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ASTRONOMERS AND OTHER SCIENTISTS ON ST. HELENA

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1. *Introduction*

Nearly one hundred years ago Captain S. P. Oliver wrote: 'It is fitting that the memorial of one should stand high, full and clear against the bright tropical sunshine, the other cower beneath, in the shade of merited obloquy'.[1] He was referring to a proposal to erect a monument to Edmond Halley (1656–1742) on the site which Dr. David Gill identified in 1877 as Halley's Observatory. 'The other' refers to Napoleon, whose cenotaph lies in a valley 350 yards below.

One may disagree with this biting comment on Britain's great enemy. However, the truth is that to the man in the street the only fact known about St. Helena is that it was the place of Napoleon's exile, whereas in fact the Island has had a varied history. Without making exaggerated claims, one can say that it has made a real contribution to scientific—especially astronomical—knowledge.

One of us (Harwood) makes regular visits to Ascension and St. Helena to examine and prescribe for the eyes of the people, and in 1968 a search was begun for the site of Halley's observatory of 1676–77 on the hill traditionally known as 'Halley's Mount'. Discovery of a pile of stones—the only such pile on the hill—led to the excavation of the foundations of a building, and the search for additional evidence produced a body of information about other scientific sites on the island. What follows is an outline of the discoveries.

St. Helena lies at 15°55′ South Latitude and 5°42′ West Longitude and has an area of 47 square miles. Although in the Tropics, the climate is equable; temperatures in Jamestown, the capital (on the sea) rarely

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[1] S. P. Oliver, *On board a union steamer*, 1881, London. This was an account of a voyage to Capetown during which the ship called at St. Helena.

reach 90°F and in the country 80°F. We shall see that Oliver's description of the bright tropical sunshine is misleading, for the sky is often covered with cloud and mists in the South are common. Volcanic in origin, St. Helena is extremely precipitous.

Sir Thomas Herbert wrote that he found it ' hard to be ascended—it is so precipitous '. The sailors have an ironic proverb: ' The way is such as a man may choose whether he will break his heart going up or his neck coming down, but being once up, scarce any place can yield a more delightful prospect '.[2]

The island was first discovered in 1502 by the Portuguese during the return of their earliest fighting and trading expedition to India. They kept it secret and almost unoccupied, a place of rest and refreshment for their ships homeward bound from the East. Thomas Cavendish was the first Englishman to land there in 1588 at the close of his famous circumnavigation of the world. He contributed to the literature a splendid and evocative description of its charms. His discovery was to be the signal for an intermittent struggle over the island's possession between the Portuguese (who soon retired from the struggle as their maritime supremacy fell away), the Dutch and the English. Eventually, in 1659, the English East India Company sent an expedition under John Dutton, the island's first governor, to colonize and fortify the island. From that year onwards, except for a very brief recapture by the Dutch, St. Helena has remained in English hands, until 1835 as a possession of the East India Company under charter from the Crown, and since that date as a Crown Colony. Large numbers of ships used its safe anchorage off Jamestown every year, and were supplied with good fresh water, vegetables, and fresh meat; but the numbers declined in the second half of the nineteenth century and the opening of the Suez Canal reduced still further the number of visitors.

During the present century, up to 1966, there was a profitable export trade in the New Zealand flax which still covers a large part of the interior, but this trade has vanished under the pressure of man-made fibres and other economic factors. All these historical details will be found to be more or less relevant to what follows.

2. *Edmond Halley*

2.1. *Edmond Halley on St. Helena* (*February* 1677 *to March* 1678).

The first and, one might say, the greatest of all the astronomers who visited St. Helena was Edmond Halley; and the original object of the writers of this paper was to find the site of his observatory. Why

[2] Sir Thomas Herbert, ' New and complete collection of voyages and travels ', 1785 (quoted by Philip Gosse, *St. Helena* 1502–1938, 1938, London, 35).

did Halley choose St. Helena? To him and subsequent observers the island offered the security of a British colony, a position in the Southern Hemisphere from which all the Southern stars could be observed and yet sufficiently near the Equator for them to be keyed to the Tycho Brahe catalogue of Northern stars. It would also be useful as a station for the determination of the distance of the Earth from the Sun by the method of transit (Venus and Mercury), and as a location in the South Atlantic of prime importance for the magnetic, meteorological, and tidal charts of the world.

Its disadvantage as an observing station of the Southern skies is that its sky is overcast far more frequently than most people would expect of a tropical island. Halley complained of this in a famous letter to Sir Jonas Moore of November 22nd 1677: ' but such has been my ill-fortune, that the horizon of this Island is almost always covered with a cloud, which sometimes for some weeks together has hid the Stars from us, and when it is clear, is of so small a continuance, that we cannot take any any [sic] number of observations at once; so that now, when I expected to be returning, I have not finished above half my intended work '. And later: ' Likewise I have seen those two Eclipses, one of the Sun the other of the Moon in May last, both of which I sent you, but the mighty winds, and extraordinary swift motion of the clouds hindred [sic] the exactness of the Observations '.[3]

The records of the island, mainly the ' Consultations ' or minutes of the meetings of the Council, are only extant from 1678, after Halley had left. However, as there is mention of ' the hill, known as Hawley's Mount ' in 1682 it seems probable that this mountain was given its present name while Halley was there, or shortly afterwards. Halley, while still at Oxford, ' found such a defect in the then best Tables, with regard, particularly, to the Motions of Jupiter and Saturn, that he was very desirous to correct the same; which however he was sensible could not be done to the purpose, without a more correct Catalogue than was yet extant of the Fixt Stars '.[4] Hevelius and Flamsteed were currently at work on the necessary improvement in Tycho Brahe's catalogue for the northern stars, and Halley set himself to produce an accurate catalogue for the southern hemisphere. He was twenty years old at the time. There are, however, one or two points which need stressing.

The first is that there appears to have been uncertainty about the dates of his stay on St. Helena. Actually, the evidence is clear that he

[3] Edmond Halley, Letter to Sir Jonas Moore, 22nd November 1677, in E. F. MacPike, *Correspondence and papers of Edmond Halley*, 1932, Oxford, 39–41.

