

## THE CULMINATION OF SCOTT'S *DISCOVERY* ANTARCTIC EXPEDITION AT PORT STANLEY, FALKLAND ISLANDS, JULY 1904

By *Phil Stone*

The British National Antarctic Expedition, 1901–1904, led by Robert Falcon Scott, is more commonly known as the *Discovery* Expedition, taking the name of the ship that carried Scott's team, via New Zealand, to the Ross Sea. *Discovery* spent two austral winters locked in the sea ice off Ross Island (Fig. 1), whence the expedition pursued its scientific and exploration programme. Two relief ships, *Morning* and *Terra Nova*, finally broke through to *Discovery* on 14 February 1904, and after a very difficult, stormy few days during which *Discovery* ran aground and was almost wrecked, all three vessels sailed for New Zealand.



*Figure 1. Discovery at the Ross Sea base of the British National Antarctic Expedition, probably early in 1902. Photograph by Reginald Skelton. Scott Polar Research Institute, University of Cambridge (P83/6/1/1/65).*

For most accounts of the *Discovery* Expedition, the ships' arrival in New Zealand on 1 April 1904 was the end of the story, but that's not the case. The last scientific leg of the expedition saw *Discovery* and *Morning* leave New Zealand on 8 June and set sail for the Falkland Islands, where a week was spent at Port Stanley, Tuesday 12<sup>th</sup> to Wednesday 20<sup>th</sup> July 1904. The principal purpose was to complete a Globe-spanning series of geomagnetic observations, but once at Port Stanley at least two of the expedition's other scientists continued to make observations and collect specimens. This article draws primarily on the Falkland Islands diary records left by Edward

Wilson, the expedition zoologist, and by Lt. Reginald Skelton, R.N., chief engineer of the *Discovery*. Hartley Ferrar, the expedition geologist, collected and documented a few rock specimens and these are now preserved in The Natural History Museum, London.

### **Edward Adrian Wilson (1872–1912)**

Edward Wilson was born in Cheltenham, England, studied Natural Science at the University of Cambridge and subsequently qualified in medicine before joining the *Discovery* expedition as ‘junior surgeon and zoologist’. A deeply religious, empathic man and a gifted artist, he was universally popular and quickly became a key figure in the expedition’s success, praised by Scott in the following extract from a letter written to Sir Clements Markham (President of the Royal Geographical Society) and reproduced in the biography of Wilson by George Seaver.

“Wilson will do great things someday. He has quite the keenest intellect on board, and a marvellous capacity for work. You know his artistic talent, but you would be surprised at the speed with which he works and the indefatigable manner in which he is always at it ... helps with every job that may be on hand, doctors the men, keeps an eye on the ventilation of the ship, runs the wine as caterer ... and in fact is an excellent fellow all round.” (Seaver 1933, p. 77).



*Figure 2. Gathered on Discovery, perhaps prior to sailing, are, from left to right: Reginald Skelton, Hartley Ferrar, Albert Armitage, Michael Barne (with dog), Edward Wilson. Photograph by Ernest Shackleton. Scott Polar Research Institute, University of Cambridge (P83/6/1/4/67).*

Wilson became a well-known figure in Antarctic exploration (Fig. 2) but his life ended tragically during Scott's second Antarctic venture, the *Terra Nova* expedition, when he died with Scott and the rest of the British Polar team early in 1912 during their doomed retreat from the South Pole. They had successfully reached the Pole on 18 January 1912, only to discover that Amundsen's Norwegian team had arrive there five weeks earlier on 14 December 1911. Amundsen's party got back safely.

In his hometown of Cheltenham, in recognition of the achievements of a local man, the Wilson family's collection of Antarctic memorabilia is now housed in the Wilson Cheltenham Art Gallery & Museum.

### **Reginald Skelton (1872–1952)**

Born in Lincolnshire, England, Skelton joined the Royal Navy in 1887 and trained at the Royal Naval Engineering College. Amongst his subsequent ships was HMS *Majestic* where, in 1899, he served alongside Robert Scott. It was that association that led to Skelton being appointed Chief Engineer of *Discovery* (Fig. 2), personally supervising the construction of the ship in Dundee. During the expedition he also acted as photographer and took part in man-hauled sledging activities, on one occasion accompanying Wilson and Ferrar. Wilson, perhaps a little patronisingly, noted that “Skelton, although not a big or strong man, is nevertheless handy and useful on a sledging trip” (Wilson, p. 195, diary entry for Friday 3 October 1902).

