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Publisher: Routledge
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Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Royal United Services Institution. Journal

Publication details, including instructions for
authors and subscription information:

<http://www.tandfonline.com/loi/rusi19>

The Antarctic Expedition

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Published online: 11 Sep 2009.

To cite this article: Clements R. Markham Esq., C.B., F.R.S. (1895) The Antarctic Expedition, Royal United Services Institution. Journal, 39:208, 589-606, DOI: [10.1080/03071849509416158](https://doi.org/10.1080/03071849509416158)

To link to this article: <http://dx.doi.org/10.1080/03071849509416158>

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Wednesday, April 10th, 1895.

Vice-Admiral PHILIP H. COLOMB, in the Chair.

THE ANTARCTIC EXPEDITION.

From a Naval point of view.

By CLEMENTS R. MARKHAM, Esq., C.B., F.R.S.

THE coming Antarctic Expedition, if it is to be made effective and successful, must be a naval expedition. The scale on which it must be planned, the character of the service, and the requirements of the work, make this a necessity of the case, a fact which will, I think, be clear to anyone who takes the trouble to study the subject in its various bearings. The present seems, therefore, to be a fitting time for considering the very important history of the work of the Navy in time of peace, so far as it appears to bear on the question of Antarctic exploration. That history takes us back to the dawn of our regular naval annals in peace and war, and recalls the traditions of many of the most famous achievements of the predecessors of our existing naval officers. Proud as this country has good reason to be of her long series of glorious naval victories, she has no less reason to look back with complacency on the work and the training which prepared the Navy for those victories, and on the achievements of the Navy in times of peace.

The main and principal work in the Navy during peace is the preparation for war. Anything that conduces to that end, either directly or indirectly, is legitimate work; and it is a satisfactory result that the pursuit of this great object has always been found compatible with the pursuance of labours which, while adding to the glory of the Navy, have conferred incalculable benefit on science, on commerce, and on humanity. Still, the preparation for the defence of our country and of our commerce must be the great object of naval operations in peace time. The training of officers and men is amply provided for, so far as technical knowledge is concerned, and at no time in our naval history has their efficiency, in this respect, reached so high a standard. There has also been a training squadron for the last twelve years, and there is the "Cruiser." But the operations of war are so complicated and many-sided, that no knowledge and no experience, so long as it is knowledge and experience connected with the sea, can come amiss. Work requiring special care and coolness of judgment; work needing an accurate judgment to be formed and acted upon on the instant; work presenting novel situations and suggesting new ideas—all these kinds of work strengthen and form an officer's character, widen his perceptions, and increase his self-reliance, based on the diversity of his experiences and

of his resources. He may not find exactly the same work in war service, but the work he has seen when employed on special service during peace time will have furnished him with many ideas and many experiences which cannot fail to increase his efficiency and value as an officer. It also stimulates the inventive faculty in cases where it is latent.

This, indeed, is the lesson that is taught by history. We have the record of grand pieces of work having been done by the British Navy, for which it has earned and received the gratitude of the whole civilised world; and we find that the training supplied by the execution of such work has turned out officers specially qualified for conducting or taking part in the operations of war. The work of surveying and of exploring must, therefore, be accepted as a useful training, and every measure which gives increased opportunities for supplying it ought to be welcomed as beneficial to the Naval Service. In the past our Navy has not only done by far the largest share of ocean surveying and exploring, but it has undertaken the most difficult and the most severe work, such as the survey of Magellan's Strait, and of the intricate channels leading to it on the western side; such, too, as the surveys of the Red Sea and of the Persian Gulf, done by the Indian Navy, which was a branch of our imperial Sea Service in peace and war.

The achievements connected with the Strait of Magellan represent work of which the Navy has special reason to be proud, because not only of the admirable results achieved and the extraordinary difficulties overcome, but also for the self-denying zeal shown by officers and men. This service is an excellent example of the value of such training to the Navy. The voyage of Sir John Narborough, two hundred and twenty years ago, was in itself a striking example of the good that such service secures for the profession. Sir John himself, having increased his efficiency by his experiences in the Strait, afterwards did valuable work in the Mediterranean, and trained a school of young officers, of which Sir Cloudisley Shovell was an example. Among his other followers in the "Sweepstakes" there were the future Arctic navigator, John Wood, and the indefatigable surveyor and cartographer, Grenville Collins.

But to come to the work in Magellan's Strait in more modern times, there are few pieces of service that are finer than those of Captains Philip King and Robert Fitz Roy. A harder and more intricate piece of surveying and of discovery—for it involved discovery—is not on record; nor must I omit to mention the unconquerable perseverance and pluck of Lieutenant Skyring. Not only were Magellan's Strait and the intricate channels of the Gulf of Trinidad explored and surveyed, but also the Falkland Islands, the outer coasts of Tierra del Fuego, and the whole Western coast of South America to Guayaquil, between 1828 and 1836. Fitz Roy's voyage of the "Beagle" produced a harvest of fresh knowledge, which, from the combination of geographical, physical, and natural history results, was unparalleled before his time. But it is not only his work, exceptionally valuable as it was, that should excite our admiration; it is Captain Fitz Roy's zeal for the Service and for the credit of the nation

that makes us feel proud of our countryman. When he found that vessels of less draught were necessary to complete the work thoroughly, he hired two small craft, and purchased a third entirely at his own expense. These gratuitous and noble sacrifices cost him several thousand pounds, not a farthing of which was ever re-imbursed. It is this unselfish spirit, called forth first by interest in the work, and then by zeal for the Service, which is fostered and bred by such employment, and it is this spirit which is sure to be invoked by special work in time of peace, arousing deep interest and enthusiasm. It is a spirit to be cherished in the Navy, imbuing our officers with the loftiest sense of honour and of fidelity, and helping to fit them to assist in the work of protecting and saving their country when the supreme moment arrives.

The work in Magellan's Strait is one example out of many. For, apart from our own islands and colonies, great part of the Mediterranean, all the coasts of Asia from Suez to Japan, nearly the whole of Africa, the west coast of South America, and the islands, have been surveyed by the Royal and Indian Navies; while the charts issued by our hydrographers are used and trusted by every nation in the world. This has, for the last century, been a splendid training ground; for such experiences, even during a short interval in the career of a naval officer, cannot fail to be most valuable to him.

