatest, it could be determined on any bearing. The maximum value he also found depended on the dip and so this too had to be taken in to account. On his way back to England he put in at Île de France (Mauritius) and was interned by the French (with whom England was at war and of which he was unaware) so that he did not reach England until October 1810[2]. He then conducted experiments in six different ships and his report states his view that their magnetism is proportional to the angle of dip and depended on geographical position. He went on to explain how it could be countered. 'Take a strong bar of old iron, of such a length as that when one end is let into the deck, the other will be nearly upon the level with the compass card.'[3] This was followed by instructions for adjusting the bar to produce the right amount of correction[4]. He was also very critical of the compasses themselves 'amongst the nautical instruments taken to sea, there are not any so ill constructed, nor of which so little care is afterwards taken, as of the compasses.' He advocated the appointment of an Inspector of Compasses. The Admiralty, having consulted Sir Joseph Banks who consulted Major Rennell (an acknowledged expert on magnetism), did practically nothing and Flinders died on 19 July 1814.

In 1820 Professor Barlow, of the Royal Military Academy, was asked to examine the compasses in store at Woolwich. In his report he described the majority of them as 'mere lumber.'[5] No action was taken.

The problem of deviation was returned to in 1835, when, at the request of the Directors of Laird of Liverpool, the principal builders of iron ships in the country, the Admiralty carried out further test. These were done by Commander Edward J. Johnson[6] in iron paddle steamer *Garryowen*, firmly moored in Tarbert Bay and warped round to all points of the compass. Compasses were mounted at a large number of stations on board and the error observed by taking the bearing of a distant mountain, the direction of which had been previously determined on shore. The ship was also warped towards instruments set up on the quay. Johnson's conclusions were that the vessel acted as a permanent magnet and he suggested this might be due to the direction in which she lay on the building slip. He also suggested that another magnet might be used for correcting the deflections. These trials led to a further set carried out by Professor Airy, the Astronomer Royal in 1838 with the aim of trying to determine the laws governing deviation and if possible the neutralization of the forces concerned. His conclusions were that the deviation was caused by two modifications of magnetic power; namely the independent magnetism of the ship which retains its effect in all positions in the ship, and the induced magnetism which changes its direction and force as the ship changes its position. He proposed two permanent magnets set one fore and aft and the other athwartship which, when calibrated correctly would correct the deviation[7].

In 1837 Captain Beaufort, the Hydrographer, again drew Their Lordships attention to the danger to

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[1] UKHO. Miscellaneous Books No. 22. Bearings taken on board HMS *Investigator*: Captain Flinders: Australia 1801–1803. p. 1.

[2] From captivity he sent a paper to the Royal Society which was read on 28 March 1805, in which he outlines his theory. Flinders, Concerning the Differences, pp. 186–97.

[3] TNA. ADM 1/1809, No. 130A.

[4] This, now known as the Flinders Bar, was not introduced into the fleet for another fifty years.

[5] TNA ADM 106/2531.

[6] He was promoted Captain on 27 December 1838. *Navy List.*

[7] Airy's results and their shortcomings are treated at some length in Fanning, *Steady as She goes.* pp. xxxv–xlii.

shipping due to the sorry state of their compasses and he recommended setting up a committee to go into the matter. This time action was taken and The Admiralty Compass Committee[1] was set up, with Captain James Clark Ross as its chairman. They examined all available compasses and concluded that there had been no change since Professor Barlow's report, and that no compass then on the market came up to the required standard. After a large number of experiments they designed their own compass which after a number of trials became The Admiralty Standard Compass. This, among other improvements, had four needles spaced so as to balance the card and thereby eliminated the tendency of the single needle to align itself with the roll of the ship. It was not liquid filled, but, like Gowin Knight's compass had a brass circumferential ring suspended below the card to balance it[2].

In July 1837 the Secretary, at the request of HRH the President and Council of the Royal Society, forwarded a paper by Mr Christie to Sir John Barrow for the Lords of the Admiralty 'on the importance of a more accurate determination of the magnetic needle on the Coast of Great Britain and Ireland,' which was marked for Captain Beaufort[3]. In April 1838, Captain Ross advised the Admiralty of the need for an accurate study of the variation of the British Isles[4], which was passed to the Hydrographer, Beaufort, who advised that Ross himself would be the best person to carry it out, which he was instructed to do.

ORIGINS OF THE ANTARCTIC EXPEDITION

At the start of the nineteenth century interest in earth science took off, and particularly in terrestrial magnetism. The lead was taken by France driven by the *Académie des Sciences*. French eighteenth century expeditions[5] had measured variation and dip and attempts had been made to determine field strength[6]. Instruments were improved and work continued after the Revolution. The *Bureau des Longitudes* was established in 1795, with an aim of finding a means of determining Longitude at sea. Its concerns were with geodesy and geophysics which included astronomy and geomagnetism. Alexander von Humbolt was interested in the forces which operated within the earth and its environment. When he came to Paris in 1798 he was persuaded to give priority to geomagnetism on his forthcoming expedition up the Nile. This had to be cancelled due Napoleon's ambitions in Egypt, so he became involved with the Paris Observatory and was invited by Bougainville to join a French voyage of circumnavigation which would include high southern latitudes. This expedition was cancelled and Humbolt sailed for South America.

In 1811 the Royal Danish Academy of Sciences offered a prize for the best theory to account for geomagnetism. This was won by Christopher Hansteen (1784–1873) who proposed a four pole theory (not unlike that of Halley) with three poles rotating from West to East and one from East to West. Various other theories were proposed, Ampère favoured a two-pole system and Faraday's discovery of electromagnetic induction, in 1831, seemed to support this. Gauss favoured a mathematical theory which regarded the earth as an indefinite collection of magnets disposed in any manner and which could be fitted to observed data.

With the end of the Napoleonic wars in 1815 interest in scientific expeditions revived. The British[7] looked towards the North-west Passage[8] and the French circumnavigation, and both fields envisaged

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[1] It consisted of Francis Beaufort, James Clark Ross, Edward Sabine, Samuel Hunter Christie, Thomas Best Jarvis and Edward John Johnson. TNA ADM 235/20.

[2] Fanning, *Steady as she goes,* pp. 3–7.

[3] TNA ADM 1/4282. This contains the letter forwarding Christie's paper, which is not with it.

[4] TNA ADM 1/2436.

[5] L. Feuillée, 1707–12; N.L. Lacaille 1750; G.J. Le Gentil, 1761 & 1769, L.A. de Bougainville, 1766.

[6] Jaques Mallet, 1769.

[7] Under the influence of John Barrow, Second Secretary to the Admiralty, 1804–45.

[8] John Ross, 1818, *Isabella* and *Alexander* and 1829–33 (privately financed) *Victory*; William Edward Parry, 1819–20,

geomagnetic measurements[1].

Edward Sabine (1788–1883), an officer in the Royal Artillery, who sailed with John Ross, in 1818, as astronomer[2] and with Parry 1819–20 and 1821–3, had developed an interest in geomagnetism and the force of gravity during this period[3]. In 1828, as a member of the council of the Royal Society he was appointed Scientific Advisor to the Admiralty. His ideas developed into an extensive co-operative project to provide a new understanding of geomagnetism on a world-wide scale, requiring massive quantities of data from a chain of observatories and an expedition to the Antarctic. This project was first raised with the British Association for the Advancement of Science[4], which he joined in 1835[5].

The British Association had already been looking at geomagnetism. It had commissioned Professor S. Hunter Christie to produce a report on the subject in 1831 (which was presented at the 1833 meeting, in Cambridge, and published the following year[6]), and passed a resolution that 'a series of observations upon the *Intensity of Terrestrial Magnetism in various parts of England* be made by some competent individual... ' and 'a certain number of observations should be made throughout Britain with the *Dipping Needle*... '[7] At the 1835 meeting the 1831 resolution was enlarged to include a recommendation to the Government that a number of observatories be set up and an expedition to the Antarctic to obtain scientific observations be undertaken[8], however this was not urged on the government, due to the unfavourable circumstances of the

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Hecla and *Griper*; 1821–23, *Fury* and *Hecla*; 1824-5, *Hecla* and *Fury*; 1827, *Hecla*.

[1] Louis-Claude de Freycinet, 1817–20, in *Uranie*; Louis-Isidore Duperrey, 1822–25, in *Coquille*, who determined the position of magnet equator; Hyacinthe-Yves-Philippe Potentien de Bougainville, 1824–26, in *Thétis* and *Espérance*; Jules Sébastien César Dumont D 'Urville, 1826–29, *Astrolabe* (formerly *Coquille*), and 1837–40, *Astrolabe* and *Zélée.*

[2] His duties also included the earth 's magnetic field, the force of gravity, meteorology, tides, currents, seawater temperature and salinity, bottom sediments, and natural history. His first papers were on Arctic birds and the Inuit, but geomagnetism, gravity and auroras dominated his research. *DNB*.