After the expedition Skelton resumed his naval career, with two periods of duty in submarines between which he won a DSO at the Battle of Jutland, 31 May 1916. Thereafter he rose through the ranks to become Engineer Rear Admiral in 1923, Engineer Vice Admiral in 1928, and was Engineer-in-Chief of the Fleet between 1928 and 1932. He was knighted in 1931.

### **Hartley Travers Ferrar (1879–1932)**

Hartley Ferrar is generally less well-known than Wilson, though celebrated in geological circles as an Antarctic pioneer and memorialised by the Ferrar Large Igneous Province, the collective term for the array of igneous rocks (all about 180-185 million years old) that he first investigated during the *Discovery* expedition, and which are now known to extend the length of the Transantarctic Mountains, and possibly beyond. He was one of the youngest members of the expedition (Fig. 2): born in Ireland but with a childhood spent in South Africa, when he joined the expedition in 1901 he had newly graduated from the University of Cambridge, England. He subsequently went on to work in Egypt and moved to New Zealand in 1914, initially teaching but then, during the First World War, he returned to the Middle East with the New Zealand Expeditionary Force. Back in New Zealand after the war, in 1919 he joined the New

Zealand Geological Survey. A comprehensive biography has been published by Brook & Ferrar (2019).

Initially, Ferrar's relative youth and inexperience left him open to bullying behaviour by some of the naval officers who dominated the *Discovery* expedition, with Lt Albert Armitage (Fig. 2), Scott's second-in-command, seemingly an egregious offender, as noted by Skelton:

“Armitage talks to him [Ferrar] in a most absurd way, a sort of bullying or ridiculing tone, in front of the men. Very bad form I think ... I wouldn't stand it, but then he knows better than to speak like that to anybody who 'knows the ropes'. (Skelton 2004, p. 138, diary entry for Wednesday 3rd December 1902).

Nevertheless, once established at Ross Island, Scott soon recognised Ferrar's observational abilities, acknowledging that one “cannot speak of any feature of the numerous hill-slopes and valleys . . . without finding out that he knows it well” (Scott 1905, vol. 2, p. 314). Elsewhere, Scott refers to his geologist as ‘this important officer’ and when a reconnaissance party returned with some interesting rocks from an area that “looks good for geology” he determined that “at all hazards our geologist must be given the chance of exploring it” (op. cit. p. 144). During one such exploratory trip Ferrar succumbed to scurvy and was fortunate to be assisted back to the expedition base at Ross Island. But there, cared for by Wilson, he made a full recovery and was able to continue with the expedition's programme.

## **To the Falkland Islands**

During the 1904 passage from New Zealand to the Falkland Islands routine scientific activities were maintained, and several deep ocean soundings were achieved from *Discovery*. One disproved the existence of the putative Dougherty Island at 59° 20' South, 120° 20' West, where 2318 fathoms were recorded. The coast of Chile was sighted on 6 July and *Discovery* passed into the Magellan Strait to drop anchor in Punta Arenas two days later. Wilson (1966, p. 382 for 8 July 1904) wrote a lengthy description of the town in his diary noting that “every other house in the place, literally, seemed to be a liquor shop. There is undoubtedly a vast amount of drinking done here.” Conversely, he was impressed by the ‘civilised worship of God’ evidenced by the Roman Catholic church and intrigued by the range of animal skins and indigenous curios on sale: his diary includes a sketch of an armadillo made up into a basket.

Although he didn't go ashore Skelton was not impressed by Punta Arenas: “The town is a wretched looking place” and “the people are mostly the dregs from other places” (diary entry for Friday 8 July 1904). He also made a curious, cryptic criticism of some of his colleagues, perhaps recognising post-expedition conceit, writing “[a] good many

Antarctic expeditions have called here during the last 5 years. The people didn't know anything about us at all, rather a change from other places we have been to & probably rather good for some of us."