But even more valuable, from this point of view, have been the expeditions of discovery. The production of more than one distinguished officer was the outcome of Lord Anson's voyage of circumnavigation. He himself displayed that temper, tact, and judgment which the circumstances called forth, and from which the Service reaped the benefit during his long and memorable term of service at the Admiralty. Among the men who received their best training under Anson's command of this exploring expedition we find the future Lord Keppell; we find Lord Hawke's most trusted officers, Sir Percy Brett, and John Campbell who was his flag-captain at the battle of Quiberon Bay; we find the well-known names of Saunders and Saumarez; and we find Hyde Parker (the elder), one of the most active captains during the seven years' war, who, in his turn, trained James Rennell, the greatest geographer that England has produced. Professor Laughton has well said that "in the whole history of our Navy there is not another instance of so many juniors rising to distinction in one ship" as on board the "Centurion" while on special exploring service under the command of George Anson. No less valuable was the training provided by Captain Cook during his three famous voyages.

Arctic expeditions have been another splendid and most fruitful training ground for our officers and men, ever since those famous Arctic explorers, Martin Frobisher, John Davis, and Edward Fenton, helped to fight and disperse the Spanish Armada. In 1773, again from 1819 to 1836, again from 1845 to 1858, and once more in 1875, our naval officers and men went forth into the Arctic regions to do hard and difficult work, calling forth all the highest faculties of their minds, giving them valuable experiences, and enabling them to raise the credit of their

profession and their country. They returned to the regular work of the Navy with minds enlarged and enriched by what they had seen and experienced, and consequently with increased efficiency and powers of usefulness. It is unnecessary to mention their names, for they are well known; but it should always be remembered that the list of naval Arctic explorers is headed by the name of Horatio Nelson.

Such voyages as that of the "Challenger" are also most useful to the Navy in time of peace. This country has undoubtedly led the way in all researches relating to the physical geography of the sea, and has kept the lead. Major Rennell, who was himself a midshipman for six years, by the preparation of his hydrographic memoirs, and his current charts, was the founder of the science of oceanography. It was zealously followed up by Captain Maury and more recent American investigators; but the most valuable and extended piece of work connected with deep-sea sounding and dredging was performed during the voyage of the "Challenger," under Captains Nares and Thomson. It was a survey of the ocean bottom of the greatest interest and the greatest importance; but that survey is incomplete until a survey of the Antarctic area has been added to it.

It is here, in the Antarctic area, that the next great scientific expedition has its work cut out, and the Navy will have the proud and glorious task of achieving those great results for the science of the world, for which scientific men are now anxiously and somewhat impatiently waiting. This is purely and exclusively naval ground. It is the largest unknown area on the world's surface, and none but English naval officers have ever penetrated more than a hundred miles beyond its bounding line on the Antarctic Circle.

Captain Cook was the first to cross the 70th parallel of south latitude, in 1774. His meridian was about 107° E., near the centre of the Pacific Ocean. It was in 71° 10' S., at the end of January, 1774, that he came to the edge of the Antarctic pack ice, and he counted ninety-seven bergs, like a ridge of mountains rising one above another till they were lost in the clouds. Captain Cook considered that, although it might have been possible to get further south, it would have been a dangerous and rash enterprise; and, with the kind of ships he commanded, he was undoubtedly right.

The next vessel which crossed 70° S. was also commanded by a naval officer, although employed by a private firm. This was Captain Weddell, in 1823, who, in about 35° W., ran down to the latitude of 74° 15' S., where he was not stopped by ice, but merely returned because there was a strong southerly wind blowing. John Biscoe, another naval officer, employed by Messrs. Enderby, was the discoverer of Enderby Land, on the Antarctic Circle in 50° E., and of Graham's Land, south of Cape Horn, which is now believed to be a promontory connected with the great southern continent. Biscoe crossed the Antarctic Circle to the south of the Cape of Good Hope, though he did not reach the 70th parallel.

But the expedition of Sir James Ross is the only one from which we can derive much practical information respecting Antarctic navigation, for

it is the only one which pushed through the south polar pack, and explored the region beyond, though only in one direction. This was purely a naval expedition, fitted out to make delicate and careful observations such as only naval officers have been found to be competent to have charge of, and to record with the accuracy which is essential for any useful scientific purpose. James Ross had had unequalled experience in the Arctic seas; he was a splendid seaman, a man of iron nerve, endowed with indomitable perseverance, and he was a most accurate and reliable observer. Under such a leader good work was sure to be done, and it was done.

We may now briefly glance at the Antarctic problem, and see what Sir James Ross did to solve it. He found the circumstances different in several material respects from what he had been accustomed to in the Arctic regions. In the north there is continental land all round the Arctic Circle, except where there are three openings; a great mass of islands, stretching in all directions to the threshold of the unknown region, forming numerous intricate channels, extends northward from the continents, and the currents and tides are complicated and often cause obstruction. In such a region large floes and fields of ice are formed, and the chief dangers are from collisions between the great ice floes and from long detention. But in the Antarctic regions the physical features are reversed. In the centre of the polar space there is a continent, probably ice-capped, whence the accumulated winter ice floats northward in all directions, accompanied by chains of enormous icebergs, flat-topped, with perpendicular sides, and often miles in length. The gales in the open sea prevent the formation of extensive fields or floes of ice, but instead there are masses of polar pack ice, consisting of huge pieces, and these masses of pack ice are sometimes several hundred miles in width. As these packs of ice float northward they leave a navigable sea behind them up to the southern continent. The problem, therefore, is how to evade and escape danger from the bergs and to get through the pack in order to explore the navigable water beyond it.

It is the glory of Sir James Ross that he alone has boldly pushed into this formidable south polar pack. Twice, in January and February, he did so successfully. A third time he made the attempt and failed, because it was too late in the season. For this service he was supplied with two old mortar vessels of great strength, the "Erebus" and "Terror." They withstood innumerable tremendous blows from the ice, and had several hair-breadth escapes; indeed, they would almost certainly have been lost had it not been for the iron nerve and consummate seamanship of their commanders.