[3] This was measured by timing free-swinging pendulums.

[4] The British Association for the Advancement of Science, founded in 1831, announced that: 'The Association contemplates no interference with the ground occupied by other Institutions. Its objects are, — To give a stronger impulse and a more systematic direction to scientific enquiry, — to promote the intercourse of those who cultivate Science in different parts of the British Empire, with one another, and with foreign philosophers, — to obtain a more general attention to the objects of Science, and a removal of any disadvantages of a public kind, which impede its progress. ' *Report of the First*, p. ix.

[5] For a detailed discussion on the Magnetic Crusade, as it came to be known, see Cawood, Magnetic Crusade and Cawood, Terrestrial Magnetism.

[6] Hunter Christie, Report on the State. It reviews the history of terrestrial magnetism up to that date, and considers its causes, 'Having discovered that a peculiar polarity is imparted to iron by the simple act of rotation, I was led to consider whether the principal phænomenon of terrestrial magnetism is not, in a great measure due to its rotation. The subsequent discovery by Arago, that analogous effects take place during the rotation of all metals, and Faraday's more recent discovery, that electrical currents are not only excited during the motion of metals, but that such currents are transmitted by them render such an opinion improbable. It is, however to be remarked, that, in all cases, motion alone is not the cause of the effects produced; but that these effects are due to electricity induced in the body by its motion in the vicinity of a magnetized body....Although it would therefore appear that the rotation of the earth is not the cause of its magnetism, yet it is highly probable, from Mr Faraday's experiments, that, magnetism existing in the earth independently of it, electrical currents may be produced, not only by the earth's rotation, but by the motion of the waters on its surface, and even by that of the atmosphere; so that the direction and intensity of the magnetic forces would be modified by the influence of these currents. ' pp. 117–8.

'If difficulties meet us at every step when we attempt to explain the general phænomena of terrestrial magnetism, these difficulties become absolutely insurmountable when we come to the cause of the progressive changes... Diligent and careful observation is the only means by which we can hope to attain this end ... ' p. 128.

[7] *Report of the First and Second Meetings*, p. 52

[8] Resolutions of the Magnetism Committee:
'1. That a series of observations upon the intensity of Terrestrial magnetism be executed in various parts of the kingdom, similar to those which have been carried out in Scotland by Mr. Dunlop.
'2. That observations should be made at various places with the Dipping-needle, in order to reduce the horizontal to the true magnetic

time. The magnetic survey of the British Isles was however undertaken, starting in Ireland, by Humphrey Lloyd, Edward Sabine and James Clarke Ross, and progressing to Scotland and England.

Sabine visited Germany in 1836 and Humbolt wrote to the Royal Society suggesting they should approach the British Government with a view to establishing a chain of observatories throughout the colonies to work in coordination with those in France, Russia and Germany. A Magnetic Committee was set up[1] but progress was slow[2].

The British Association returned to geomagnetism in 1838 when the undertaking was joined by Sir John Herschel, who had recently returned from South Africa. A further set of resolutions was passed[3], and as result he wrote to the Prime Minister, Lord Melbourne, and it was raised officially at Cabinet level on 29

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intensity.

'3. That it be represented to the Government of this country that it would be of great service to Science if Magnetical and meteorological Observatories were established in several parts of the earth, furnished with proper instruments, well conducted on uniform principles, and if provision were made for careful and continuous observations at those places; that in Great Britain and its colonies there are points favourable for such observations; and that it is more desirable that the British nation should take part in carrying them on, since a system of similar observations has already begun to be established in France and its dependencies.

That Mr. Baily, Mr. Davies Gilbert, Mr. Lubbock, and the Rev. G. Peacock, be a Committee to make the required representation to the Government, and to solicit the cooperation of the French Institute.

'4. That the East India Company be requested to further the same objects, especially at their establishment at Madras.

'5. That M. Arago be respectfully requested to publish, and to have reduced, his valuable and extensive collection of Magnetical Observations made at the Observatory at Paris.

'6. That a representation be made to the Government of the importance of sending an expedition to the Antarctic regions, for the purpose of making observations and discoveries in various branches of Science, as Geography, Hydrography, Natural History, and especially Magnetism, with a view to determining precisely the place of the Southern Magnetic Pole or Poles, and the direction and inclination of the magnetic force in those regions.

'7. That a further examination of the Electro-magnetic condition of mineral veins be recommended.' *Report of the Fifth Meeting.* pp.xx-xxi.

[1] It consisted of Sabine, Airy, Christie, Lubbock and Whewell, the principal activists in the British Association.

[2] Cawood, Magnetic Crusade, p. 505.

[3] 'Resolved,—

'1. That the British Association views with high interest the system of Simultaneous Magnet Observations which have been for some time carrying on in Germany and in various parts of Europe, and the important results towards which they have already led; and that they consider it highly desirable that similar series of observations, to be regularly continued in correspondence with and in extension of these, should be instituted in various parts of the British dominions.

'2. That the Association considers the following localities as particularly important:

Canada, Van Diemen's Land,
Ceylon, Mauritius, or the Cape of Good Hope,
St. Helena,

and that they are willing to supply Instruments for the purpose of observation.

'3. That in these series of observations, the three elements of horizontal direction, dip and intensity, or their theoretical equivalents, be insisted on, as also hourly changes, and on appointed days their momentary fluctuations.

'4. That the Association views it as highly important that the deficiency yet existing in our knowledge of Terrestrial Magnetism in the Southern hemisphere should be supplied by observations of the magnetic direction and intensity, especially in the higher latitudes, between the meridians of New Holland and Cape Horn; and they desire strongly to recommend to Her Majesty's Government the appointment of a naval expedition expressly to that object.

'5. That in the event of such an expedition being undertaken, it would be desirable that the officer charged with its conduct should prosecute both branches of the observations alluded to in Resolution 3, so far as circumstances will permit.

'6. That it would be most desirable that the observations so performed, both in the fixed stations and in the course of the expedition, should be communicated to Prof. Lloyd.

'7. That Sir John Herschel, Mr. Whewell, Mr. Peacock and Prof. Lloyd be appointed a Committee to represent to the Government these recommendations.

'8. That the same gentlemen be empowered to act as a Committee, with power to add to their number, for the purpose of drawing up plans of Scientific cooperation &c. &c., relating to the subject, and reporting to the association.

'9. That the sum of 400l. be placed at the disposal of the above-named Committee, for the purposes above mentioned.*

'* The application to Government on this subject has been successful, the command of the expedition to the Antarctic regions being entrusted to Capt. J. C. Ross.' *Report of the Ninth Meeting,* pp. xxi–xxii.

November 1838[1]. A few days before Herschel had been advised by Lord Minto, First Lord of the Admiralty[2], that the Royal Society carried more weight than the British Association[3], and the matter was raised again at the Royal Society (of which the British Association activists were also members) two weeks[4] later and at the next meeting Herschel presented a report requesting action in similar terms to those proposed by the British Association[5]. This was approved[6] and a committee was appointed which saw Lord Melbourne, who agreed that the government would take notice of the request. After considerable lobbying the Antarctic expedition was approved and Lord Minto, informed Herschel of this on 11 March. James Ross was appointed to lead the expedition in April[7]. There was consternation when, in early May, as a result of very small majority on the proposal to suspend the Constitution of Jamaica, Lord Melbourne resigned, as it was felt that Sir Robert Peel might cancel the operation. In the event Peel did not form a government[8], Lord Melbourne resumed office, and the expedition went ahead.

In his presidential address to the British Association, at their ninth meeting, the Revd W. Vernon Harcourt was able to say 'A few weeks since I bade farewell to one... setting forth on an enterprize full of labour and hazard, but full also of such visions of glory and so brilliant prospects for scientific conquests, that for the mind combining the high aims of the philosopher and the intrepidity of a sailor, no danger, no difficulty, no inconvenience seemed to exist... '[9] He went on to reflect on the possible consequences of the expedition 'The problem of Terrestrial Magnetism solved – first, the laws of the changes of the elements detected, their constant parts determined, and the whole proved to coincide with a theory based on a

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[1] Ross, *Voyage*, I. p. vii, says that 'This memorial, on its presentation to Lord Melbourne, was not only supported by the personal arguments of the eminent philosophers by whom it was framed, but on its being referred by the Government to the President and Council of the Royal Society, (its acknowledged advisers upon all points of scientific inquiry,) by similar and even more urgent representations on their part, "who, on this occasion, in a manner most honourable to themselves, and casting behind them every feeling but an earnest desire to render available to science the ancient and established credit of their institution, threw themselves unreservedly and with their whole weight into the scale, with immediate and decisive affect."*
*Quarterly Review, No. CXXXI. p. 297. June 1840. '

[2] Gilbert Elliot-Murray-Kynymound, 1782–1859, 2nd Earl of Minto, First Lord of the Admiralty 1835–41, Lord Privy Seal 1846–52. *Burke's Peerage.*

[3] Cawood, The Magnetic Crusade, p. 510, quoting Herschel's diary for 23 Nov. 1838.