[4] Attributed by MacPike to Martin Folkes, President of the Royal Society 1741–42, *Memoir of Dr. Halley*, MacPike *ibid.*, 1–13.

arrived with his able assistant, Mr. Clarke, in February 1677, having set sail in November of 1676, and left at some date between January and March 1678, arriving in London by May.[5]

Secondly, it is established that Halley brought with him recommendations not only from the East India Company but also from Charles II. It is made plain from one sentence in the Introduction to the Catalogue that the Governor, Captain Richard Field, was by no means cooperative. One wonders why. It is tantalising that we have not got the copies of the Consultations which might throw some light on this question. In 1676 the total population of St. Helena was 390. Is it possible that Halley demanded too large a labour force for building, transport and other duties? It seems clear that Field was found unsatisfactory by his masters in London and that in any case he failed to keep his people in order.

2.2. *The site of Halley's Observatory.*

It is a reasonable assumption that an astronomer who planned to stay for a period of a year or more would require some shelter for himself and his valuable instruments. We have a description of these from the introduction to Halley's *Catalogus Stellarum Australium*—published in London (Latin) and in Paris (Latin and French) in 1679:

> ' When my voyage had been assured I had a sextant made, of which the radius was five and a half feet in London measure: the framework [la structure] is of iron, the limb [bord] and the scales are of brass, it is fitted with telescopes, and so that it can be rotated easily and precisely in the necessary operations [applications] it is placed on two toothed semicircles which intersect at rightangles, and which rotate on an endless screw, adjusting [disposant] the plane of the instrument in such a way that without any labour and the greatest readiness, they [les semiciercles] adjust themselves to any situation for any two stars at the same time. I have also a quadrant [quart de ciercle] which I have used before, of which the radius is about two feet; I have used it infrequently in celestial observations, but only to find the elevations of the Sun which are necessary to correct the faults and in equalities which usually occur in the timekeeping [mouvement] of clocks. Lastly, I prepared several telescopes of various lengths, of which the longest is twentyfour feet, with two micrometers to measure the arc between the object and the bearing [portée] of the telescopes '.[6]

[5] The *Dictionary of National Biography, G–H*, 988, gives the date of his arrival in London as October 1678, and the ' Memoir ' as the Autumn. However, Robert Hooke, in his manuscript diary, records meeting Halley in London on May 30th. MacPike *ibid.*, 183.

[6] These very long telescopes were developed before the corrections required for spherical and chromatic aberrations had been discovered. Hevelius of Danzig had already made one with a wooden tube of 150 feet, and Huygens an ' aerial telescope ' without a tube, the objective of which was hoisted on a high pole. Magnification was quite good, but image brightness poor. See H. C. King, *The history of the telescope*, 1955, London, 48 *et seq.*

There seems no doubt that this sextant was a slightly scaled-down version of the first major instrument at the Royal Observatory, Greenwich, and used by Flamsteed, the first Astronomer Royal. His instrument does not survive, nor does Halley's but the two illustrations show the contemporary design (Plate 1) and the modern interpretation of its use (Plate 2). It is clear that this large and rather flimsy machine, which required two operators, would have needed protection from wind and rain. The small walled enclosure which the authors found, measuring about 12 feet by 14 feet, would have been well adapted and sited for this purpose. It seems likely that a light removable cover was drawn over the top of the walls and the instruments between observations.

One would assume too, that on a wild, hilly, and overgrown island Halley would choose a spot as near as possible to some inhabited centre, where communications were reasonably good. Less than a century ago the site of Halley's observatory was traditionally known and was positively identified by a professional astronomer (Gill).[7] However, in 1968 it appeared at first that no one knew where the observatory had been placed, and it was the intention of the authors to attempt the rediscovery of this site.

This apparently simple operation was actually fraught with difficulties. The evidence about Halley's observatory is set out below in chronological order:

1. The name of Halley's (or Hawley's) mount from earliest days.

2. The ' Consultations ' of 8 May 1682 stated that the inhabitants of Sandy Bay were too far away to hear the Alarm Gun. It was ordered that the ' sayd two guns on the East Ridge be moved to the toppe of the hill, known as Hawley's Mount '.

In 1803 Governor Patton introduced a system of signalling of his own invention by discs and shutters.[8] In 1806 a list was given in the ' Consultations ' of the stations which include Halley's Mount. The occasion was the substitution of oil for candles for signalling at night!

T. H. Brooke, writing in 1808 does not mention the visit of Halley, but in a list of the highest hills he includes Halley's Mount as part of the ridge Diana-Actaeon and gives the height as 2467 feet.[9] The modern map gives 2470 feet.

[7] Mrs. David Gill, *Six months in Ascension*, 1878, London, 33–34. This rare little book, subtitled *An unscientific account of a scientific expedition*, describes a stay on Ascension Island, mainly spent encamped in a little rocky bay now called ' Mars Bay '. David Gill, who later became Astronomer at the Cape, made observations of the quadrature of Mars which enabled him to make a very accurate determination of the Astronomical Unit. Mrs. Gill's book is devoted to their domestic and social life and the manifold difficulties in a small naval garrison.

[8] Lt. Col. G. Patton, ' Signals Code ', 1803; Archives of the Meteorological Office, Bracknell, Berks.

[9] T. H. Brooke, *A history of the island of St. Helena*, 1808, London.