On January 5th, 1841, Ross found the line of the main pack right ahead of him. He at once made the signal to his consort, bore away before the wind, and made straight for it, with a view to breaking through the outer edge, which is usually formed of much heavier ice than the rest. The bold manœuvre was successful without serious injury, although the old ships received some very heavy blows. The ice beyond the outer edge proved to be much lighter than when viewed from a distance. Ross's splendid audacity was rewarded. In six days he forced his way

into the open water to the southward, and on January 11th he discovered land, with a great range of mountains extending for 450 miles to the southward; which received the name of Victoria Land. On the 28th he came in sight of an active volcano 12,400 feet in height, emitting flame and smoke in great profusion. It was named Mount Erebus, and an extinct volcano by its side received the name of Mount Terror. There was a bay near the base of Mount Erebus, named M'Murdo Bay, after the First Lieutenant of the "Terror," where a landing might probably be effected, and where a ship might winter. At least, this was the opinion of Dr. McCormick.

The most astonishing discovery made by Ross was the lofty perpendicular cliffs, forming an ice barrier, extending from the neighbourhood of Mount Erebus for several hundreds of miles to the eastward. There was no appearance of rent or fissure. The cliff, stretching to the horizon, rose to a height of 200 feet, and the intensely bright sky beyond it indicated the great distance to which it reached to the southward. That it rested on land seemed certain, although its outer edge was probably not so resting. Indeed, this prodigious ice mass is doubtless one source of supply for the icebergs which encumber the Southern Ocean.

These were the great discoveries of Sir James Ross in the season of 1841.

In the following year the daring explorer took the pack on the 12th of January, and had a much more terrible experience. On the 19th the wind suddenly freshened to a violent gale, and the sea quickly rose to a fearful height. The ships were involved in an ocean of rolling fragments of ice, hard as floating rocks of granite, which were dashed against them by the waves with so much violence that the masts quivered as if they must fall at every successive blow. Their destruction seemed inevitable, from the tremendous shocks they received. By backing and filling the close-reefed sails they tried to avoid collisions with the larger masses, but this was not always possible, and thus the rudder of the "Erebus" was so much damaged as to be no longer of any use; while that of the "Terror" was completely destroyed, and nearly torn away from the stern-post. Ross says that, "throughout a period of twenty-eight hours, during any one of which there appeared to be very little hope that they would live to see another, the coolness, steady obedience, and untiring exertions of each individual were every way worthy of British seamen." The breadth of the belt of ice in which they weathered this gale of wind, and through which they forced their way into the open sea to the southward, was calculated to have been 800 miles. But Ross was not to be beaten. He forced his way through it, and explored the marvellous ice barrier, which is in $78^{\circ} 10' S.$, once more.

On the third occasion, in 1843, an attempt was made to force a way through the pack, near the meridian on which Weddell had reached 74° without seeing any ice. But it was in March, much too late in the season; young ice was forming, and the attempt had to be abandoned. But even then Ross pushed down south as far as $71^{\circ} 30'$. Thus three British naval

officers, Cook, Weddell, and Ross, are the only seamen who have ever crossed the 70th parallel, and Ross did so no less than three times.

It will have been seen that such a seaman as Ross could face and overcome the difficulties of the polar pack even in an old sailing vessel. But still more formidable in such a craft was navigation in thick weather, blowing hard to windward of a chain of Antarctic bergs. I know nothing more thrilling, in maritime story, than Sir James's narrative of the way he escaped, almost by a miracle, from such a predicament. It was on the evening of the 12th of March, 1842, blowing very hard, with blinding snow showers, and numerous small pieces of floating ice warned them of the presence of bergs. Suddenly a large berg was seen ahead; the ship was immediately hauled to the wind on the port-tack, hoping to weather it, when the "Terror" loomed out of the thick snow shower, running down upon the "Erebus" under topsails and foresail. It was impossible for her to clear both the "Erebus" and the berg, so a collision became inevitable. Sir James hove all aback to diminish the shock; still the concussion was tremendous, and the bowsprit and foretopmast were carried away. The ships hung together for a time, amidst the crashing of boats and upper works, while both were drifting down on the perpendicular cliffs of the berg on their lee. Providentially they gradually forged ahead of each other, and the "Terror" just cleared the end of the berg. But the "Erebus" was left completely disabled. She could not wear, for by this time she was so close to the berg that the waves, when they struck against it, threw back their spray on to the deck. The only way to extricate the ship from this appalling situation was by resorting to the hazardous expedient of making a stern board. She was rolling heavily, and the lower yard-arms were actually grinding against the ice cliffs, which towered high above the mast heads. This rendered it a service of extreme danger to loose the mainsail; but no sooner was the order given than the daring spirit of the British seaman manifested itself. The men ran up the rigging, and, although more than once driven off the yard, they eventually succeeded in loosing the sail. The yards were braced by, and the main-tack hauled on board with the sail flat aback. The ship then gathered stern way, washing away the gig and quarter-boats, and, with her lower yard-arms scraping along the rugged face of the berg, she reached its western termination. The under bow alone prevented her from drifting to atoms against the berg. But no sooner were they clear than another berg was seen directly astern, against which they were running. It was, in fact, a chain of bergs. The difficulty then was to get the ship's head round and pointed fairly between the two bergs, the width of the intervening space being about three times the ship's beam. This, however, was accomplished, and in a few minutes after getting before the wind she dashed through the narrow channel, between the two perpendicular walls of ice and was safe.

Nothing can give a better idea of one of the dangers of Antarctic navigation than this admirable picture drawn by a master hand. Sir James Ross faced and overcame the perils from icebergs, and the still greater difficulties from the pack, and after three seasons in the ice, from

1839 to 1843, he brought the two old ships safely home, laden with a rich harvest of valuable scientific results. This was a service of which our Navy may well be proud. It was a glorious peace-victory. It is now more than fifty years since this great achievement was done, and nothing more has been attempted in the south polar regions during all that long time. But now there is a pressing call for renewed Antarctic exploration, and the work cannot be done well—some of it cannot be done at all—except by the Navy; so that another noble opportunity of emulating the deeds of Ross and Crozier is presenting itself.