[4] Revd W. Vernon Harcourt, in his Presidential address to the British Association said: 'The Royal Society, moved by a fresh spirit of zeal, its most distinguished members sacrificing personal considerations, and postponing individual to public projects ... and whom did I recognise, Gentlemen, among those who were thus zealously employed? Their faces were familiar to me; they were the same men who first proposed the subject and discussed it together at the meetings of this Association, the same who went from you to call the national attention to it, and had since added to that call all the influence and all the efficiency of the Royal Society. ' *Report of the Ninth Meeting*, p. 4.

[5] Herschell was chairman of the Joint Physical and Meteorological Committee. The report recommended the establishment of oberservatories in 'Canada, St. Helena, the Cape, Van Diemen's Land and Ceylon (or Madras), 'with observations being taken hourly of magnetic variation, dip and intensity, and at five minute intervals on specified days in agreement with European observatories, for three years. It also expressed the opinion that an Antarctic voyage of magnet research would be 'productive of results of the highest importance and value. ' *Nautical Magazine and Naval Chronicle*, Vol. 8, 1839, p. 110.

[6] The resolution states, *inter alia*, 'That the council, deeply impressed with the importance of the scientific objects which might be attained by an Antarctic expedition, particularly by the institution of magnetic observations in southern regions, do earnestly recommend the Her Majesty's Government be pleased to direct the equipment of such an expedition. ' Ibid. p.111.

[7] Cawood, Magnetic Crusade, pp. 510–11.

[8] This was because he and tried to persuade Queen Victoria to change some of the Ladies of her household who were related to Whig ministers. She refused and wrote to Lord Melbourne, who, on behalf of his cabinet, wrote to say they would stand by her, Peel resigned his commission. Woodward, *The Age*, pp. 103–5.

[9] *Report of the Ninth Meeting*, p. 3.

Legitimate representation of known facts. [1]

OBJECTIVES

The objectives of the expedition were set out in the orders issued by the Admiralty and the scientific objectives in a book issued by the Royal Society.

The Admiralty orders[2] for the expedition are quoted in full in Captain Ross's account of the voyage, together with the majority of the Physics and Meteorology sections of the Royal Society's instructions.[3] The Admiralty orders start: 'Whereas it has been represented to us that the science of magnetism may be essentially improved by an extensive series of observations made in high southern latitudes, and by a comparison of such observations with others made at certain fixed stations, and whereas practical navigation must eventually derive important benefits from every improvement in that science: we have, in consideration of these objects, caused Her Majesty's ships Erebus and Terror to be in all respects prepared for a voyage for carrying into complete execution the purposes above mentioned: and from the experience we have had of your abilities, zeal, and good conduct, we have thought fit to entrust you with the command of the expedition, and to direct Commander Crozier, whom we have appointed to Her Majesty's ship Terror, to follow your orders for his proceedings.

'You are therefore required and directed, as soon as both vessels shall be in all respects ready, to put to sea with them ... '

Captain Ross was instructed to call at Madeira (to rate chronometers), the Rock of St. Paul, St Helena (to land and set up a fixed observatory to be manned by the Royal Artillery), the Cape of Good Hope (to land and set up another fixed observatory to be manned by the Royal Artillery), thence to Marion and Crozet Isles and Kerguélen Island (where both magnetic observations and pendulum observations to determine the figure of the earth were to be taken). Thence, depending on the time of the year, either to the south to examine, and take observations on reported indications of land, or direct to Van Diemen's Land, where another observatory was to be established manned by naval personnel. As soon as this was established he was to proceed to Sydney (to take magnetic observations, since it was anticipated that Sydney would become the future reference for local observations), and New Zealand to take more observations, returning to Van Diemen's Land in time to refit and prepare for the southern summer voyage. The aim of this was to determine the position of, and if possible visit, the south magnetic pole[4]. At the expiry of the summer season, assuming the ships were not caught in the ice, they were to return to Van Diemen's Land to refit sailing for the south again the following year, and examine any land discovered, correct the positions of Graham Land and Enderby Land. Observations were to be taken at all possible locations and it was anticipated that the South Shetlands or Orkneys, or possibly Sandwich Islands and lastly the Falkland Islands would terminate their magnetic work, after which, provided no further orders were received he was to return to England.

'In the event of England being involved in hostilities with any other power during your absence, you are clearly to understand that you are not to commit any hostile act whatever; the expedition under your command being fitted out for the sole purpose of scientific discoveries, and it being the established practice of all civilised nations to consider vessels so employed exempt from the operations of war. '

The Royal Society Instructions were produced by committees, physics and meteorology (these two by

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[1] Ibid. p. 4.

[2] Drafted by Captain Beaufort, Hydrographer, dated 14 Sept 1839, (UKHO MB3: Minute Book No. 3, Sept. 1837 to May 1842, pp. 138–46, *Memorandum for the Orders of Captain James Ross of HMS Erebus* 14 September 1839) and forwarded with only minor alterations. e.g. On sailing from the Cape of Good Hope Beaufort says 'you are to proceed to the Eastward touching at Mauritius and Crozet isles, ' the final orders state 'touching at Marion and Crozet Isles. ' Mauritius is well off the track and would appear to have been an error (although, together with Isle of Bourbon, it is mentioned under the Heads of Inquiry at Specific Places in the Geology and Mineralogy section in the *Royal Society Instructions*, p. 30).

[3] Ross, *Voyage*, I, pp. xxii–xlvi.

[4] Captain Ross had already visited the north magnetic pole, which he reached on 1 June 1831. Ross, *Narrative*, pp. 549–66.

a joint committee), geology and mineralogy, botany and vegetable physiology, and zoology and animal physiology. The Report of the Physics and Meteorology joint committee was circulated by letter dated 1 July 1839, requesting the cooperation of the addressees[1]. It stated that 'Her Majesty's Government has ordered the equipment (now in progress) of a naval expedition of discovery, consisting of two ships under the command of Captain James C. Ross, to proceed to the Antarctic Seas for the purpose of magnetic research, also the establishment of fixed observatories at St. Helena, Montreal, the Cape of Good Hope, and Van Diemen's Land, having for their object the execution of a series of corresponding magnetic observations during a period of three years[2], in consonance with the views expressed in that Report. The Court of Directors of the Honourable East India Company have also, in compliance with the suggestions of the Royal Society, resolved to establish similar observatories at Madras, Bombay and at a station in the Himalaya Mountains.' It added '... it may here be noticed that one essential feature of them will consist in observations to be made at each station in conformity with the system (in so far as applicable) and at the times already agreed on by the German Magnet Association, either as they now stand or as (on communication) they shall by mutual consent be modified.' A list of instruments for each observatory and their estimated prices was included[3].

The Report, published dated 8 August 1839, was for the use of the expedition (it was subsequently revised and republished for more general use[4]). It contains, under Physics and Meteorology, sections on Terrestrial Magnetism, Figure of the Earth[5], Tides[6], Meteorology, Distribution of temperature in the Sea and Land, Currents of the Ocean, Depth of the Sea[7], Atmospherical Phenomena[8], Variable Stars, Refraction, and Eclipses: under Geology and Mineralogy, Miscellaneous Suggestions[9], Erratic Blocks[10], Volcanic Phenomena

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[1] One of whom was Captain Beaufort, Hydrographer of the Navy. UKHO Incoming Letters: Miscellaneous Letters and Papers, File No. 122.

[2] In the event the period of observations at the fixed observatories was extended twice, by a further three years on each occasion.

[3] Magnetic Instruments required at Observatories. UKHO Incoming Letters: Miscellaneous Letters and Papers File No. 122.

1 Declination Magnetometer }		
1 Horizontal Force Magnetometer }	Grubb, Dublin	£ 73 10
1 Vertical Force Magnetometer	Robinson	£ 21 00
1 Dipping Needle	Robinson	£ 24 00
1 Azimuth Transit	Simms	£ 50 00
2 Reading Telescopes	Simms	£ 6 6
2 Chronometers		£ 100 00

A similar set of instruments was supplied to each ship.

[4] See Rosove, *Antarctica*, pp. 325–30.

[5] Invariable Pendulums were to be used at several places especially in high latitudes, the tops of mountains (and at their respective bases) and on a fixed ice field as far from land as possible. (It was not until the mid 1950s that the measurement of gravity at sea, by pendulum, could be carried out. It was then done in a submarine submerged to sufficient depth to be clear of wave motion, later on gravimeters based on the spring principle were used.)