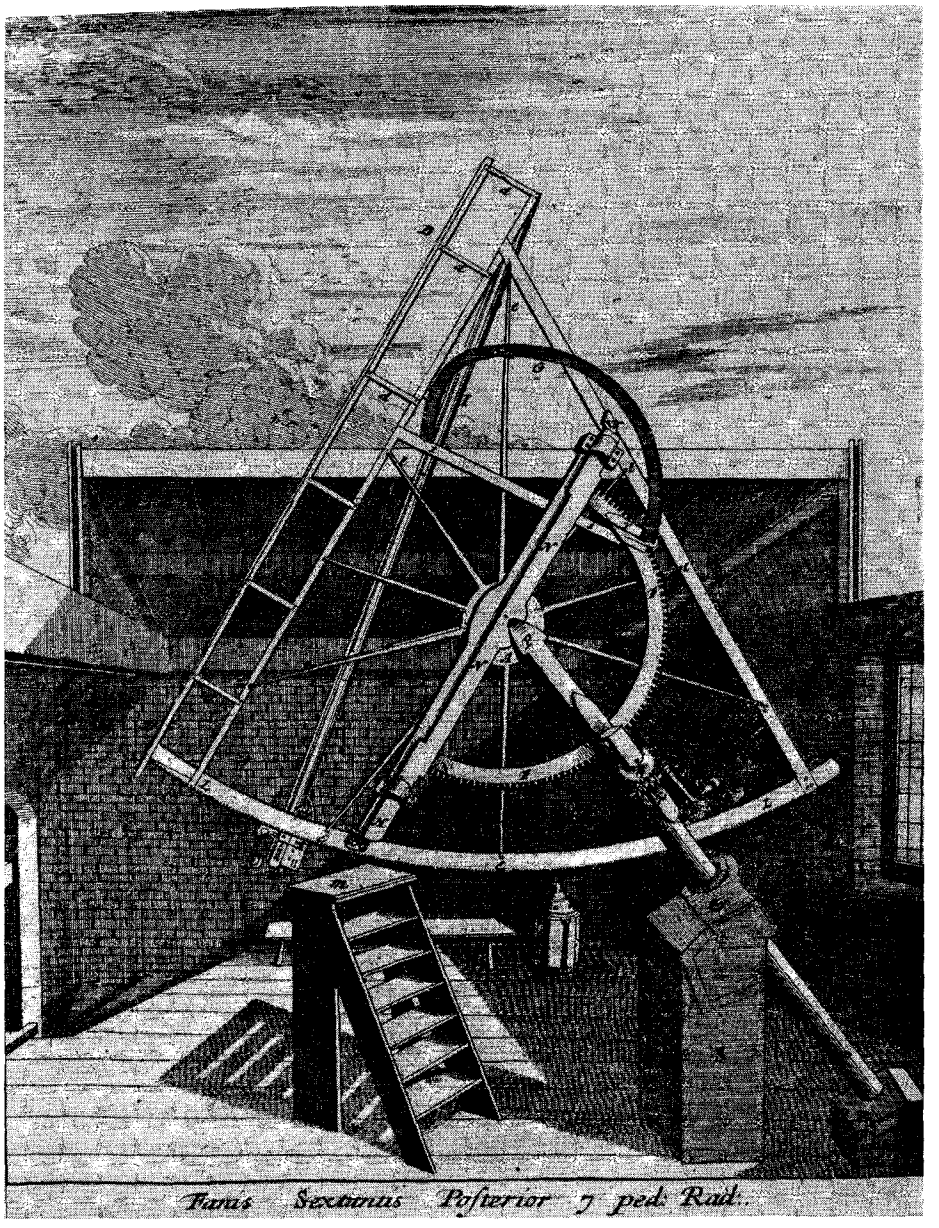

Plate I Contemporary diagram of Flamsteed's sextant.
(By kind permission of the Director of the National Maritime Museum, Greenwich.)

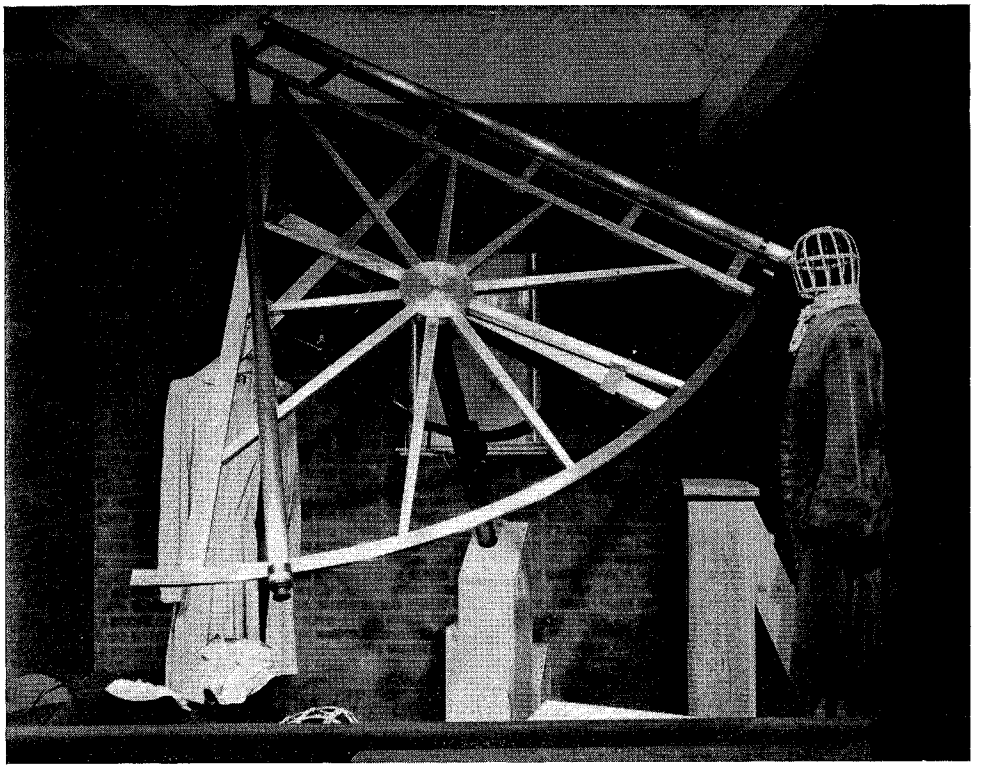

Plate 2. Model showing the construction and method of use of Flamsteed's sextant.
(By kind permission of the Director of the National Maritime Museum, Greenwich.)

Lt. Col. Cocks, on his map dated 1804, marks in the ' telegraphs '. The word is placed immediately above the words ' Halley's Mount ', both words being written far from the summit and on a knoll, where the modern trigonometrical point 2220 feet is placed in the modern survey.[10]

W. J. Burchell, schoolmaster and naturalist on the island from 1805 to 1810, wrote in his journal on 7th May 1810: ' Going past Halley's Mount telegraph went as far as true Halley's Mount', and a little later he mentioned ' Diana's Ridge (Halley's Mount) '. This quotation was found in a typed copy in a file of Mr. G. C. Kitching.[11] The original diary is in the Hope Collection, the University Museum, Oxford and is badly

[10] Lt. Col. Cocks, manuscript map 1804, St. Helena Archives, showing principally land holdings for revenue purposes.