It must be the work of naval officers, because the most important part of it, such as the magnetic observations, can only be entrusted to those who have received a thorough scientific training; nor could the deep-sea sounding be entrusted to inexperienced people with inadequate apparatus. For such difficult service, too, naval discipline seems absolutely necessary, for, as Dr. Murray has well put it, "the work of such an expedition involves long and faithful attention, drudgery, devotion to duty, year in and year out, which can only be looked for, with certainty of success, in the discipline of the Navy, where there is zeal for the honour of the service."

We now come to the results that are required from a new Antarctic expedition. The most urgently needed are, without doubt, connected with the requirements of magnetism; and they are thus set forth in the Report of the Committee of the Royal Society. The positions of the south magnetic pole and of the southern force of maximum intensity are still uncertain. The question as to whether the magnetic poles are at rest or revolve is of the greatest importance. Further than this, while we know that south of 40° S. changes have taken place in the magnetic elements since Ross's Antarctic survey, there are no means of ascertaining the extent of those changes without another expedition.

The practical importance of a more complete knowledge of terrestrial magnetism is forcing itself upon the attention of navigators. Wooden ships, which contributed largely to our knowledge of magnetic variation, have disappeared. They are replaced by rapid iron ships, to which a correct knowledge of variation means saving of distance, and such knowledge is a necessity in latitudes where the sun is often obscured. The iron ships cannot themselves contribute to the variation charts, because it is not possible to make correct magnetic observations on board them. Hence increasing difficulty is experienced in constructing a variation chart to meet the requirements of iron steamships navigating between New Zealand and Cape Horn, a region where the sun is often obscured, and no observations possible. The same, in a lesser degree, may be said of vessels navigating between the Cape of Good Hope and Australia.

At all the southern extremities of the great continental areas, the Cape of Good Hope, Cape Horn, Australia, and New Zealand, the secular change of magnetic declination is small. In the intermediate ocean areas and to the south it is large, but the amount is unknown. It is only by organised observations that it can be ascertained, and that the great

changes that are known to be taking place can be calculated for the different parts of the Southern Ocean. In short, the interests of science and the practical navigation of iron or steel ships point to the increasing necessity for further information as to the facts of terrestrial magnetism; and it is only by an Antarctic expedition that the missing data can be obtained.

In the near future magnetic disturbances are expected to be at a minimum, and this is the most appropriate time for making magnetic observations in high latitudes, where such disturbances are more severely felt than in the temperate zones.

This branch of the Antarctic expedition's work is of the highest scientific value; it is also of great practical importance, and it would be done more satisfactorily now, or in the near future, than if there is delay. But magnetic observations, though perhaps the most important result, are very far from being the only result of Antarctic research. Oceanography requires many observations in the Antarctic regions. The temperature at different depths, the specific gravity, the movement of the water, both on and below the surface, all bear directly on the study of the ocean in more temperate climates. Meteorology will also derive great benefit from observations within the Antarctic Circle. For the effect which the meteorological condition of the south polar region, unimpeded by land, may have on the changes of climate over large areas north of it, is unknown, though it must be great. The cause of the abnormal lowness of the barometer in southern seas is not understood; and this, too, is an investigation of special interest. Dredging is another part of the work, and a knowledge of the biology of the depths of the Antarctic Ocean, which is ultimately connected with the past history of the globe, is all but wholly wanting. Such knowledge will be a great service to biological science.

Equally valuable results are to be derived from the discovery and exploration, so far as is possible, of the Antarctic Continent. Here geological observations may be made, the thickness and structure of the ice sheets may be examined, and the coast lines may be delineated. To all this must be added the certainty, established by all former experience, that numerous unforeseen and unexpected results of scientific value will be derived from the exploration of an unknown region of vast extent.

The leaders of an expedition will decide upon the means of overcoming the obstacles presented to Antarctic navigation, and of securing the important scientific and practical results that are required. They will find that steam-power has revolutionised the conditions as they were presented to Sir James. Admiral Sir R. Vesey Hamilton, after careful investigation, has come to the conclusion that steam-power has only added 25 per cent. to the facilities of Arctic navigation, but that it has increased the power of exploring the Antarctic Ocean more than 100 per cent. Calms occur sometimes, and there are often adverse winds when there is clear weather. At such times a sailing vessel would be beating up twenty miles, while a steamer might make 100 miles. A steamer would pass through the polar pack in a tenth of the time that a

sailing vessel could work through it; while in a navigable sea a steamer would easily do all the work in one season which occupied Ross three seasons, and a great deal more. A steamer will be in little danger from large icebergs, except during fogs, and in heavy gales she could lie in safety under their lee, instead of drifting at the mercy of wind and waves. This was actually done by Sir George Nares in the "Challenger."

During a gale of wind in the pack a screw steamer would be in some danger, and would require very skilful handling. She would avoid collisions with heavy pieces of ice better than a sailing vessel, but she might not be able to do so altogether, so that her rudder-post and screw-propeller might be seriously injured. Much attention will therefore have to be devoted to the fitting, and especially to the strengthening, of the after-part of the screw steamers that may be selected for Antarctic service. There should certainly be two vessels; they should be as well strengthened to receive blows from the ice as were the "Erebus" and "Terror"; they should have steam-power, and they should be specially strengthened or protected aft. They would, of course, be fitted with all modern appliances for deep-sea sounding and dredging. A full commission of three years would be necessary for the performance of the work, and an effort should be made to find a safe place near the shore of the Antarctic Continent where one of the vessels could winter. It is desirable that the pack should be approached at least a month earlier than was the case in Ross's expedition, in order that there may be more time for exploration during the navigable season, and this can easily be done with steam-power. Screw steamers will also be better able than sailing vessels to double the pack.