[6] Since it was anticipated that it would not be possible to obtain observations over a long period, the expedition was to attempt to obtain the correct establishment (mean lunitidal interval) of each place visited, time of high and low water, range and, if any, diurnal inequality.

[7] This calls for soundings in as great a depth as possible, and suggests trials of a system of sounding by exploding a charge just below the surface and listening for the returning echo from the sea-bed. Echo sounding came into general use slightly under one hundred years later!

[8] Apart from the normal requirements for information on storms, waterspouts, thunder, lightening etc., this also calls for remarks on Aurora and its effects on the magnetic needle. (This had been commented on in 1759. Caton, An Attempt to account.)

[9] i.e. Rocks and minerals, fossils, bones in caves, bone-breccia, coral reefs, floating drift wood and plants, islands, elevation of the land, terraces, depressions of the land, structure and forms of land, stratification and cleavage and floating masses of ice.

[10] Masses of rock, often found loose upon the surface, which differ from stone of the country.

and Heads of Inquiry at Specific Places[1]: Botany and Vegetable Physiology[2], Zoology and Animal Physiology, including marine invertebrate, fishes, reptiles, birds, mammalia and Particular regions[3]: finally there is a lengthy section on Instructions for Making Meteorological Observations at Fixed Observatories.

The section on Terrestrial Magnetism starts 'The subject of most importance, beyond question, to which the attention of Captain James Clark Ross and his officers can be turned, — and that which must be considered as, in an emphatic manner, the great scientific object of the Expedition, — is that of Terrestrial Magnetism ... ' It continues to review the position with regard to magnetic theory which divided into two branches. The one considering the distribution of magnetic influence over the globe when the effects of temporary fluctuations had been eliminated, and the other the considering all that was not permanent in the phenomena, i.e. variations taking place over short (momentary) to prolonged (many years) periods. These remarks conclude: 'The electrodynamic theory, which refers all magnetism to electric currents, is silent as to the causes of those currents, which may be various, and which only the analysis of their effects can teach us to regard as internal, superficial or atmospheric. '

The observations to be taken were of Magnetic Declination (variation), Inclination and Intensity. At sea these were to be made daily, weather permitting, using Mr Fox 's instrument[4] to measure Inclination and Intensity, while the Variation was obtained by the standard compass. Certain precautions were to be taken to obviate the magnetic effects of the ship itself: With every set of observations the ship's head was to be noted: The ship was to be swung round the anchor when ever possible, taking a complete set of observations on each cardinal point: When ever magnetic observations were taken ashore or on the ice, duplicate observations were to be made in the ship: No change was to be made in the disposition of considerable masses of iron on board, or if necessary it was to be noted: When crossing the line of no dip observations were to be made on a series of different magnetic azimuths.

On land or on ice every opportunity was to be taken to observing the same parameters, with as much exactness as practicable, using similar instruments to those supplied for the fixed observatories. If they visited a place where magnetic observations had already been taken they were to repeat the observations to determine any change with the lapse of time.

Gauss had established a chain of observatories across Russia and Europe[5], which carried out observations every five minutes over a period of twenty-four hours four times a year, in order to determine the synchronism of the magnetic perturbations. It was anticipated that the additional stations to be set up by the British Government would enhance the data obtained by these (since they covered a somewhat limited part of the globe), and also provide readings in the vicinity of the points of maximum intensity - Canada and Van Diemen 's Land – where the perturbations might be expected to be at their greatest[6].

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[1] St Paul 's Rock, St Helena, Mauritius, Isle of Bourbon, Kerguelens Land, Van Diemen's Land, New Zealand, Land in Antarctic Regions, Staten Island, South Shetland Isles, Icebergs.

[2] Collections were to be formed of seeds and bulbs of useful and ornamental plants which were to be forwarded to Europe with duplicates to Calcutta for distribution in India. Two complete collections were to be made for the Government, one for incorporation with the general collection of the public and the other preserved separately to illustrate the botany, &c., of the expedition. (The Hydrographic Office had also produced a modest paper, *On Collecting Plants and their Products*, London, 1833, 4 pages, which may well have been on board.)

[3] Listing species worthy of particular attention and their habitats.

[4] This consisted of a dipping needle with a graduated circle. The needle was supported on an axle which terminated in small cylinders, supported on jewelled bearings. A small grooved wheel was carried on the axle with a thread of unspun silk on it with hooks at each end to which small weights could be attached. These were used to deflect the needle from its position of rest. The weight being constant and the magnetism of the needle being assumed also to be constant, the amount of deflection was proportional to the intensity of the earth's magnetic field. Readings were taken with the weight attached first to one hook and then the other, deflecting the needle upwards and downwards, and with different weights. The apparatus was mounted on a gimballed table. When the weather precluded the use of weights deflecting magnets could be used. Full details are given in Herschel, *Manual*, pp. 19–21, and 38–42.

[5] At Altona, Augsburg, Berlin, Bonn, Brunswick, Breda, Breslau, Cassel, Copenhagen, Dublin, Freyberg, Göttingen, Greenwich, Halle, Kazan, Cracow, Leipsic, Milan, Marburg, Munich, Naples, St Petersburg and Uppsala.

[6] In the event the full extent of participating observatories in 1840 was:

The principal object of the observatories, however, was to be the hourly readings and 'from the accuracy of which the observations are susceptible, and the extent which it is proposed to give them, there can be no doubt that a very exact knowledge of the empirical laws will result. '

The days selected for simultaneous observations at the fixed observatories would include the *terms*[1] or stated days of the German Magnetic Association (*Magnetische Verein*), and Göttingen Mean Time was adopted to synchronize measurements – despite which the *Magnetische Verein* only appears to have cooperated when its observations happened to overlap.[2]

Meteorological data was to be noted during observations; special attention was to be paid during any earthquakes which might be experienced and during auroras continuous uninterrupted observations were to be taken.

Observations and collections were to be obtained under all the headings in the Instructions listed above so that whenever landings were made, if possible, the portable observatories were set up, the chronometers rated, observations taken for position and gravity (with the invariable pendulum), while the geologists (M^{c}Cormick and Robertson) and the botanists (Hooker and Lyall) made collections (including zoology), and the tides were observed. At sea magnetic observations were taken daily, weather permitting, meteorological data was collected; soundings and seawater temperature taken when practicable, currents measured, and specimens of birds and marine creatures collected. Observations were also required on eclipses, aurora, meteors, shooting stars, and the brightness of southern stars, together with the amount and laws of horizontal refraction, both celestial and terrestrial.

THE VOYAGE

HMS *Erebus* and *Terror* were inspected by the First Lord of the Admiralty, the Earl Minto, together with Vice Admiral Sir Charles Adam and Rear Admiral Sir William Parker on 2 September 1839 and on the 19th they moved down river to moorings off Gillingham. Final stores were embarked and the ships swung to determine the errors of their compasses; The Commander in Chief, Vice Admiral Sir Robert Otway visited the ships; the crews were paid three months advance wages, and on the 25th the ships slipped and sailed down the Medway to Sheerness. *Erebus*, after a night at anchor, was towed to Margate where she was joined the next day by the *Terror*. They were delayed by contrary winds until 30 September when they were finally able to start their voyage. The ships were separated by a gale, off Start Point, on 3 October, and proceeded independently to Madeira. Captain Ross, in *Erebus*, arrived first and was joined by Crozier in *Terror* four days later. They took observations ashore and sailed on 30 October, calling at Santa Cruz de Tenerife to land mail, and proceeding thence the Cape Verde Islands where they came to anchor off Priai, São Tiago. Observations were again taken ashore, however the magnetic observations were unsatisfactory, due to the volcanic nature of the islands; the chronometers were rated. They next called at São Pedro e São Paulo (Saint Paul 's rocks), and, having landed, proceeded to Ilha da Trindade where they landed again. The next stop was at Saint Helena, where the first permanent observatory was established, manned by Lieutenant Lefroy and men of the Royal Artillery. Thence the ships sailed to Simon 's Bay, under the Cape of Good Hope, arriving 17 March 1840. Another observatory was established ashore under the direction of Lieutenant Eardley

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Admiralty and Royal Artillery: Greenwich, Dublin, Toronto, St Helena, Cape of Good Hope, Van Diemen 's Land.
East India Company: Madras, Simla, Singapore, Bombay.
Russian Government: Ten stations in European and Asiatic Russia plus Peking.
Other: Prague, Milan (Austrian Government); Philadelphia, Cambridge Massachusetts (Respective Universities); Algiers (French Government); Breslau (Prussian Government with British help); Munich (Bavarian Government); Cadiz (Spanish Government); Brussels (Belgian Government); Cairo (Pacha of Egypt); Trivandrum (Rajah of Trivandrum); Luknow (King of Oude). Cawood, Magnetic Crusade, p. 513.

[1] A system of monthly days at which all stations undertook a series of intensive observations.