[11] G. C. Kitching was Secretary to the Government of St. Helena in 1938. He took an interest in Island history, and Gosse's book was dedicated to him. Some of his papers are preserved at Plantation House, the Governor's residence.

mutilated. But from a critical evaluation of the transcript of Burchell's journal, made by Professor Poulton, it seems clear to the authors that Burchell thought Halley's observatory (and he says 'observatory') was on top of the mountain near Diana now called 'Actaeon'. Burchell does not adduce any evidence for this viewpoint. Indeed his journal, fascinating though it is as a record of life on the island in the early nineteenth century, and to the botanist as a record of the plants existing at that time, is very lacking in interest in, and comments on, the history, scientific and otherwise, of the island. For these reasons the authors feel that his opinion should be discarded.

Dr. David Gill (later Sir David and Astronomer at the Cape) in 1877 stopped at St. Helena on his way to Ascension. He found the Governor, Hudson Janisch, to be a keen amateur astronomer and was able to arrange visits to the observatory of Manuel Johnson (see section 3.2 below). On one visit, accompanied by a Captain Oliver, after a long ride to Hutt's Gate (an inn at the time) where he left his wife with the innkeeper, he climbed on foot a short distance:

> 'He most good-naturedly entertained me with his gossip, while Captain Oliver and David strolled along to Halley's Mount to search for the Observatory where Halley in 1677 made his Catalogue of Southern Stars and observed the transit of Mercury. It was a pleasant surprise to find on the spot that an astronomer's eye at once picked out as the most favourable, a bit of low wall, duly oriented, and overrun with wild pepper. This had been the Observatory without a doubt; and near it is a quarry from which the stones for its erection had evidently been taken'.[12]

He spent so long that 'it left us little time to linger in the little hollow lying at the foot of Halley's Mount. Napoleon's tomb is here'. There is only one site, about a quarter of a mile from Hutt's Gate with a small quarry nearby. It lies on a relatively level stretch, the only one which could conceivably be suitable for making astronomical observations, so precipitous is the terrain, and which could be described as within 'strolling' distance.

Captain S. P. Oliver must have visited the Island before 1881, for he includes in his book a sketch which, though drawn from a distance, nevertheless makes clear that the site visited by Gill and that rediscovered in 1968 were the same.[13]

In 1876 the first New Zealand flax (*Phormium Tenax*) was planted but proved a failure. A second experiment was made in 1917 and continued,

[12] Gill (footnote 7), 26, 27. Gill himself describes the site in similar words in *Mon. Not. Roy. Astron. Soc.*, 1878, **38**, 2–3.

[13] S. P. Oliver (footnote 1). Captain Oliver, who accompanied Gill, was probably one J. R. Oliver, and not the author.

this time successfully, until 1966, when it became uneconomic. 1917 was the probable date of the planting of flax on Halley's Mount, before which date the ruins were probably visible.

The United States Scientific Expedition to West Africa visited St. Helena in 1890. In a letter from Ascension dated 16 March to the *St. Helena Guardian* (published 28 August) the leader, Professor Todd, says: ' Workers in exact science also beginning with Edmond Halley who, only twenty, came to the island in 1676, built an observatory on a ridge near the present road to Longwood, a spot still known as Halley's Mount and distinctly visible as a ruin of walls overgrown with bushes '.

In 1937 G. C. Kitching wrote: ' The hill immediately above St. Matthews Chuch '—which adjoins Hutt's Gate buildings—' is named Halley's Mount after Emmanuel [sic] Halley who set up an observatory in 1677 for the purpose of observing the transit of Mercury. The site was not well selected and the great scientist was unable to achieve his objects owing to the mist and fog but he was able to complete his researches on the stars of the Southern Hemisphere and it was here that he formulated his Theory of Springs based on the condensation of dew on the glass of his lenses '. Again: ' Various attempts have been made to discover the site of the observatory and much has been written on the subject; *but it was established in the open air and moved about all over the hill* '.[14]

In the introduction to his manuscript Kitching acknowledged his debt to E. F. MacPike. None of their correspondence can be found on St. Helena, but a semi-private file of Kitching contains letters on other topics to and from MacPike and shows that he was related to a Governor Pyke who lived during the early eighteenth century and that the Pykes and Halleys were related by marriage. Attempts to trace the correspondence between Kitching and MacPike (University of Chicago, Newberry Library and John Crerar Library) proved abortive. But the authors have in their possession, in addition to MacPike's *Correspondence and Papers of Edmond Halley*, his bibliographical guide to Halley's life and work.[15] It would be unlikely that MacPike's extensive researches have left unrevealed any other papers of Halley's, or writings referring to him. He records in full Halley's letter to Sir Jonas Moore from the island (from which we have quoted above), and we must assume that this is the only surviving letter of this period in Halley's life.

[14] G. C. Kitching (footnote 11), our italics. All other evidence suggests this is untrue.

[15] E. F. MacPike, *Dr. Edmond Halley* (1656–1742) — *A biographical guide to his life and work arranged chronologically*, 1939, London.

In December, 1968 we began our search for Halley's observatory.[16] Relying on Mrs. Gill's account, we made a preliminary reconnaissance through the flax, which is over 5 feet high and densely thick, and we came on a thin patch where there was an elongated pile of loose stones, which did not seem natural. Subsequent clearing and digging by week-end volunteers disclosed the foundations of four almost complete walls of dressed stone. The walls were found to be true North/South and East/West. This was verified by compass aligned with a thin string stretched along the middle of a wall, the error being probably less than two degrees of arc. There was a quantity of broken china, glass, clay pipes and an old hinge, obviously of some age. Close to the site we found a small quarry. By sheer luck we seemed to have achieved our object. In addition, the whole area within the limits of the hilltop, which was not too precipitous, was searched by a slowly moving line of volunteers. Not only were no other traces of a building discovered, but no other