As regards the question of expense, this will in no way affect the Navy Estimates. The Antarctic expedition will be a separate vote. It is scarcely necessary to discuss the question, because as soon as public opinion has made itself known, and an expedition has been decided upon, there is never any difficulty on that score. It may, however, be worth while to allude to the very misleading way in which the Arctic estimates and the "Challenger" estimates are shown. The real cost to the country is always enormously exaggerated. For instance, the whole double pay is invariably charged, whereas officers and men would be receiving single pay under any circumstances; consequently only single pay ought to be charged to the expedition. Then, as regards the ships, supposing the building and equipping of two suitable vessels cost £90,000—probably an excessive estimate—the whole would be charged to the expedition.

But this would be a most erroneous view of the case. The ships are ready for use elsewhere when the expedition comes to an end. Take the cases of the "Alert" and "Discovery." The Arctic expedition had the use of them only for eighteen months. But the "Alert" has been in constant use, doing valuable service in Magellan's Strait, in Hudson's Bay, and elsewhere during the following twenty years. The "Discovery" has been incessantly used for dockyard work during the same period, and is still in use. Consequently the expedition ought only to be charged with about a twentieth of the £90,000, or £4,500 divided over three years

in the case of an Antarctic expedition; or £1,500 a year for the ships. The same applies to scientific apparatus of all kinds. It is misleading to charge the whole cost to the expedition; the estimate should only be for the wear and tear during three years. When the estimate is fairly and honestly prepared, it will be found that the real cost is about £20,000 a year—a mere trifle compared with the great value of the scientific results, and with the other benefits to the Navy and to the nation that will be derived from the Antarctic expedition. But this is a question of account, which can be treated in various ways.

Foremost among those benefits is the excellent effect that all such undertakings, in which our country has ever been prominent, have always had on the Navy, by opening up interesting employment in a new field, and by maintaining that spirit of enterprise which is the life blood of the profession. Personally, I value this more than all the scientific results put together, valuable and important as they are. It was to secure this end that my dear friend Sherard Osborn so persistently advocated a renewal of Arctic exploration until he secured the desired end just twenty years ago. On the last occasion that our Government was approached by an influential scientific deputation, the reply was worthy of a Prime Minister of England, it was that, "having carefully weighed the reasons set forth in support of an expedition, the scientific advantages to be derived from it, its chances of success, as well as the importance of encouraging that spirit of enterprise which has ever distinguished the English people, Her Majesty's Government has determined to lose no time in organising a suitable expedition for the purposes in view." These noble words represent the best and wisest policy of England when her destinies are guided by men worthy of her traditions. That policy has never been reversed. It will be an evil day for our country if it ever is reversed; and that day, we trust, is far distant. So that we have no reason to anticipate anything but a favourable answer from Her Majesty's Government as soon as public opinion is formed and made known, and the proper time has arrived for representing the necessity for renewing work that has been so lamentably neglected during the last fifty years and more.

An Antarctic expedition is, then, a training squadron of great value to the Navy; a training squadron with double pay and promotion, and openings for gaining credit and distinction. It will supply training in all those qualities which are most valuable in time of war, while encouraging a spirit of enterprise and stimulating zeal for the credit of the Navy and of the country. As Anson's circumnavigators became the foremost naval commanders during the seven years' war, so we may expect our future Antarctic navigators to return to the regular service, invigorated by new experiences and fresh energy, and more ready than ever for anything that may befall.

Admiral Sir Richard Vesey HAMILTON, K.C.B. : Before entering upon the discussion of this paper, in which my name has been mentioned by the lecturer, I think I will lead off the ball by saying that I have only one complaint to make of the paper, and that is—that the lecturer, who was allowed an hour to read his paper, has occupied only three-quarters of an hour. He has defrauded us of a quarter of an hour of pleasure, but we will forgive him that. A very eminent clergyman once said that he would like his congregation to hunger for more. I think in this case we are hungering and thirsting for more, and I hope it will create an interest in this important subject and induce you to use your influence, and the influence which even the ladies may bring to bear on those who have the dealing with and fitting-out of an expedition of this sort. I will make a few comments upon the paper. There is no doubt about it that every one here will agree that "the coming Antarctic expedition, if it is to be made effective and successful, must be a naval expedition." That cannot be too strongly enforced. I cannot do better than refer the words of Dr. Murray to those who have not had the advantage of reading this paper. Dr. Murray was one of the eminent *savants* of the "Challenger," and therefore knows what he is talking about. He put it very well in the paper he read at the Geographical Society some time ago, where he said, "The work of such an expedition involves long and faithful attention, drudgery, devotion to duty, year in and year out, which can only be looked for with certainty of success in the discipline of the Navy, where there is zeal for the honour of the Service." I think he might very well have added to that "very great zeal for the interest of science," because the interest of science is the interest of commerce, and without commerce there would be no Navy. I was about to allude to the valuable magnetic observations in order to induce Captain Creak to enlighten us on the subject; but he has done so in the excellent paper read by the secretary, so that he has anticipated me. The lecturer has laid great stress on Captain FitzRoy's Polar Works, and more especially that his "gratuitous and noble sacrifices cost him several thousand pounds, not a farthing of which was ever reimbursed. It is this unselfish spirit, called, fostered, and bred by such employment, and it is this spirit which is sure to be invoked by special work in time of peace, arousing deep interest and enthusiasm. It is a work to be cherished in the Navy, imbuing our officers with the loftiest sense of honour and of fidelity." Gentlemen, I will make one comment in that case, and that is the contemptible meanness of the Government of the day in not refunding to this officer so much money spent for the public service. The Treasury was bad enough in those days, and it is no better in the present day. Professor Laughton has certainly produced a very strong argument in favour of these expeditions, when quite a number of Lord Anson's men came to the front—"it is here in the Antarctic area that the next great scientific expedition has its work cut out." On that point I recommend those who have not read it to read the very excellent summary of the voyage of the "Challenger," by Dr. Mills, in, I think, one of the latest geographical journals. He there gives an account of the temperature of the water at various depths, which is most interesting to us as seamen. The lecturer has dwelt upon the iron nerve and splendid seamanship of Sir James Ross. His followers did not allow him any nerve—they called him "nerveless"—and it is a man of that sort that you want for a future Antarctic expedition. The lecturer also dwelt upon the damage done to the ships, to the stern posts and screw propellers in the ice. On that point there is no doubt. A modern screw ship is weaker than an old sailing ship, because she has a double stern post. I put it forward as a matter of consideration whether the turbine principle should not be adopted. It has many drawbacks, but at the same time we have used it in two national lifeboats with great success, and being in the middle of the ship, I think we would be able to fence it in, and the probability is that it would be a very much better means of moving in that region than the screw. With regard to the lecturer's remarks on magnetic variation, there is no doubt