[2] Cawood, Magnetic Crusade, p. 513. Ross, *Voyage*, I. p. 111, records that observations were taken every two and a half minutes throughout the twenty-four hours of the term day, and, ibid p. 113, every hour for the remainder of the time.

Wilmot with three assistants from the Royal Artillery.

The ships sailed on 6 April and were immediately separated in a gale, and made their way independently to Kerguélen. Captain Ross, having embarked some stores for the sealers on Crozet Islands, after considerable difficulty hove to off Île de la Possession, and was boarded Mr Hickley and a party from the shore. *Erebus* then continued her passage and was rejoined by *Terror* in Christmas harbour, Îles Kerguélen. The observatory was landed, astronomical, gravity (pendulum), magnetic and tidal observations taken, the chronometers rated, and Port Christmas (Christmas Harbour) and the adjacent bays surveyed. The weather was generally tempestuous and they were glad to get away on 20 July 1840.

The ships were again separated in bad weather. The Boatswain of *Erebus* fell from the rigging and was lost overboard, although two boats were lowered they were unable to save him and the loss was nearly made worse when four of the sailors in one of the boats were washed into the sea by a huge wave. They were however recovered and the boats re-hoisted with considerable difficulty. *Erebus* arrived off the Derwent River, Tasmania, on 16 August to learn that the *Terror* was already there.

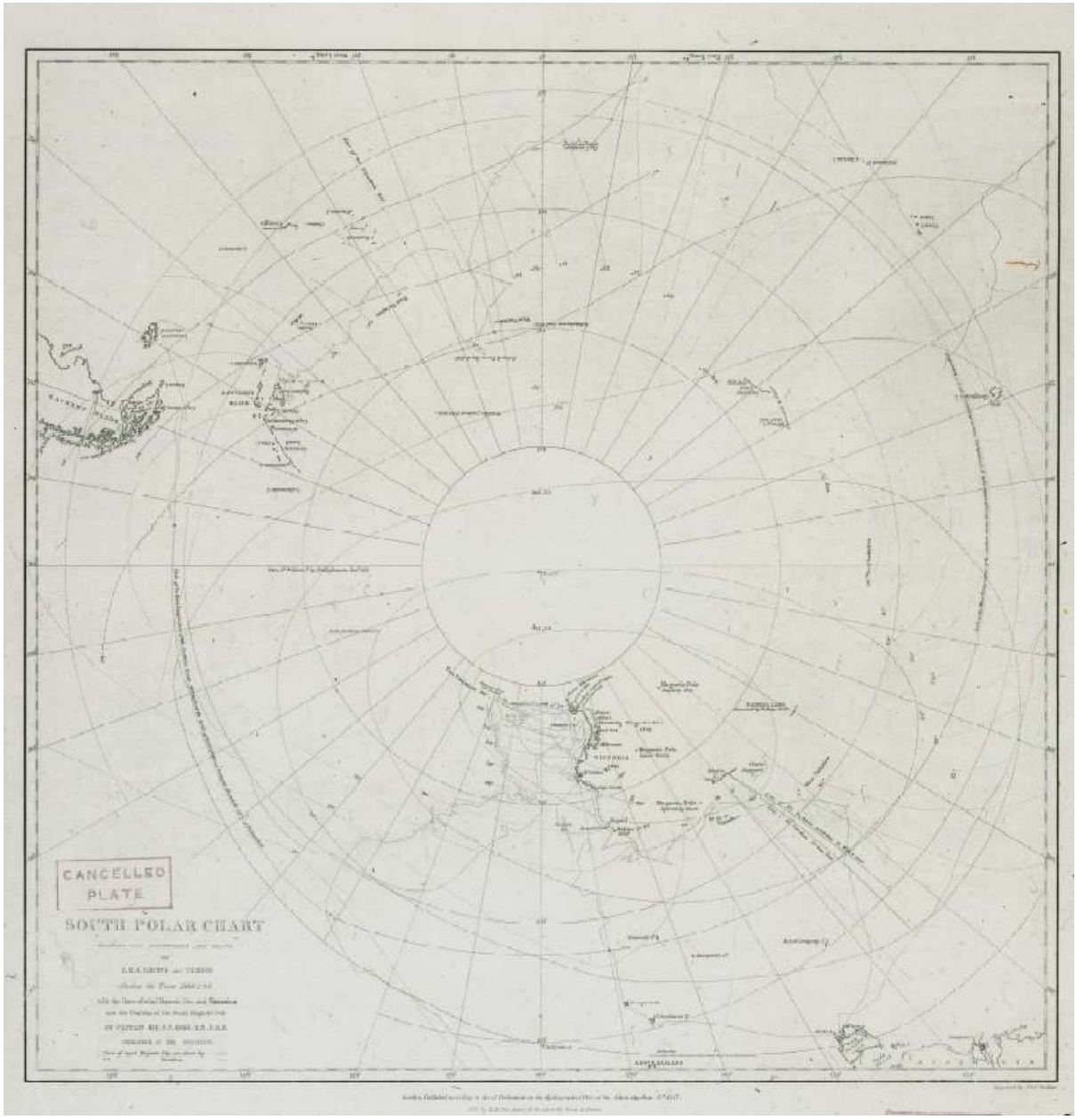

Fig 3. South Polar Chart shewing the track of HMS *Erebus* and *Terror*, during the years 1840,1,2,3. 1847. Courtesy UKHO, Cancelled Plate C 56.

In Hobart they were all made welcome by the Lieutenant Governor, Sir John Franklin, who was already well known to Ross. Another observatory was established ashore, under Lieutenant Kay of *Terror* with Mr Scott and Mr Dayman, mates of *Terror* and *Erebus* respectively, and a marine from each ship. The crews were able to rest and recuperate and the officers were entertained by Sir John Franklin and the local residents; fresh provisions were embarked and the ships got ready for the main objective of the expedition in the Antarctic.

On arrival in Hobart Ross had learned of the French and American Antarctic voyages of Captain Dumont D 'Urville and Lieutenant Charles Wilkes. The former had published an account of his discoveries[1] and Wilkes, despite his instructions to keep his results secret, wrote a friendly letter to Ross, from the Bay of

[1] Ross, *Voyage*, I. pp. 114–5.

Islands, New Zealand, dated 5th April 1840, enclosing a chart of his discoveries[1]. Neither had found the south magnetic pole, although D'Urville had searched for it. There has been some dispute over Ross's reaction to the news of these two voyages, but the result was that he determined to go further to the east than they had, to an area where open sea had been reported by sealers.

The ships sailed from Hobart on 12 November 1840, calling first at the Auckland Islands, where the usual observations were taken. Course was then directed to Campbell Island where both ships ran aground on the way to the anchorage. They were re-floated without damage. Having taken more observations and completed wooding and watering the ships sailed towards the south on 17 December.

They reached the edge of the pack ice on New Years day, 1841 and pushed into it. Captain Scott says 'Making all allowance for the fortified condition of the ships, it was a bold stroke'.[2] Amundsen was more extravagant, 'Ross plunged boldly into the pack with his fortified ships, and, taking advantage of the narrow leads, came out four days later, after many severe buffets in the open sea to the South... these men sailed right into the heart of the pack, which all previous polar explorers had regarded as certain death. It is not merely difficult to grasp this; it is simply impossible – to us, who with a motion of the hand can set the screw going, and wriggle out of the first difficulty we encounter. These men were heroes – heroes in the highest sense of the word.'[3]

They crossed the open sea, now know as Ross Sea, and discovered land on 11 January 1841, which Ross named Victoria Land, after his sovereign. The highest mountain was named after Lieutenant Colonel Sabine 'one of the best and earliest friends of my youth, and to whom this complement was more especially due, as having been the first proposer and one of the most active and zealous promoters of the expedition.'[4] Names of friends, M.P.s, members of the Admiralty Board, Royal Society, British Association for the Advancement of Science, etc. were given to mountains, headlands and islands. They landed on Possession Island and formally took possession of the newly discovered land 'in the name of our Most Gracious Sovereign, Queen Victoria.'[5]

The land effectively barred the way to the south magnetic pole. 'New portions of land opened to our view as we proceeded to the southward. The sun shone forth with great brilliancy ... and its beams were reflected from the now distant mountains in every variety of tone and modification of light which the different forms of their icy coverings exhibited; and which, whilst attracting the admiration, and delighting the eye, could not fail also to improve the mind; for how was it possible thus to admire the stupendous and magnificent fabric, without our thoughts rising in adoration of the Author, and Maker, and Preserver of all?'[6] On 27 January they sighted a new island, which on closer approach the next day, turned out, to their amazement, to be an active volcano. It was named Mount Erebus and another extinct volcano to the eastward, a little inferior in height, Mount Terror. 'As we approached the land under all studding-sails, we perceived a low white line extending from its eastern extreme point as far as the eye could discern to the eastward. It presented an extraordinary appearance, gradually increasing in height, as we got nearer to it, and proving at length to be a perpendicular cliff of ice, between one hundred and fifty and two hundred feet above sea level, perfectly flat and level at the top ...