Leaving Punta Arenas on 9 July, *Discovery* navigated the eastern section of the Magellan Strait and headed for the Falkland Islands, with land sighted two days later; Port Stanley was reached on 12 July 1904. *Morning* arrived on 17 July having made a slow passage around Cape Horn rather than through the Magellan Strait. In his account of the expedition, Armitage simply acknowledged that he had "spent a very pleasant week at Port Stanley, where everyone was most hospitable and kind to us" (Armitage 1905, p. 297). Scott had even less to say about the time spent in Port Stanley, merely noting that "Here we replenished our stock of coal and took the last series of magnetic observations in connection with our Southern Survey" (Scott 1905, vol. 2, p. 401). The magnetic observations would have been mainly the responsibility of Armitage (he was the *Discovery* Navigator), Louis Bernacchi, the expedition's physicist and Lt. Michael Barne (Fig. 2), second officer of *Discovery* and the 'assistant magnetic observer'; hence Skelton recorded on Friday 15 July "Armitage ashore Magnetic work". But for most of the scientists there was no planned work programme, and like the rest of the expedition team, they probably viewed their time in the Falklands as an unwelcome delay on the way home. Bernacchi summed things up in his account of this late phase of the expedition:

"We passed through the beautiful Magellan Strait ... spent three days [*sic*] at Port Stanley in the Falkland Islands, where food and coal were replenished and the last series of our magnetic observations taken, and then, rather wearily, but slowly and surely, we sailed north and homewards." (Bernacchi 1938, p. 113).

### **At Port Stanley**

Armitage, Bernacchi and Barne would have made their geomagnetic observations at Stanley whereas previous Falkland Islands measurements had been made at Port Louis: in 1842 by the James Clark Ross *Erebus & Terror* expedition, and in 1876 during the oceanographical cruise of HMS *Challenger*. The next measurements at Stanley were made in 1923 by surveyors from the Carnegie Institute of Washington, USA. In their historical review of geomagnetic observations in the Falklands, Riddick & Harris (2000) do not mention the *Discovery* data, perhaps another example of the erroneous presumption that that expedition ended in New Zealand.

Wilson maintained his diary entries whilst in Stanley and describes his impressions in some detail. The first was not particularly favourable: "when we came into the harbour ... we saw about a hundred shanty huts, a brick and stone church, and a number of old hulks ... you could shout from one end [of the town] and be heard at the other ... It

was a queer old sleepy hollow with a vengeance, and everyone made a mental vow to be away as soon as ever we could get the work done” (Wilson 1966, p. 385 for 12 July 1904). Skelton was equally dismissive: “This place seems a pretty Godforsaken sort of place.” But it was mid-winter, so the town would not have been seen to its best advantage. However, things looked-up for Wilson when he went ashore and at Government House met the Colonial Secretary, Mr Hart Bennett – “He turned out to be a very nice man.” As for Wilson’s inspection of the town ... “It took about an hour to do the whole thing. There seemed plenty of inns – the *First and Last*, the *Rose*, the *Globe*, the *Ship* ... and several others”. The Cathedral met with his approval, but despite that “We were glad enough to get back to the comparatively civilized atmosphere of the ship.” But Wilson and his colleagues were not left in peace and the following day were entertained to a tea party at Government House “where we met the élite of Port Stanley ... the most awful nonsense.” (Wilson, 1966, p. 385, diary entry for 13 July 1904).

Excursions beyond the confines of Stanley proved more to Wilson’s liking. His companion of choice would probably have been Lt. Michael Barne with whom he had developed a particular friendship; Barne is one of the very few expedition members commonly referred to by his first name in Wilson’s diary. But Barne may have been occupied with the geomagnetic observations so, on 14 July Wilson set off with Hartley Ferrar, the expedition’s geologist, for Cape Pembroke: “a long walk over the hills and back by the coast along the shore by the lighthouse.” He comments on the abundance of birds and under normal circumstances would have shot and collected them, but on this occasion does not seem to have taken a gun with him. That didn’t mean the birds escaped unscathed. “We saw a good many birds and got two Ringed Dotterels out of a flock. Ferrar knocked them over with his geological hammer.” There was a sprinkling of snow on the ground, but Wilson was still able to note the variety of plants growing on the peat. He also seemed impressed that “The shore in many places is of the most perfect silver sand.” (Wilson 1966, p. 385, diary entry for 14 July 1904) (Fig. 3).