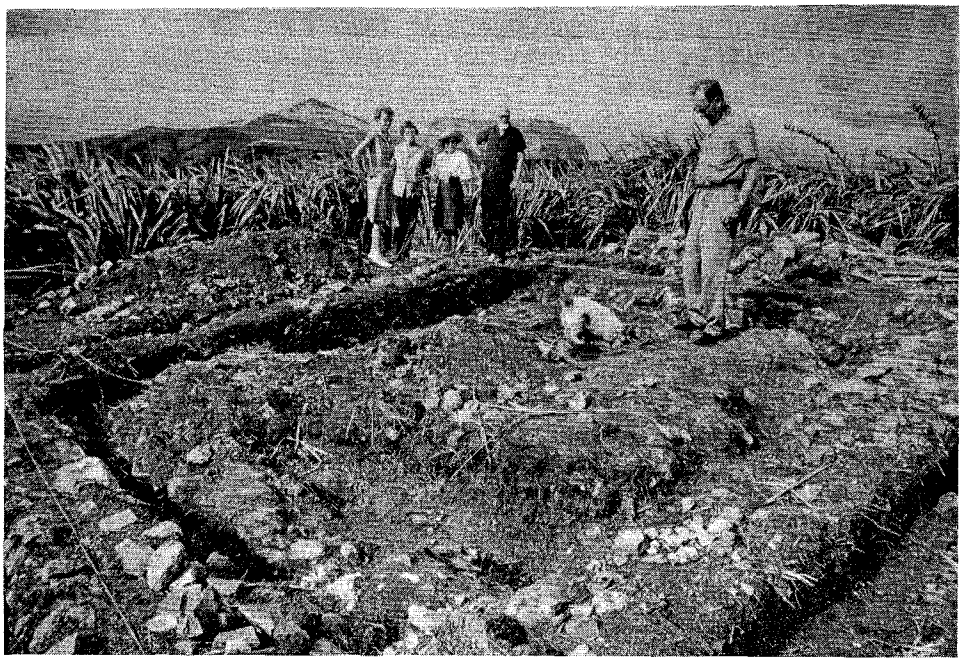

Plate 3. The site of Halley's observatory, partly cleared, 1970.
(By kind permission of The National Geographical Magazine.)

[16] At the beginning of our investigation we were aware of little of this evidence and relied almost entirely on the passage describing the site in Mrs. Gill's book. On finding the site and disclosing the walls and the quarry, we were convinced of the success of our efforts. The later evidence makes it necessary to review the alternative.

stones of diameters more than an inch or two. Its exact position is at the triangulation point nearest St. Matthew's Church on the 1 : 25,344 map; 15°57′31″S, 5°41′20″W (see Plate 3).

Kitching's statement that attempts had been made to find the observatory was proved to be inaccurate. On advice we interviewed an old man born in 1890, Mr. James Crowie, a gravedigger. The substance of our conversation, which was recorded, was that as a boy he had played truant from school and used to sit on the hill above Hutt's Gate at what he called ' Halley's Place ' or ' Halley's Comet '. One cannot rule out the possibility of some one having prompted him beforehand; but he was bombarded with questions and certainly impressed his hearers with his apparently genuine knowledge of some structure, though he appeared to draw on his imagination when he described a complete house with a circular window and a felt roof. He also stated that about 1903 his father had taken away some stone to build a retaining wall for a churchyard below the site, which abuts on the road, and that later he himself had taken more stone to build the foundations of a house opposite. The strangest thing was that he described the pottery with extraordinary accuracy, although it is fair to say that such shards are not uncommon on the island. Another man, married to Mr. Crowie's niece, asserted that he also remembered the site in 1930. However, another and very reliable witness told the authors that in his memory of his long life on the island going back to before 1900, he has no recollection of an actual building on this site, which he knew well.

In November 1969 further digging revealed a wall running East from the South-East corner of the room already excavated, though it was not tied to the original wall. For this reason, and because it was different and far rougher, it is thought to be of later construction. There was insufficient time to complete the clearance, but during March 1971 the walls of a second room were exposed and a partition wall, $2\frac{1}{2}$ feet from the South-East corner running North, which seemed to indicate some sort of store cupboard. Although it was difficult to verify it also appeared that there was a passage between the two rooms. Further excavations were done to establish if there were traces of any flooring and at several points the lowest course of the foundation wall was exposed in the East building. Little of interest was found except a buttress 3 feet by 2 feet in the South-West corner of the West room and a bottle of some age in the East room. This was later dated by the Keeper of Ceramics at the Victoria and Albert Museum as between 1650 and 1800. One of the workers, an islander, stated that he had often been to the site in more recent years and had seen the piece of wall (which had since then tumbled down into a stony heap which we found) when the flax had been cut. He had been to the top of the hill when a boy.

2.3. *The site discovered.*

There were five possibilities for the purpose of this site: Halley's Observatory, a site for an alarm gun, a telegraph station, some building of unknown use, or some combination of all these.

If Halley had an observatory on the hill, this site would appear to be ideal. It has a clear view to the North, East and West and a visible sea horizon, and is within easy reach of Hutt's Gate, where there was probably a building from earliest times in which Halley might well have lodged. To the South and South-West the sea horizon is obstructed by Diana's Ridge, but map measurements show that the line of sight due south was no more than 6° above the true horizon, and thus the ridge would not have interfered with Halley's observations. Furthermore, the little knoll just to the south forms a very essential windbreak—beyond this the trade wind blows at ten knots and more—enough to upset delicate observations. The walls are truly orientated, and this is the more significant because this orientation is out of line with the shoulder of the hill by some 20° and must have made the building operation significantly more difficult. The area is the only one which is reasonably level. It is as certain as can be that this site is identical with that found by Dr. Gill in 1877, and he, a professional astronomer, expressed no doubt that it was Halley's observatory.

The suggestion that this was the site of alarm guns in 1682 was made by Mr. A. W. Mawson, a retired mining engineer resident on the island.[17] He also stated that the site had been artificially flattened. He adhered to the view of Kitching that there was no observatory, basing his theory on a shortened quotation from the ' Consultations ' of 1682 that this was the site for an alarm gun and that the gun was moved from Alarm House to this spot to allow the inhabitants of Sandy Bay to hear the alarm. The original entry states that the guns were on the East Ridge (presumably at a spot now known as Alarm Hill) and were to be moved to the ' the toppe of Halley's Mount '.

This site is not the top. Alarm House is a long way from Sandy Bay. Alarm Hill is not much further away from the site, but apparently it was most unsatisfactory in being backed by a high hill whereas the top of the hill is visible from Sandy Bay. Again, why should it be necessary to build a large shelter, since the guns were not permanently manned? A small shelter for the gunpowder would have been perfectly adequate. We suggest that the theory that this site was first used as an emplacement for an alarm gun can be ruled out; but it is not impossible that there was a change of mind and that they placed the gun later on Halley's

[17] A. W. Mawson, in correspondence with Joseph Ashbrook, ' Edmond Halley at St. Helena ', *Sky and Telescope*, 1970, **40**, 86–87.

observatory, as being more accessible than the top of the hill in spite of acoustic difficulties.