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[1] Ibid. pp. 115–6. The letter is given in full at: ibid. Appendix IV, pp. 346–52 together with a copy of the chart.

[2] Scott, *Voyage of the Discovery*, I. p. 21.

[3] Amundsen, *The South Pole*, I. p. 12.

[4] Ross, *Voyage*, I. p. 183.

[5] Ibid. p. 189.

[6] Ibid. pp. 197–8.

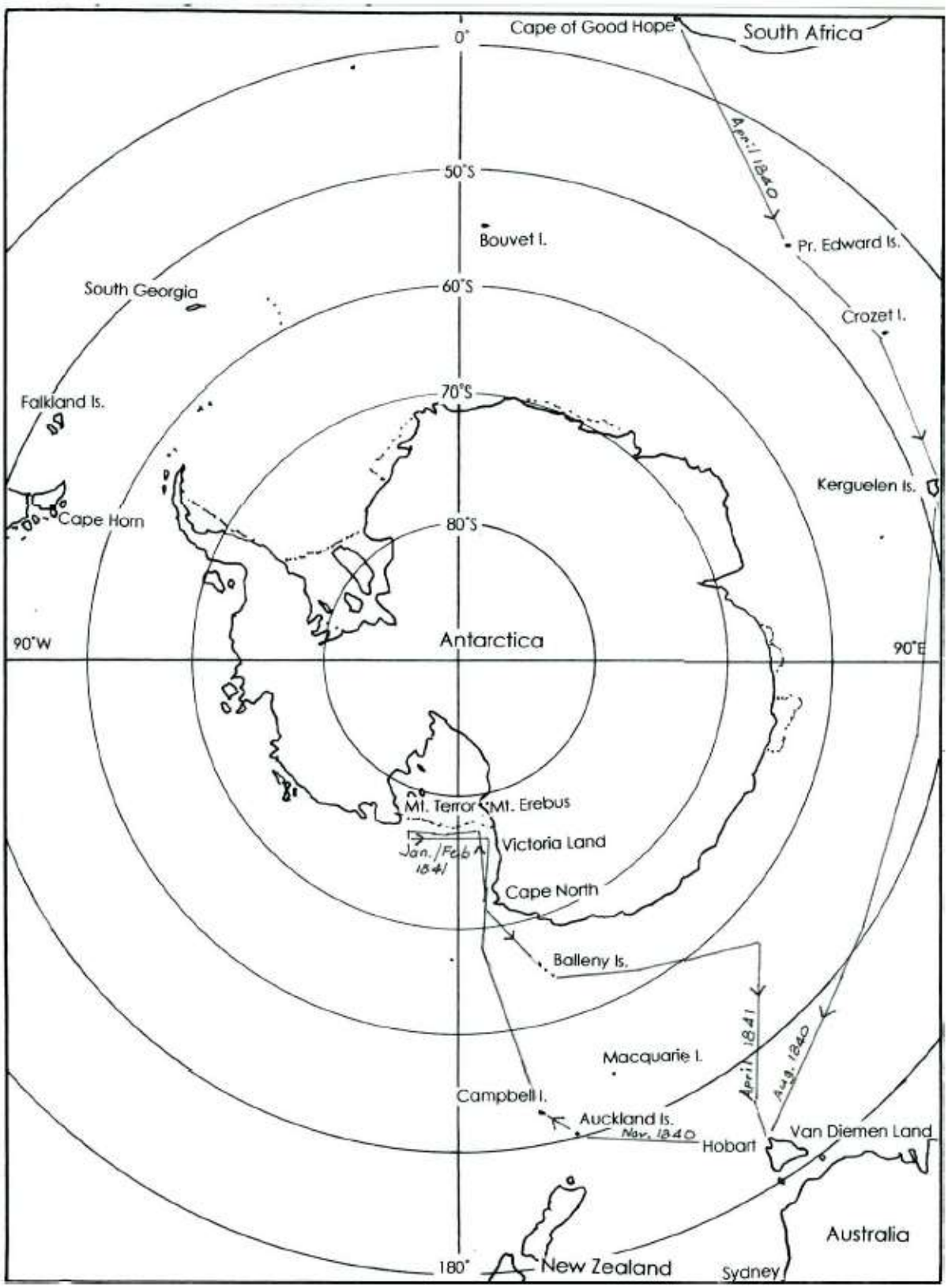

Fig. 4. Route of HMS *Erebus* and *Terror*, 1840–1841.

What was beyond it we could not imagine; for being much higher than our mast-head, we could not see any thing except the summit of a lofty range of mountains extending to the southward as far as the seventy-ninth degree of latitude. [1] They followed the barrier as far as they could and searched for a harbour in which to winter, but without success, and turned north. Passing the islands discovered by Balleny in *Eliza Scott*, they searched for the land discovered by Wilkes. Ross was concerned that he would be unable to weather it. 'We had a moderate breeze from the eastward, and a beautiful clear day, so that land of any great elevation might have been seen at a distance of sixty or seventy miles. As we advanced on our course in eager expectation of "making the land," our surprise and disappointment may be imagined when no indications of it were seen at sunset, although we were not more than twelve or thirteen miles from its eastern extreme, as laid down on Lieutenant Wilkes's chart; and we began to suspect that from having had but little experience of the delusive appearances in these icy regions, he had mistaken for land some of the dense well-formed clouds which so continually hang over extensive packs of ice. [2] The conclusion was indeed that Wilkes's Land did not exist, which subsequently gave rise to considerable controversy, discussed by Ross in his account of the voyage[3].

Thence they proceeded to the position of maximum magnetic intensity, as indicated by Colonel Sabine's calculations, in about latitude 47°S, longitude 140°E, but were forced to conclude that the actual position lay considerably further to the south. The ships reached Hobart again 6 April to be greeted warmly by Sir John Franklin. Ross recorded that 'it was a source of no ordinary gratification to me to reflect that the execution of the service had been unattended by casualty, calamity, or sickness of any kind, and that every individual of both ships had been permitted to return in perfect health and safety to this our southern home. [4] Ross immediately forwarded a report of his discoveries to the Admiralty, which was greeted with great acclaim (and delight by his friends). Details were published in the newspapers[5] and in due course extracts were published in *Return to an Address of the Honourable The House of Commons, dated 26 August 1841*. He wrote to Beaufort on 9 April 'I trust the results of our operations will be satisfactory to you, I am the more anxious that you should be satisfied with our exertions because of the high expectations you have always expressed and from being to a certain degree <u>security</u> for my good behaviour - and altho' our Geographical discoveries may be of sufficient importance to justify the hope that it may be Considered that the Expedition has not been sent forth in vain - and the conclusions & extensive series of magnetic and other observations will I trust be deemed not unworthy of praise. Yet I cannot conceal from you the deep disappointment I feel in not having attained the M^{c} <u>Pole</u> itself and being so completely defeated in all attempts to find a harbour in which to pass a winter. 'He went on to say that he felt it unlikely they would succeed the following year, but would do his best and added 'I send you herewith the original tracing & a copy of Lieut Wilkes's letter to me by which you will perceive the great mistake he has made & the very cursory manner of his proceedings, sufficient I think to throw great doubt on all he has done and I have no doubt that many other of his Mountain Ranges will prove to be delusive appearances by which an unpractised eye in the Icy Regions is so likely to be deceived. [6] He also forwarded a sketch of his discoveries, see Fig. 6.

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[1] Ibid . pp. 217–8.

[2] Ibid. pp. 278–9.

[3] Ibid. pp. 285–99, and Appendix No. VI, pp. 346–59. See also Ross, *Ross in the Antarctic*, pp. 118–132.

[4] Ross, *Voyage*, I. p. 323.

[5] Ross, *Ross in the Antarctic*, pp. 109–111.

[6] UKHO. SL 25a. Incoming Letters: Surveyors 'Letters: James C Ross: letter to Captain Beaufort 9 April 1841. The letter is marked Rec^{d} 10th August.