about it that it is only by an Antarctic expedition that the missing data can be supplied, and that is almost indispensable in the interests of commerce at the present day. When the last magnetic observations were made fifty or sixty years ago, our ships steamed 7, 8, or 9 knots. If we went 10 knots we thought the ship was running away with us. Now 10 knots is "half-speed." When we get 20, 25, or 30 knots an hour, it is of the highest necessity in the interests, not only of commerce, but of human life, that every single thing should be done to facilitate the navigation of the ocean. The lecturer has quoted a remark of mine which I made thirty years ago, to the effect that steam power, while adding 25 per cent. to the facilities of Arctic navigation, has increased the power of exploring the Antarctic ocean more than 100 per cent. Upon that I should like to say this: My remarks made in those days applied to steamers of 5 or 6 knots speed. In the present day we shall probably have steamers of 7 or 8 knots there; consequently, my remarks were considerably under-estimated in those days from what they would be at present, and I think that is a very important point. The work done in the whole of the united expeditions of that time—the British expedition under Ross, the American expedition under Wilkes, and the French expedition under Dumont d'Urville—might be done at the present day in one year by more powerful steamers and with greater safety. The only regret I have is that the lecturer has not been able to get that most stirring picture of the episode that he has already alluded to with regard to the collision with the iceberg, and which gives you a far greater realisation of the danger in an Antarctic expedition than any of the pictures on the wall. The lecturer has dwelt upon the misleading way in which the Arctic estimates have been shown, and has stated that the real cost to the country has been enormously exaggerated, and that the cost of the ships charged to the expedition votes ought to have been charged to the Navy votes. He has also stated that "as Anson's circumnavigators became the foremost naval commanders during the seven years' war, so we may expect our future Antarctic navigators to return to the regular service, invigorated by new experiences and fresh energy, and more ready than ever for anything that may befall." In the past Arctic expedition we have a very signal instance of that in the part taken by the late Admiral Sherard Osborn, who was one of the most distinguished officers in the Sea of Azov and also during war operations in the Black Sea, and who was selected to have been—if the war had continued—the leader of an expedition up the rivers Mingrelia and Imerita, which no doubt would have been of very great interest to this country. I am only sorry that there is not what I may call a subject of controversy in this paper. Controversy, like flint and steel, strikes out all the information that can be acquired. I like to find out what various people have to say on these points, and I can only say for myself I agree entirely with every word that has fallen from the lecturer.

Admiral A. H. MARKHAM: As no one else appears to be getting up to discuss this paper, I will just say a few words. I am sure I am only expressing the thoughts and feelings of everybody here this afternoon when I say that we have listened with a very great deal of pleasure to Mr. Markham's most interesting paper. To me, having always taken a very keen and very great interest in all matters appertaining to the exploration of the high latitudes, whether in the Arctic or Antarctic regions, it has been especially interesting. Mr. Markham has alluded to the various scientific results that he says are likely to be derived from the despatch of an Antarctic expedition. These results, I am quite sure, are not only likely to be derived, but they are sure to be more than fully realised, for when we come to consider the admirable work that was done by Sir James Ross more than fifty years ago, and remember, as the lecturer has told us, that that excellent work was carried out in a couple of old sailing tubs dependent on the action of wind on their sails for their motive power, we shall see that steam has made a great revolution in all matters connected with ice navigation. I am

quite in accord with the lecturer; and also with Sir Vesey Hamilton, in believing that a couple of well-found steamers, perhaps one of them fitted on the principle that he has alluded to, viz., the turbine principle, will do as much in a summer's cruise as Sir James Ross did during the whole four years of his absence; and, I take it, if proper precautions are taken, and the necessary precautions, it will be done with absolute certainty and safety. The point, ladies and gentlemen, that Mr. Markham has made in his paper, and which has been so ably supported by Sir Vesey Hamilton, is the one that I particularly wish to emphasise, and that is, that an Antarctic expedition, if it is despatched from this country, should be despatched under naval auspices. Private enterprise, as we all know, has done a great deal, and is still doing a great deal in good and useful geographical work in various parts of the world; but in order to ensure success to an expedition that is sent out, either for the exploration of the Arctic or Antarctic regions, it is in my opinion absolutely necessary that the members of that expedition should be amenable to naval discipline, and that it should be under the direct control of the Admiralty. Speaking as a naval officer, and as one who has had various experience in all parts of the world, I unhesitatingly say that I know of no school better adapted to develop those essential qualities to which every naval officer could aspire—I mean, watchfulness, accuracy of judgment, readiness of resource, prudence, combined, of course, with that necessary element of audacity and dash, and perhaps a little more of the latter than of the prudent part—than will be found in handling your ship whilst navigating among these massive icebergs of the Arctic and Antarctic regions, to say nothing of those subsequent operations that always follow after a ship has been secured in winter quarters, I mean travelling on sledges along the coast line, where hardships and privations of no mean order have to be faced and battled with. It may, perhaps, be somewhat strange, but nevertheless true, that we owe a good deal of our knowledge of the Arctic regions to the last Antarctic expedition, for I cannot help thinking that had it not been for the return of Sir James Ross, and the fact that the two ships, the "Erebus" and "Terror," were lying idle, and therefore at the service of the Government, in all probability Sir John Franklin at that time would not have been sent in quest of the North-West Passage; and we also got a great deal of our geographical information of the Arctic regions from those several search expeditions that were sent out year after year to look for the missing ships. The lecturer's reference to the erroneous statements with regard to the expense of scientific expeditions, has put the matter before me in quite a new light. I never for one moment considered it before, and I do think it is a very misleading fact to charge the last Arctic expedition with the value of those two ships, which the lecturer has told us, and which I will corroborate, have been doing very good and useful service for the last twenty years. I will say no more, except that we are deeply indebted to Mr. Markham for having thus come forward to ventilate this question of Antarctic research in this theatre, and I sincerely trust that his efforts to secure the despatch of an Antarctic expedition—let us hope it will be a naval one—will be crowned with success.