Wilson took another long walk with Ferrar on 16 July, this time heading west from Stanley. They enjoyed a chance encounter with a local farmer, Christoph Bender (*Dictionary of Falklands Biography* entry by Peter Millam 2008), whose land (he claimed 7 000 acres, “one of the smaller farms”) extended from Moody Valley west to Two Sisters, so that was probably their route. From Bender, Wilson seems to have acquired much local information, on Falklands farming for example “Three acres here support a sheep”; there were also complaints about the conduct of the Falkland Islands Company, and scurrilous gossip about the colonial surgeon, Samuel Hamilton (*Dictionary of Falklands Biography* entry by David Tatham 2008) who “seems a standing joke to everyone.” (Wilson 1966, p. 386, diary entry for 16 July 1904). Wilson also learnt of the warrah – “There was a large grey fox, but he is killed out” – and was told of “wild cats, true bushy-tailed beasts”, and geese in such abundance that many thousands were killed annually just to preserve the grass for the sheep.



*Figure 3. “The shore in many places is of the most perfect silver sand.” Gypsy Cove and Yorke Bay. Photograph by Phil Stone. BGS image P1043245 © UKRI.*

In Ferrar’s company Wilson’s attention would undoubtedly have been directed to the geology and he notes “nothing but quartzite, much faulted, often on its beam ends, producing the rocky hill tops that break the dead flat of this otherwise uninteresting sheep’s paradise.” (Fig. 4).



*Figure 4. “Nothing but quartzite ... often on its beam ends.” Steeply inclined beds of quartzite at Vantan Arroyo, looking west towards the Wickham Heights. Photograph by Phil Stone. BGS image P1043244 © UKRI.*



But then Wilson promptly contradicts himself by expressing great interest in the stone runs, “that have puzzled everyone from Darwin downwards”. As an early and accurate description of this remarkable Falklands landform, now interpreted as huge periglacial blockfields (e.g. Clark & Wilson 2008), it is worth citing Wilson at some length.

“They look just like rivers of big boulders of grey lichen-covered rock, all higgledy-pig, etc. But when the bigger boulders are removed for building, as they are in places, you find they are resting on a basis of smaller and far more uniform stones, which are clean and without any vegetation on them, and down among these you hear water trickling. The upper layer boulders vary from as much as you can lift alone to the size of a large wagon, and all are of grey quartzite rock. The lower layers are the size of a child’s head. The funny thing is that these rivers winding down the hill sides have definite banks, level with themselves, but quite definite as far as growth of vegetation goes. So that you step from the peat edge onto the stone river and there is no half and half between them.” (Fig. 5) (Wilson 1966, p. 386, diary entry for 16 July 1904).



*Figure 5. “Rivers of big boulders of grey lichen-covered rock ... winding down the hill sides have definite banks, level with themselves.” Stone runs on the southern slopes of Mount Challenger. Photograph by Phil Stone. BGS image P575724 © UKRI.*

Turning back to his principal interests, here inland only few birds were seen, but amongst the plants Wilson was impressed by the large green masses of “Bog Balsam” which proved “so hard that you can hardly impress it with your clodhoppers.” He also



noted the widespread occurrence of Diddle dee, “used to make a bitter stomachic tea”, and several other berried plants, fruit from one of which was “as big and sweet as cranberry”. Given that his observations were made in mid-winter some of his account must include received wisdom, but he and Ferrar do seem to have been fortunate with the weather: “Altogether we had a good day – the ground hard and frozen with a smattering of snow and the air keen and bracing.”

When writing-up his results after the expedition Ferrar (1907) makes no mention of the Falkland Islands, but whilst in Stanley he did collect four specimens of the local quartzite rock which are still held with the rest of the *Discovery* geological collection in the Natural History Museum, London, with registration numbers 87171(867-70) (Bishop *et al.* 1971). It is not clear whether these were acquired during one of the excursions with Wilson, or during an independent foray. The specimens were all recorded as having been collected at “Flagstaff Hill, Port Stanley”. This is not a placename in current official use but refers to the area around the flagstaff that once stood at what is now the junction of Villiers Street and Davis Street. There is still plenty of quartzite to be seen in that vicinity and Ferrar would not have needed to carry his haul very far. In Stanley, Villiers Street is still sometimes referred to locally as Flagstaff Hill, whilst Flagstaff Row was an old name for Davis Street. The flagstaff was used for signalling communication with the Cape Pembroke lighthouse (Fig. 6).