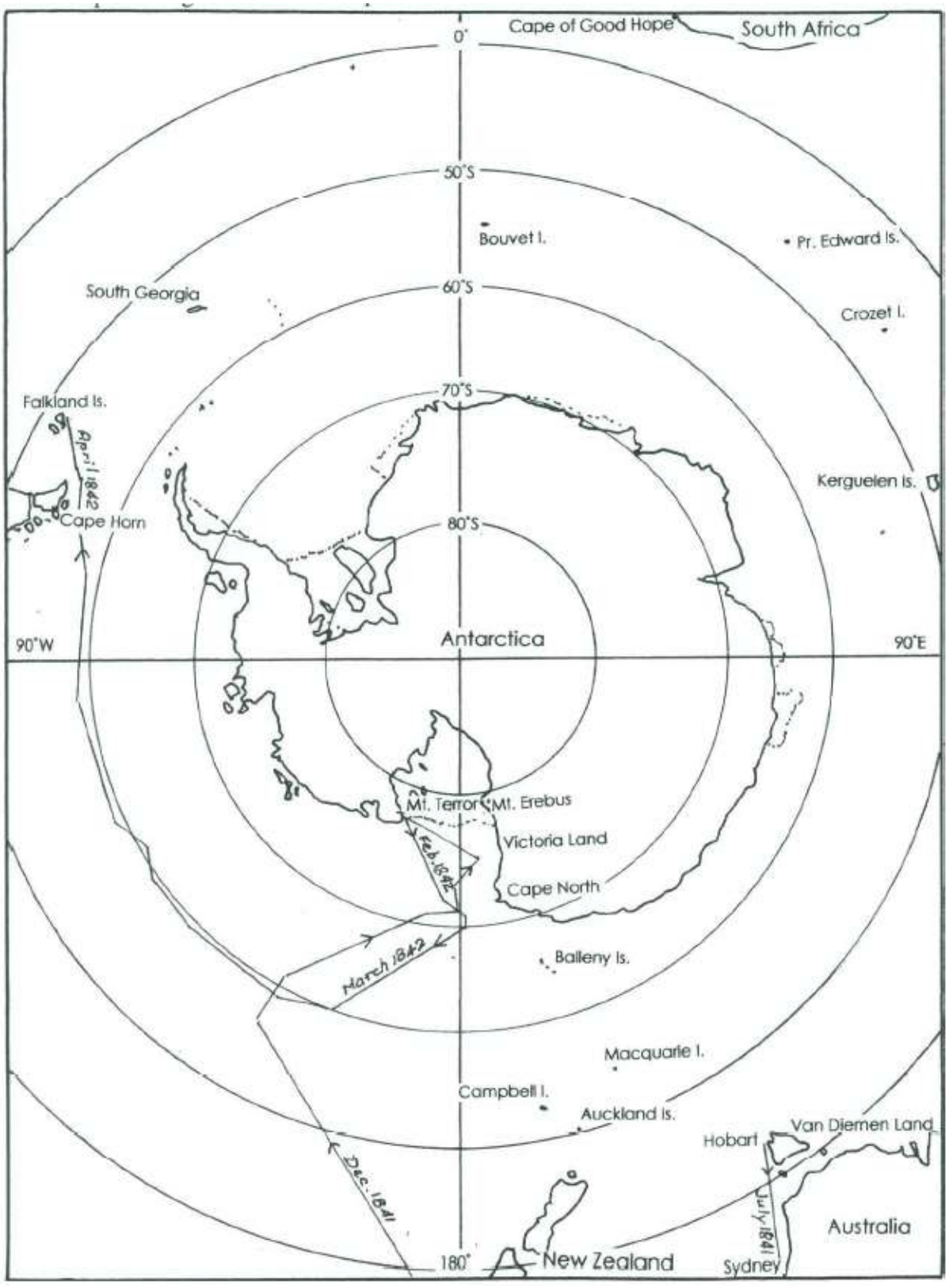

Fig. 5. Route of HMS *Erebus* and *Terror*, 1841–1842.

As before the ships companies were entertained ashore and made very welcome. The instruments checked and observations taken, the ships refitted and prepared for the next season's work and stores embarked. In order to repay some of the hospitality the two ships gave a ball on 1 June 1841, which was a great success and extravagantly reported by the local newspapers. They sailed again on 7 July, calling at Sydney, where the observatories were landed and observations taken, before proceeding to the Bay of Islands in New Zealand where more observations were obtained. The ships left the Bay of Islands on 23 November 1841, with the intention of calling at the Chatham Islands, but were unable to do so. The second Antarctic voyage aimed to start where the first had ended at the eastern end of the barrier reef in the Ross Sea. The ships ran into the pack ice on 18 December and spent a dreary Christmas day warping their way through the ice. The end of the month saw them locked in the ice and allowed them to celebrate the advent of the New Year in style with all manner of revelry, including a ball, and the traditional ringing of the ship's bells at midnight. Before they reached open water the ships were severely damaged in a gale and *Terror* had to replace her rudder. Finally, on 12 February they got clear of the ice, and were able to make their way to the eastern end of the Barrier which was reached on the 22nd, and where the furthest south was achieved in Latitude 78°9'30"S. After an attempt to follow the barrier, they turned north and having cleared the pack, on 9 March, altered course to the east for Cape Horn.

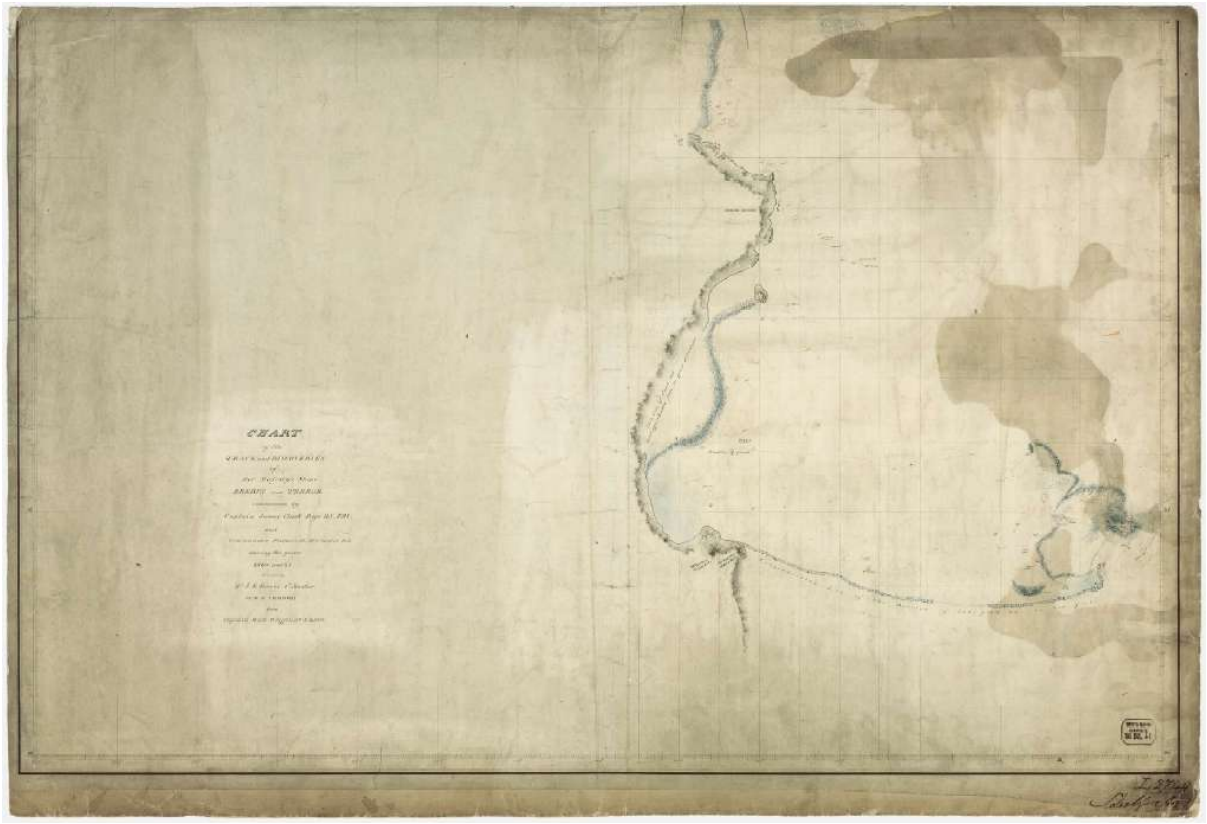

Fig. 6. Chart of Victoria Land. Courtesy UKHO. L2749 Shelf Ae 1

In the early hours of 13 March the two ships were driving before the wind, at about 8 knots, with *Terror* on *Erebus*'s port beam (i.e. to the northward) when ice was sighted ahead from both ships. They both turned away from the ice, and towards each other, with the inevitable collision; *Erebus* striking *Terror* on the starboard cathead and subsequently grinding her way aft along the length of her side before the ships parted. *Terror* was able to pay off, and finding a gap between two ice bergs, passed through into comparative safety. *Erebus*, her bowsprit broken off and fore top mast and main topgallant mast carried away, was less fortunate. She drifted down on the berg, which was being struck by the lower yard arms. Captain Ross ordered the main sail loosed and set aback so that the very hazardous operation of making