Lieutenant MARTIN LEAKE: If a lieutenant may be allowed to speak in this theatre, I feel sure I am expressing the feeling of my brother officers of my own standing, in stating that we hail an Antarctic expedition as a means of learning much that will be useful to us and of gaining distinction, and I feel sure that enough volunteers will be found among the lieutenants to man the entire Antarctic expedition.

Admiral FITZGERALD: Sir Vesey Hamilton has asked for a little controversy. He seemed to think that the Arctic people were having it too much their own way. I have not read the paper, and I could not hear what Mr. Clements Markham said, but I suppose that is no disqualification for criticising it. I imagine I am not wrong in gathering that another Antarctic expedition is proposed. Well, the foxes that had no tails had very little difficulty in proving that tails were a useless and

ridiculous appanage; and I have no doubt that, from one point of view, another Antarctic expedition might be so considered. If it is intended to be undertaken and money spent on it for the purpose of finding out what magnetism is, I do not believe it would be a success. I do not believe you will ever find out what magnetism is, and I think you will be able to navigate just as well without. You know what it does. That is quite enough for you. You cannot find out what it is. But if you put it on what I might call higher grounds, as an opportunity for exercising those qualities which Admiral Markham so eloquently expressed—enterprise, dash, resource, courage, and, in fact, fighting the forces of nature; for what I might call shamming war, when we cannot have real war, to call forth those qualities, I should say that it would be entirely worthy of the support of any Government. On these grounds, and if it is for the encouragement of that insatiable desire which our country has of planting the British flag upon every barren rock in the ocean and every desert sand in Africa, or every mound of snow or ice in the Arctic or Antarctic regions, then I can thoroughly sympathise with you. I believe that desire would carry you to the moon if there were only a way. I am sure it would if you were not forestalled by our friends the Americans, for I believe that immortal bird of freedom would soar there before you and plant the Stars and Stripes before you could get there. But if it were not for that, I feel sure we should be the first. Under these circumstances I believe that the Antarctic barrier is not an unworthy object for the chivalry of the British Navy to break their lances against, and if another expedition is undertaken I shall heartily wish them every success.

Professor J. K. LAUGHTON: I do not think I can add anything to what Sir Vesey Hamilton and Admiral Markham have so well said. Research in the Antarctic regions undoubtedly offers very great advantages in the way of supplying desiderata in connection with many sciences, not only magnetism, which Admiral FitzGerald seems to scorn, but meteorology. I wish the President of the Royal Meteorological Society had been able to remain, for he might have been able to speak more at length on the advantages to be gained to that science by such an expedition; and then, of course, there is geography, to say nothing of the rational curiosity of human beings to know what is to be found in the dark corners of the earth. I hope that this expedition may go forward. I hope I may live to see it return with glory, having planted the British flag on the South Pole itself.

The CHAIRMAN: As Captain Tizard has been in the Antarctic regions himself, we should be very glad to hear him.

Staff-Captain T. H. TIZARD, R.N., F.R.S.: I had no intention of saying anything, being entirely of opinion that an Antarctic expedition would be a very good thing; but I do not think it is any use preaching to people who have not any authority, and calling upon them to send such an expedition, although they may have every will to do so. It is something like a parson holding forth to his congregation, saying how bad it is for the people to stop away; this is useless, because he does not get at the people who are stopping away to tell them that they ought to be there. I only wish the financial authorities of the Government were here to have heard the proofs brought forward that such an expedition would cost very little, and that it ought to be carried out by the Government. We, however, have no power to send such an expedition. It is only the financial people of the Government who have the power to do it. We have only the will, which is, of course, an argument in favour of such an expedition, as the work must be done by the Navy to be done successfully.

The CHAIRMAN: As it appears that the discussion so far as the audience is concerned is closed, it becomes my pleasing duty to ask you to render your warmest thanks to the lecturer for his eloquent and most instructive paper. My own view of Antarctic discovery is, that it is one of those things that is bound to come. You cannot escape from it. It will be done at some time or another, and the only question is, When? And it is by the promulgation of such ideas as are

announced here in the theatre of this Institution that public opinion on that matter will be ultimately formed. It seems to me impossible that, while we are exploring every part of the world so far as the land is concerned, we should in any degree drop exploration as far as the sea goes. It is by exploration at sea, as the lecturer has shown us, that we have made ourselves what we are, and I think we are quite sure to go on with it. I think we are all agreed, even that contemptible creature, an "edge-of-the-icer," and especially those of us who have seen something of what Arctic scenery and Arctic work is, with the lecturer in thinking that it is in any case a splendid training for the naval officer. It may be perfectly true that the numbers who would go on such an expedition would be few, but you may be quite sure that every one of them will come back a better naval officer than he went, and that he would spread the spirit and the knowledge and the way of looking at things which he has gained in his Southern expedition amongst his fellows in the regular service who have not had that privilege. A great deal of stress has been laid upon the scientific part, and Admiral FitzGerald, as usual, has struck oil in the way of wit, where others would fail altogether; but for myself I think that that question of magnetism is, after all, more practical than scientific. We are distinctly told that, by our scientific discoveries and arrangements, we have reduced, within a comparatively small number of years, the wrecks of all kinds by about one-half. Most wrecks take place by running on shore, and a very large proportion of these runnings on shore have occurred from defects of one kind or another in the compasses; and the perfection of the compass is a matter, therefore, which closely affects our safety at sea, our commerce, and the prices of everything we consume which comes to us over sea. There is another point with regard to Arctic exploration which the lecturer has dwelt upon—that is, the commercial aspect. For myself I cannot help thinking, having looked somewhat into the question, that the "right" whale must be in abundance in the Antarctic regions, if the locality could be only found. It is quite certain that parcels of whalebone come to us from New Zealand, the product of the "right" whale; and though these parcels are small and few and far between, the price of them at home is enormous. I suppose all ladies know what the price of whalebone means, and all ladies, therefore, should be on the look-out for the development of more whale fisheries if they are in any way to be got. Sir Vesey Hamilton spoke on the question of steam, and his remarks were referred to by the lecturer as to the great advantages that steam gave in combatting with the ice in the *Northern and Southern regions*. I had myself some experience of that kind. I made a voyage to the Arctic regions in a steamer which was comparatively powerful for that kind of work, the most powerful steamer that has ever navigated in those waters; and unquestionably the way in which we were able to push through the ice, when neither a sailing vessel nor a small, low-power steamer could have done it, was most surprising. It did not seem as if any thickness of pack would have absolutely stopped the ship. We could have worked through in some way or another. With regard to the question of collisions with icebergs, we had some, and I quite recollect on one occasion scraping our yards against the sides of one. It was one of those days of misfortune, when we weighed on Friday, and we all thought we came to grief for that reason! But it was not so serious a matter for a steamer to do that as it was for a sailing vessel, and we came clear of our iceberg without material damage. Sir Vesey Hamilton mentioned how many, and the lecturer, in the early part of his paper, dwelt greatly and rightly on the number of distinguished men who had, early in their career, acted as discoverers in these matters. He was modest, naturally about himself. We all know what he was in active service, and I hope he will allow us to put down some of it to his Arctic training. That the expedition must be naval, I think there can be no question. I do not suppose that a private expedition could face the Antarctic regions, although some of them have faced the Arctic regions, where things are better known; but you do require the discipline and the strength