*Figure 6. Flagstaff Hill as seen from Stanley Harbour in a painting (gouache) by Eduardo De Martino who visited Stanley on the Italian Navy ship Ercole in 1866. The two balls (signalling equipment) indicate it is not a ship’s mast. Original painting is 20 x30cm. Reproduced with permission from the Falkland Islands Museum and National Trust.*

Skelton had less opportunity to go ashore, being concerned with the supervision of coaling, taking on fresh water, and on Tuesday 19<sup>th</sup> July “swinging ship for compass” (a process also mentioned by Armitage). Skelton noted that some of the crew had been skating and a diary entry of “Skating ashore” on Thursday 14<sup>th</sup> July presumably refers to himself. Otherwise, he had an introduction from a mutual friend to Vere Packe, a local businessman, and visited him and his family for lunch on Sunday 17<sup>th</sup>. He summed up his day thus:

“Mrs Packe is a Falkland Islander, was a Miss Fulton. Don’t go very much on her, but he seems a very decent chap. Met Royds [*Discovery* First Lieutenant], The Skipper [Scott] & Hart Bennett, the Colonial Secretary, after lunch & played a few holes of golf, then went back to the Packes to tea with Royds. Came off at 6.30 having seen quite enough of The Shore.” (Skelton 2004, p. 214).

Wilson had one more day away from the ship, 18 July, but this time “had a long wander over the moorland and along the shore by myself.” The birds and plants attracted his attention as usual, but his final comments on Stanley and environs were rather sombre.

“One would like the opportunity of working out the birds of a place like this, but to shoot the commoner birds only that one sees around this miserable township seems a pity. There is a slaughter house at each extreme end of the town and the refuse is thrown out on to the shore where the Turkey Buzzards and the Dominican Gulls swarm round it. Everywhere the ground is littered with sheep skulls and on the moor one constantly stumbles on a dead horse or cow and on the shore a succession of remains of Steamer Duck. I have nowhere seen such an abundance of life destruction littering the place up.” (Wilson 1966, p. 387–8, diary entry for 18 July 1904).

And after that he had to be back on the ship “for a reception tea party to the Acting-Governor Hart Bennett and the élite of Port Stanley.” Wilson turned down the opportunity to attend a dance the next evening “in a tin tabernacle”, but Skelton went along and described the event: “All the natives were there from the pro-tem Governor to the chimney sweep. Funny show, too long, all sorts of odd dances.” He, Wilson, and their colleagues were all probably mightily relieved when *Discovery* got under way early in the morning on 20 July 1904 and headed north, away from the Falkland Islands.

### **The later history of *Discovery***

After working in the Arctic for the Hudson Bay Company, *Discovery* sailed again for the Falkland Islands in 1916 as part of the relief effort seeking Shackleton’s *Endurance*

expedition, missing in the Weddell Sea; but the voyage was abandoned in Montevideo where news was received of the successful rescue of the *Endurance* crew from Elephant Island (Savours 2001).

*Discovery* was to return to the Falkland Islands, but not until 1926, and then as a Royal Research Ship with her registration transferred from London to Port Stanley. This marked the beginnings of the ‘*Discovery* Committee’ investigations into the scientific background of the whaling industry, oceanographical and biological, and the old ship’s new role had required a major refit. The foremast and mainmast were both moved forward several feet and the overall sail area was increased by over 20%; new deckhouses and winches were added, and the bulwarks were raised to assist the deployment of nets and sampling devices (Savours 2001) (Fig. 7). And so, after completing work around South Georgia during the 1925–26 austral summer, it was a rather different-looking *Discovery* that dropped anchor in Stanley Harbour in late April.



*Figure 7. Discovery at Portsmouth, either arriving for the 1924-1925 refit or more probably leaving once it was completed. An image from the Jane Cameron National Archives, Falkland Islands (PC-006-0095). Photograph by Russell & Sons, Southsea.*

*Discovery* spent the 1926 austral winter in Cape Town, then completed a second research cruise in the South Atlantic, this time taking in Bouvet Island, South Georgia, the South Orkneys and Shetlands, and the Antarctic Peninsula. From there she sailed north via Tierra del Fuego to arrive in Port Stanley on 6 May 1927. That was to be her last visit to the Falkland Islands, but not to the Antarctic. Two voyages between 1929

and 1931 supported BANZARE – the British, Australian and New Zealand Antarctic Research Expeditions – around the East Antarctic coastline. Thereafter, back in London and in retirement, *Discovery* became a familiar site moored on the Thames Embankment, spared by wartime bombs and saved from dereliction by philanthropic benefactors and the Maritime Trust.