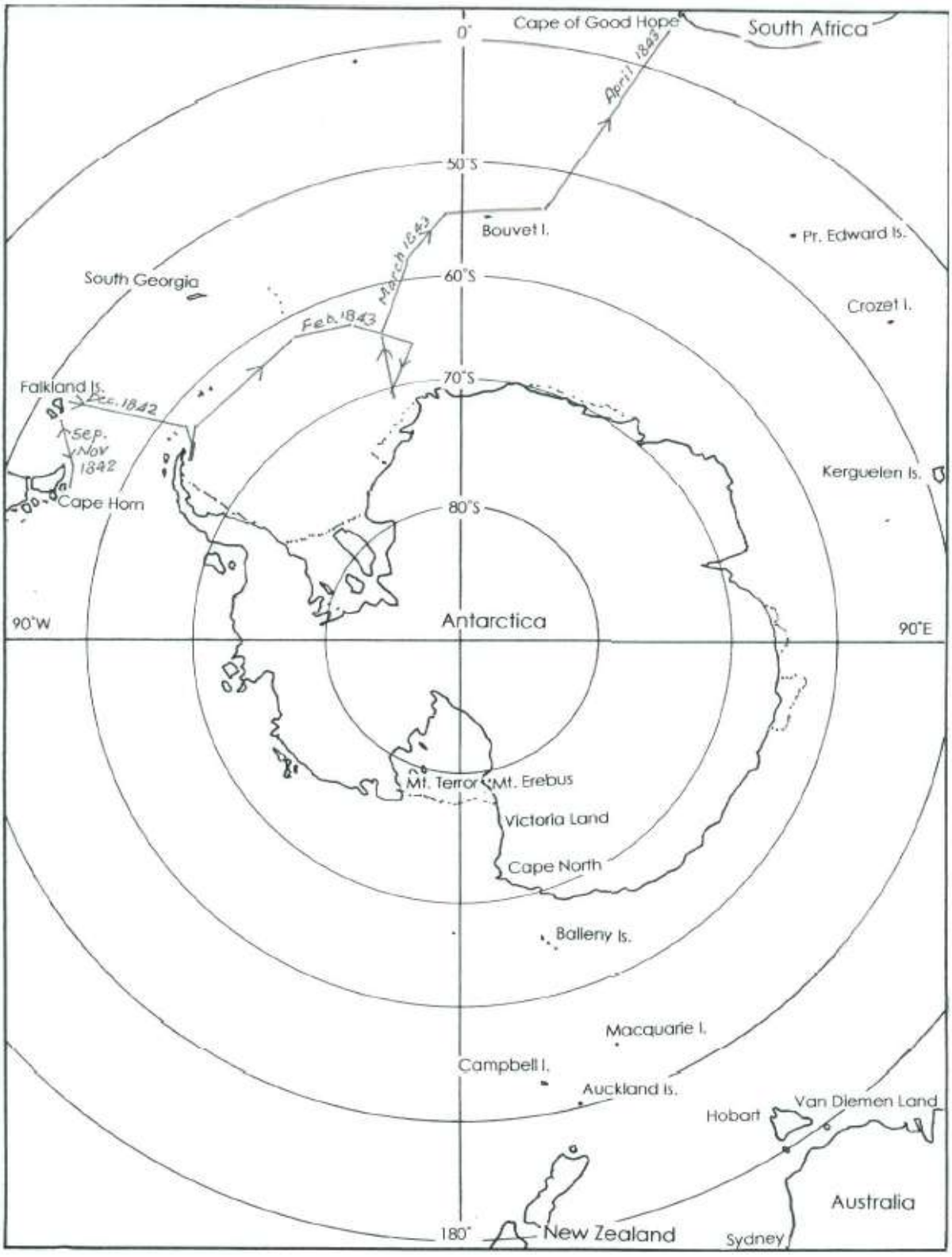

Fig. 7. Route of HMS *Erebus* and *Terror*, 1842–1843.

a stern board was undertaken. She gathered way, her stern driving into the sea, and cleared the berg, at which stage they could to see the gap, through which *Terror* had passed. With difficulty the head was brought round, the sails trimmed, and they were able to run through it into relatively calm waters. In the morning, following what repairs they could make, they proceeded on their way, and, on 6 April ran up Berkeley Sound to anchor off Port Louis, in the Falkland Islands.

As usual the observatories were immediately set up and the full range of observations carried out. Fresh food was obtained and dry provisions (bread and flour) given to the settlers who were on short allowance. HMS *Arrow*, 10, Lieutenant Robinson, which had been employed for several years surveying the islands, arrived towards the end of April, and provided the expertise, and a pack of dogs, to enable them to hunt the wild cattle for fresh beef. The *Arrow* then sailed for Rio de Janeiro and Ross took the opportunity to send reports and collections home and ask for a replacement bowsprit together with various other stores. The ship's companies built a pier to enable the boats to land at any state of the tide, and then all the stores from *Erebus* were disembarked and she was beached, and hauled up as far as possible at the top of the tide, so that the carpenters could work on her hull. Work was completed and the ship was re-floated and hauled off on 26 May. The same operation was then carried out for *Terror*, and she was hove off again on 25 June. Towards the end of June HMS *Carysfort*, 26, Captain the Right Honourable Lord George Paulet, arrived in Berkeley Sound bringing a new bowsprit for *Erebus* together with other stores from Rio de Janeiro, for which they were all most grateful. She sailed again for the Pacific on 7 July. During their stay Ross and Crozier were asked by the Lieutenant Governor, Lieutenant Moody, Royal Engineers, to advise him on the relative merits of Port William and Port Louis as the principal port of the colony. The decision was firmly in favour of Port William, and in due course the capital, named Stanley, after the Colonial Secretary, was established there.

Having completed the term-day series of magnetic observations, Ross sailed for Isla Hermite, near Cabo de Hornos, on 8 September 1842, leaving Lieutenant Sibbald in charge of the observatory at Port Louis. They anchored off the island on 19th and moved into Caleta San Martín the following day. The usual observations were taken and a bench mark cut in the rock to indicate the mean sea level. They sailed back to Port Louis on 7 November, investigating the Burdwood Bank[1] on the way, and found a least depth of 24 fathoms over it. The ships entered Port Louis on 13 November where they were met by Lieutenant Sibbald who had received letters from England, among which was one from the Secretary of the Admiralty 'conveying to me the expression of their Lordship's great satisfaction at the result of our exertions.'[2]

Having embarked the observatory and what fresh provisions they could, but unable to spare the time to go cattle hunting, the ships sailed on 17 December 1842, for their final deployment into Antarctic waters. The aim was to proceed south along the meridian of 55°W 'where I was in expectation of meeting with a continuation of Louis Philippe's Land[3], and hoped, by following the coast line to the south eastward, keeping between the land and pack to combine the survey of its shores with the attainment of a high latitude. 'If this proved impracticable he intended to follow the track taken by James Weddell when he reached 74°15'S.[4]

In the event they passed east of Joinville Island (off the tip of the Antarctic Peninsula) and discovered Erebus and Terror Gulf, but were unable to get much further south, and despite great efforts, and having been beset in the ice, and fearing they might not be able to escape, at the end of January had to give up and return to more northerly waters[5]. Ross hoped that when he reached the meridian of 40°W, on which Weddell had

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[1] Latitude 54°S, Longitude 60°W, least depth now given as 44 metres.

[2] Ross, *Voyage*, II. p. 316.

[3] This was named by Dumont D'Urville in honour of Louis Philippe, King of the French, in 1838, but was in fact the land discovered by Bransfield in 1820 and named by him Trinity Land. (Campbell, *Discovery of the South Shetland Islands*, p. 132.) It is now Trinity Peninsula at the north east end of the Antarctic Peninsula.

[4] Ross, *Voyage*, II. p. 321.

[5] It was in these very waters that Nordenskjöld's ship *Antarctic*, was crushed in January 1903. Nordenskjöld, *Antarctica*,

penetrated to the south, he would find the sea clear, but it was not to be. They continually tried to get south and early in March reached 71°30'S, in 14°51'W, but had to turn back. They searched for Bouvetøya, and, having failed to find it, made for Simon's Bay at the Cape of Good Hope, where the ships arrived on 4 April 1843. 'The refitment of the ships and refreshment of their crews, the repetition of our magnetic experiments, and comparison of our instruments with those at the permanent magnetic observatory, gave us full occupation to the end of the month.'[1] They sailed again on 30 April and having called at Saint Helena and Ascension Island for observations, reached Rio de Janeiro on 18 June. Here they found their mail had been sent to Montevideo, and, since it would take at least a month to recover it, having taken magnetic observations ashore they departed on 25 June on the final leg home. Folkstone was reached at midnight on 4 September, where Ross landed to report to the Admiralty, while the ships proceeded to Woolwich where they were paid off on 23 September 1843.

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pp. 521–36.

[1] Ross, *Voyage*, II. p. 350.