The evidence for a telegraph station is of a different type. That there was such a station here is conclusively proved by Lt.-Col. Cock's (contemporary) map, by Burchell's diary, the 'Consultations' and by the artefacts found there. These were all examined by the Ceramics Department of the Victoria and Albert Museum. Apart from the bottle already mentioned, in almost all cases where it was possible to give dates, they suggested 'between 1800 and 1825'. The lack of seventeenth century artefacts disappointed us. However, it would be unreasonable to expect much of this kind in a site, not domestic, which had been occupied for a year only. But if this building was originally put up for signallers, why did they so carefully (and unnecessarily) orientate the walls? It seems likely that the site was originally Halley's and that the building was adapted by the signallers as ideal for their purpose of seeing the signal stations on the coast and relaying the information to headquarters—and they needed shelter.

The possibility that the building was erected and used for some quite different purpose than those above must, we feel, be discounted. Its possible existence around 1900 rests on the word of an old man who may very likely have wished to please his hearers. Others were alive in 1901, including Major Moss, who is a well-known source of accurate information about the island, and is quite certain that such a prominent building would have been visible for miles, and certainly from his own house. Neither was there any reason to believe that such a site would at any time have been chosen for a dwelling-house.

The adaption and subsequent use of the building, or its foundations, as a telegraph station would not be unusual on St. Helena. As examples, the Longwood Magnetical Observatory, specially built for its purpose, was later converted first to an hotel and then to a church. Manuel Johnson's observatory on Ladder Hill was used as an officers' mess long before its lamentable destruction to supply building materials.

2.4. *Conclusion.*

Absolute proof concerning this site is not likely. But it seems certain that the early use of the name 'Halley's Mount' indicates that Halley operated somewhere on this hill. Common sense tells one that it is impossible to make precise observations on a near precipice, in the full strength of the South-East Trades. There does not appear to be any piece of ground which could be sufficiently flat and protected, except for this site and (possibly) the summit, to which the ascent from the East in the last 150 feet would be a difficult task for loaded men; nor has

it any advantages. No problem would arise, if it were not certain that this site was used from 1803 for several years as a signal station. One can rule out the suggestions of the alarm gun and some building of unknown purpose. We suggest that certain facts make it almost certain that this was the spot used by Halley; the recognition by Dr. Gill and Professor Todd, the orientation of the walls, and the tradition of 1876. We believe that the lower stones now disclosed were laid in 1677; what was added later, and for what purpose, is uncertain but probably for conversion to a signal station. This spot was almost certainly Halley's Observatory, and should be marked and preserved as such for ever, by some enclosure and monument.

3. *Other Astronomers of St. Helena*

3.1. *The Transit of Venus.*

One of Halley's contributions to astronomy was his suggestion that measurement of the times of transit of planets across the Sun's disc, observed from points at different latitudes on the Earth's surface, would afford a good and accurate method of measuring the distance of the Earth from the Sun, the ' Astronomical Unit '. His observation of the transit of Mercury across the Sun's disc on St. Helena was used to give a first and rather inaccurate result. But he strongly advocated that the next approach of Venus to Earth in the Ecliptic should be used for more accurate measurements, and such was his reputation that world-wide plans were accordingly made to observe this phenomenon in 1761.

Among others, Neville Maskelyne, a noted astronomer, who was to become Astronomer Royal in 1765, visited St. Helena. Mason and Dixon, best known to the general public for their ' line ' in the United States, were to go to Bencoolen, Sumatra. The voyage of the latter was frustrated by a French privateer and they did not go further than the Cape. Maskelyne made his own arrangements for sailing and arrived in February or March 1761, while his assistant Robert Waddington came by scheduled ship and reached St. Helena in April. Waddington left in July. Maskelyne, the most famous astronomer after Halley to spend any time on the island, appears from the only portrait we have of that period (in the National Maritime Museum) as a rather swash-buckling figure in an apparently naval uniform, although he was a priest of the Church of England. An itemized account of his expenditure shows that his expenses for one year's board on St. Helena were about £110 and his drink bill £91 (excluding drink on board ship of £50). Newcomb writes: ' Admiral Smyth considers that Maskelyne was not quite what is yclept a teetoller '.[18]

[18] S. Newcomb, *The reminiscences of an astronomer*, 1903, London, 152–153.

Arrangements had been made for the Government on St. Helena to build Maskelyne a temporary observatory, which they duly did to the satisfaction of the astronomer. The ' Consultations ' note that this observatory was built for him behind Alarm House, and on the ridge. This house stands today. (Alarm House and Alarm Hill are far apart.)

One of us (Tatham) with Dr. Cartwright and Mr. Driver, sought for the site in vain, as there was more than one piece of suitable ground ' behind Alarm House '. However, the description is misleading, since the true site, later identified by Tatham from a letter from Cleveland Abbe (a member of the U.S. Expedition to the West Coast of Africa 1889–90) published in the *St. Helena Guardian* on 10 March 1890, is over a half mile from the house and not far from Halley's site. The letter mentions a small cairn, and a tumbledown heap of stones in the correct location may be all that remains of this cairn. The site is at a spot height marked on the modern map as 2103.

Once again, cloud partially spoiled the observation of the transit, although it was seen from sea level by Waddington and by the observers at the Cape. Maskelyne carried on measurements of lunar distance (in preparation for his publication six years later of the first Nautical Almanac and of the rate of clocks (as agreed with the Royal Society),[19] until he was joined by Mason and, for a short time, Dixon. They checked their results by Mason's clock,[20] while Dixon returned to the Cape to check Maskelyne's clock there. They also carried out some observations of the tides, which were not in the original programme.[21] Clock experiments were made from a site in Jamestown, which the authors have been able to identify as ' Sisters' Walk ', originally an avenue made for recreation of the daughters of Governor Patton. Contemporary sketches show it planted with trees, but these have disappeared, and it is now a bleak spot. ' Sisters' Walk ' was also used by the United States scientists.