The happy ending to the *Discovery* story began in 1979 with a move to London’s St Katherine’s Dock and a major overhaul that aimed to restore her as far as possible to her 1925 appearance. Finally, in 1986, she rode piggy-back aboard the floating dock ship *Happy Mariner* back to Dundee where she had been built 85 years earlier. And there she remains as a major tourist attraction. The full details of this remarkable ship’s history have been researched and described by Ann Savours (2001) in her well-illustrated and highly recommended book.

### **Acknowledgements**

For their assistance in accessing historic images, I thank Lucy Martin, Scott Polar Research Institute, University of Cambridge, UK, and Chloe Anderson-Wheatley, Jane Cameron National Archives, Falkland Islands.

Details on the location of Flagstaff Hill were provided by Chloe and by Brian Summers. The painting showing Flagstaff Hill (Figure 6 )was bought by the Friends of the Falkland Islands Museum and National Trust and the Jane Cameron National Archives (FIMA Friends) in 2016 for exhibition at the Historic Dockyard Museum. I am grateful to Alison Barton for sourcing it in the Museum collection.

### **Footnote**

Background to Figure 6. Eduardo de Martino joined the Italian navy and served as navigating officer on the steam corvette *Ercole* (‘Hercules’) in a naval detachment on the River Plate. In March 1866 the *Ercole* set off on a voyage from Montevideo to the Pacific coast of South America, calling at the Falkland Islands on the way. *Ercole* arrived in Stanley on 19<sup>th</sup> April under command of Commander Orazio Persichetti. While in Stanley de Martino painted two watercolours of the town and these provide a rare and beautiful glimpse of the fledgling capital.

### **Bibliography**

Armitage, A. B. 1905. *Two years in the Antarctic*. Edward Arnold, London.

Bernacchi, L. C. 1938. *Saga of the “Discovery”*. Blackie & Son, London & Glasgow.

- Bishop, A. C. *et al.* 1971. *Catalogue of the rock collections in the British Museum (Natural History)*. Trustees of the British Museum (Natural History), London.
- Brook, M. S. & Ferrar, S. 2019. Hartley Travers Ferrar (1879–1932) and his geological legacy in Antarctica, Egypt and New Zealand. *Earth Sciences History*, **38**, 43–58.
- Clark, R. & Wilson, P. 2008. Recent aspects of stone run research. *Falkland Islands Journal*, **9**(2), 37–52.
- Dictionary of Falklands Biography*, D. Tatham (ed.) 2008.  
Bender, Christoph Peter Wilhelm (Charles), 71-72, by P. J. Millam.  
Hamilton, Samuel, 265, by D. Tatham.
- Ferrar, H. T. 1907. Report on the field-geology of the region explored during the ‘Discovery’ Antarctic Expedition, 1901–4. *National Antarctic Expedition 1901–4, Natural History*, **1** (Geology), 1–100. Trustees of the British Museum, London
- Riddick, J. C. & Harris, M. R. 2000. The measurement of the Earth’s magnetic field in the Falkland Islands 1683 – 2000. *Falkland Islands Journal*, **7**(4), 8–17.
- Savours, A. 2001. *The Voyages of the Discovery: the illustrated history of Scott’s ship*. Chatham Publishing, London. This is an abridged version, with additional illustrations, of a book with the same title published in 1992 by Virgin Books. An extract from the 1992 book describing the ‘Shackleton Rescue Mission’ was published in *Falkland Islands Journal*, **11**(1) for 2017, 81–86.
- Scott, R. F. 1905. *The Voyage of the Discovery*, **2**. Smith Elder & Co., London.
- Seaver, G. 1933. *Edward Wilson of the Antarctic*. John Murray, London.
- Skelton, R. 2004. *The Antarctic Journals of Reginald Skelton*. J. Skelton (ed.). Reardon Publishing, Cheltenham.
- Wilson, E. A. 1966. *Diary of the Discovery Expedition to the Antarctic Regions 1901–1904*. A. Savours (ed.). Blandford Press, London.

British Geological Survey, Edinburgh (psto@bgs.ac.)