of naval cohesion to carry a ship through the difficulties and the dangers which are inevitable in such navigation. I was very glad—and we are always very glad in this theatre—when the younger naval officers address us. It is one of the things we are always looking for, more and more, and I am practically sure that he only represents the feeling of the whole Navy amongst the younger officers when he says that there would be volunteers forthcoming to man the ships in question entirely from the list of lieutenants. I hold my opinion as to the desirability and the ultimate certainty of our Antarctic exploration, because I am in no way connected with it, and I am perfectly sure that if I were a Lord of the Admiralty I should doubt about it, and if I were connected in any way with the Treasury I should laugh it to scorn! But there are powers behind the Treasury stronger than the Treasury, and a little thing sometimes puts those powers in action. Let us hope that the eloquent address we have listened to to-day may apply some of that force and make a certain amount of stir in the country, which will ultimately lead to the action even of the Treasury. I am quite sure you will join me heartily in thanking the lecturer for the trouble he has taken in preparing the lecture, but before I finally give him your vote I have to ask him to make his reply himself.

Mr. CLEMENTS R. MARKHAM: The mention by Sir Vesey Hamilton of the use of turbines for Antarctic ships reminds me that poor Captain FitzJames, who went out as commander of the "Erebus" in Sir J. Franklin's expedition, in a letter he wrote on the subject to our old friend, John Barrow, suggested the use of the turbine or some principle of the same kind in the Arctic regions, instead of the very small engines that were put on board the "Erebus" and "Terror." Only last night I was reading his letter on the subject, and looking at a little pen-and-ink sketch which he made. The hope in the existence of "right" whales in the Antarctic regions is not only derived from the small amount of bone—I believe it is a very small amount of bone—that comes from New Zealand, for Sir James Ross certainly does mention having frequently seen "right" whales, and Captain Larsen told me this summer that he was actually fast to one, and if anyone knows what "right" whales are it is he, because he has been fishing for them all his life. So I am inclined to believe, although separated from the northern "right" whales by the warm seas of the tropics, that whales having bone of sufficient length to be valuable do exist in the Antarctic regions. I have felt much satisfaction in listening to the discussion; and, if our greatest enemy is Admiral Fitzgerald, I feel quite confident that the whole feeling of the Navy is unanimous in advocating the despatch of an Antarctic expedition, and with that feeling I give you my most sincere thanks for the way in which my paper has been received.

On the motion being put by the Chairman, a hearty vote of thanks was accorded to the lecturer.

The following letter was read by the Secretary:—

REMARKS ON MR. C. MARKHAM'S PAPER.

The importance of terrestrial magnetism as a subject of enquiry in the regions south of 40° south latitude has already been duly noticed by the lecturer, and the broad features of the large amount of work that remains to be done for that science have been ably enumerated.

I would, however, remark upon the debt of gratitude which the modern seaman owes to his brethren who lived and laboured during the first fifty years of this century, and who, by their observations, in all parts of the world, contributed so much to our knowledge of the earth considered as a magnet. The Antarctic regions being specially under consideration, I have one more name besides that of Ross and his companions which I think should be mentioned—that of Captain Matthew Flinders—who, by his observations of the dip of the needle in southern latitudes, combined with a study of the deviations of the compass in the "Investigator," invented, in 1805, that important item in the correction of the

compass in iron and steel ships, the Flinders bar. In short, if we had not already a fair knowledge of the earth's magnetism in the majority of navigable latitudes, we should be unable to send our thousands of iron and steel ships over the world with the remarkable precision which due care can attain. Each of these ships is a magnet, and if we would know the nature of their magnetism we must first know the nature of their parent magnet, the earth. Now, the distribution of the earth's magnetism is well known to be constantly changing, and there is a vast deal to be learnt of these changes. If, however, we can once obtain a correct knowledge of the earth's magnetism for different epochs, there is little doubt that scientific men will be able to obtain a series of constants, by means of which they will be able to construct in advance those charts of the variation of the compass, and the magnetic dip and force, which are so important to navigation. In fact, we shall be able to treat the subject much in the same manner as the computation of the times of high water in advance.

Both the maritime and scientific world may be said to be full of gratitude of two kinds to naval officers : that for the past, and the more common kind, of a lively sense of favours to come. These favours as regards terrestrial magnetism are locked up in the Antarctic regions, and I hope before long the key will be placed in the hands of naval officers.

ETTRICK W. CREAK,
Retired Captain R.N.,
Superintendent of Compasses, Hydrographic Department.