3.2. *Manuel Johnson* (1833).

Manuel Johnson has a longer connection with St. Helena than any other astronomer. Although he was not born on the island, he joined the St. Helena Artillery in 1821. Napoleon had died in 1821 and the world was peaceful. The garrison, freed from tension, must have been bored. The new Governor, Brigadier-General Alexander Walker, arrived

[19] N. Maskelyne, 'Account of the observations made on the transit of Venus June 6, 1761, in the island of St. Helena ', *Phil. Trans. Roy. Soc. London*, 1762, **52**, 434.

[20] C. Mason, ' Observations for proving the going of Mr. Ellicott's clock at St. Helena ', *Phil. Trans. Roy. Soc. London*, 1762, **52**, 534.

[21] N. Maskelyne, ' Observations on the tide at St. Helena ', *Phil. Trans. Roy. Soc. London*, 1762, **52**, 586.

in 1823 and soon realised the disruption caused by the ending of the Napoleonic captivity. To occupy young officers of the garrison, he set up a Military Institute for the study of various sciences. He was lucky in finding more than one able student, and soon these officers became the instructors. The work of one, G. W. Mellise, is still seen today—the 900 foot ladder from sea level to the top of the cliff with a railway (now disused).

Manuel Johnson (whom the Governor appointed his aide-de-camp) achieved a greater fame. The interest and ability he showed in astronomy encouraged the Governor to build an observatory and time office, not far from the top of the ladder. It is to the credit of the Honourable East India Company that they provided funds for these two ventures, apparently without much demur, in an island which had always drained their revenues considerably and whose future was already uncertain. It was to be taken over by the Crown within ten years.

The observatory was begun in 1826 and completed in 1828. Dr. Fellows, the Astronomer at the Cape, advised about its layout and construction, and Johnson, who was to be put in charge, made two visits to the Cape about it. Johnson began work in the observatory in 1828 and left the island in May 1833. In 1835 he published the record of his work there,[22] which was awarded the Gold Medal of the Royal Astronomical Society.

By Act of Parliament the East India Company was ordered to hand over the island to the Crown, to take effect in 1834. A commission was set up to effect economies. Among drastic and crippling savings the Commission recommended the abolition of the observatory, on the grounds of its uselessness and immense cost (£300 per annum!). It became an officers' mess, on which Mrs. Gill who visited it, wrote with bitterness:

> ' It is now an artillery mess room and in the recess formed for the shutters of the openings through which Johnson's transit used to peep, they stow wine glasses and decanters, and under the dome they play billiards '.[23]

The instruments were sent to England, with the exception of two clocks, two sidereal clocks, a chronometer, and a fine brass altazimuth used in a survey of the island in the mid-1820's. The outcome of this survey was a map, apparently never printed, which hangs in the Castle archives. The other instruments arrived at the Royal Observatory, Greenwich, where they were in the charge of the Astronomer Royal,

[22] M. Johnson, *Catalogue of* 606 *principal fixed stars in the southern hemisphere*, 1835, London.

[23] Mrs. Gill (footnote 7).

Sir George Airy. The copy of the inventory made on St. Helena corresponds with Airy's list. Airy reported on their condition to the Admiralty and recommended their overhaul, which was carried out by Simms (of Cooke, Troughton and Simms). There exists a note from Simms to Airy saying that the telescope was now in repair, and the clock overhaul in hand.[24]

In 1938 Philip Gosse wrote of the observatory: 'Half the roof is fallen in and in a few years it will be a complete ruin'.[25] The lack of interest of the British Government is shown by an incident in 1907, when the garrison was disbanded; the chronometer in the Time Office needed replacement and the Government suggested a sundial.

The observatory was finally pulled down a little later to provide material for the new bridge to the wharf. However, some relics of Johnson are still with us. The stone commemorating the foundation was rescued and now rests in the Castle, and two fine instruments have been carefully preserved. These are the altazimuth, the like of which we have been unable to find in the major scientific museums in England, and the V-level, a surveying instrument which preceded the dumpy-level. Both these were made in the early 1820's by Gilbert of London. The site, bare concrete and rubble, but with a wall still surrounding it, is clear, though it has no mark to identify it.

Johnson was later appointed director of the Radcliffe Observatory and performed much important work there. He was one of the earliest astronomers to use photographic recording, and to record transits electrically. He died in 1859.

4. *The Magnetical and Meteorological Observatory at Longwood* 1840–1849, *and its officers*

This observatory was one of three set up in the Empire for regular magnetic observations (the others were at Toronto and The Cape, in addition to a naval expedition to the Antarctic), at the suggestion of Humboldt, who had already set in train a similar series of stations in Northern Asia. The Government gave approval in 1839, and Major Sabine, R.A. was appointed with a small staff at Woolwich to supervise the undertaking. Sabine was, at the time, in the middle of a distinguished military and scientific career. He had already acted as a secretary of the Royal Society, was to become President, was influential in the matter

[24] Here this correspondence ends, and the authors could find no later clue to the fate of the instruments in the Royal Observatory Records. There is a tradition that they were lent to the Royal Hospital School at Greenwich for the use of the boys, but no record remains since the school moved to Holbrook in 1933.

[25] P. Gosse, *St. Helena, 1502–1938*, 1938, London, 333.

of the great trigonometrical survey of India, and became a leading authority on terrestrial magnetism.[26]

The Longwood Observatory was specially designed and built for its purpose, and observations continued there from 1840 to 1849. The building later became an hotel and a frequent resort of the Eastern Telegraph employees from The Briars; more recently it has been converted into a church. Its most prominent feature—an octagonal room containing the magnetic apparatus—has disappeared, but the main outline of the building, some small special features such as the inclined embrasure used for observation, and the slab of York stone used to support the magnetometer and now converted to a step, are still to be seen.

Three young officers were successively in charge of the station, and a great deal of their correspondence with Sabine (but none of his replies) still exists in the archives of the Meteorological Office at Bracknell. The first was J. H. Lefroy (1817–1890),[27] who observed from 1840 to 1842. He and Eardly Williams, who performed the same task at the Cape, travelled out together in H.M.S. Terror (one of the ships of Sir James Clark Ross's expedition to the Antartic) via the Canaries, Madeira, C. Verde Islands, St. Paul's, Trinidad and Martin Vas Island.

His regular letters to Sabine are friendly and personal, except on the few occasions when Sabine had cause to be dissatisfied with his work, when they became stiff and official. He did not, as his entry in the *Dictionary of National Biography* suggests, assist the Prince de Joinville at the exhumation of Napoleon's corpse in 1840, but he used the necessary entertainment of ' the horde of French Officers ' as an excuse for the interruption of his observation. Lefroy went on to Toronto observatory in 1842, and some of the St. Helena equipment was eventually sent there too. This may explain the long-held belief noted in the *St Helena Guardian* that Johnson's apparatus was sent to Canada in 1835—there was perhaps confusion between the two observatories. Lefroy was relieved by Smyth, who was in turn relieved by Clark. Lefroy's subsequent career was not less distinguished than Sabine's, particularly in the field of geomagnetism, and he became Governor of Bermuda and later Tasmania.[28]

5. *Miscellaneous Visits*

For the sake of completeness a list of astronomers and scientists working in similar fields who visited St. Helena is given below. In one or

[26] *Dictionary of National Biography*, 563–567.

[27] *Dictionary of National Biography*, 840–845.

[28] File: Letters from J. H. Lefroy to E. Sabine from St. Helena, April 1839–January 1842. File: Letters from Capt. Smyth R. A., to Col. Sabine R. A. 1842–1848, 8 February 1842.

two cases the evidence is second-hand, being derived from a list contained in letters from the U.S.S. Pensacola ('The United States Expedition to West Africa') to the newspaper *St. Helena Guardian*.

1. *Edmond Halley.* In command of H.M.S. Paramour, briefly visited St. Helena while making his magnetic survey of the Atlantic Ocean (March 1700).

2. *John MacDonald*, 1796. Examined Magnetic Variation.[29]

3. *Captain Henry Foster, R.N.* 1828–1831. Carried out pendulum experiments in Jamestown and Lemon Valley.

4. *Admiral Duperry*, 1832. Stayed two weeks. Made magnetic observations.

5. *Sir James Clark Ross*, 1840. Arrived with H.M. Ships Erebus and Terror from his Antarctic Expedition, and stayed to make magnetic observations in Sisters' Walk.

6. *Lt. Edmund Palmer, R.A.*, 1850–1852. He was responsible for the triangulation and finding of levels for the map, which is the basis of the modern map.

7. *Lt. Washington, R.E.*, 1872. Survey of St. Helena.[30]

8. *Captain S. R. Oliver, R.A.*, 1869. Mainly geological work which was published in 1869.

9. *Dr. David Gill*, 1877. Later head of the Royal Observatory at Capetown. He used the ' observatory ' at Ladder Hill as the base of his determination of the longitude of Ascension.

10. *Professor David Todd and Cleveland Abbe*, 1890. Voyage of the U.S.S. Pensacola. This visit took place on the return of the expedition to West Africa (where they had met Gill). The team worked hard on St. Helena on contours for Palmer's map, on the force of gravity, on magnetic elements, variation of temperatures, pressure, and wind, rainfall, and on the ' Rollers '.[31] In addition they compiled a considerable historical survey of scientific work, confirming Gill's finding of Halley's observatory, and providing the clue to the position of Maskelyne's observatory. The Pensacola also visited Tristan da Cunha and, more briefly, Ascension.

[29] J. Macdonald, ' Observations of the diurnal variation of the magnetic needle in the island of St. Helena ', *Phil. Trans. Roy. Soc. London*, 1796, **18**, 355.

[30] Original draft maps of Palmer and Washington in St. Helena Archives.

[31] Measurement of gravity and geomagnetism were the responsiblility of E. D. Preston, of the U. S. Coast and Geodetic Survey, Washington, D.C. His report, *U.S. scientific expedition to West Africa*, 1889, *Appendix No.* 12–1890, includes sketch maps of his observing at Jamestown (p. 638) and at Longwood (p. 639).

11. *Sir John Jackson*, 1948. H.M. Astronomer at the Cape. He paid a day's visit to St. Helena and observed and photographed a comet on his way to Capetown.

12. *Dr. David Cartwright and Mr. John Driver*, 1969. These oceanographers came to survey the tides, previously done by Maskelyne and Mason in 1761, and also to study swell and other waves.[32] John Driver returned in 1971 to take more records of ocean swell.

6. *Postscript*

It is a long list of visitors which this island has welcomed. A great deal of work has been, of course, routine or of interest only to the island; and it is hardly unique in having received surveyors and meterologists. We have omitted to mention such scientists as Charles Darwin and W. J. Burchell, whose field was too remote from our interests. No mention is made of Captain Cook's brief visit in 1771 or of the voyage of H.M.S. Challenger, which visited Ascension and Tristan da Cunha but did not come to St. Helena. Although Ascension is now a dependency of St. Helena, theirs is another story of astronomy in the South Atlantic and continues today, with its participation in the tracking of the Apollo flights.

One of the letters from the U.S.S. Pensacola mentions 25 stations from which scientific observations were made. This list must include minor points such as rain gauges or ' The judge's room at the court house ' where Mr. Preston ' swung a pair of Peirce Pendulums '. Of the five places spread over the island where buildings were erected specifically for observation (though one was a temporary structure), Halley's observatory is a ruin; behind Alarm House Maskelyne's point of observation is a bare mound; Ladder Hill has a slab of concrete and rubble surrounded by a wall; and Lemon Valley is a desolate spot with some unidentifiable buildings (see Plate 4). Only at Longwood does the original observatory stand with its roof, through the octagonal transit room is gone; and there is visible evidence as to where the instruments were fixed.

The introduction to this paper began with a quotation from an English writer, S. P. Oliver, deploring the neglect by St. Helena of her historical monuments. An appropriate postscript comes from a letter written in 1890 by the American scientist, Cleveland Abbe: ' It would be highly creditable to the patriotism of St. Helena if memorial tablets or equivalent inscriptions could be placed at the localities where Johnson and others have done their work '.[33] Certainly Halley and Maskelyne are worthy of permanent monuments.

[32] D. E. Cartwright, ' Tides and waves in the vicinity of St. Helena [with an appendix by J. S. Driver]', *Phil. Trans. Roy. Soc. London*, 1971, **270**, 603–649.

[33] C. Abbe, letter to *The St. Helena Guardian*, 16 March 1890.

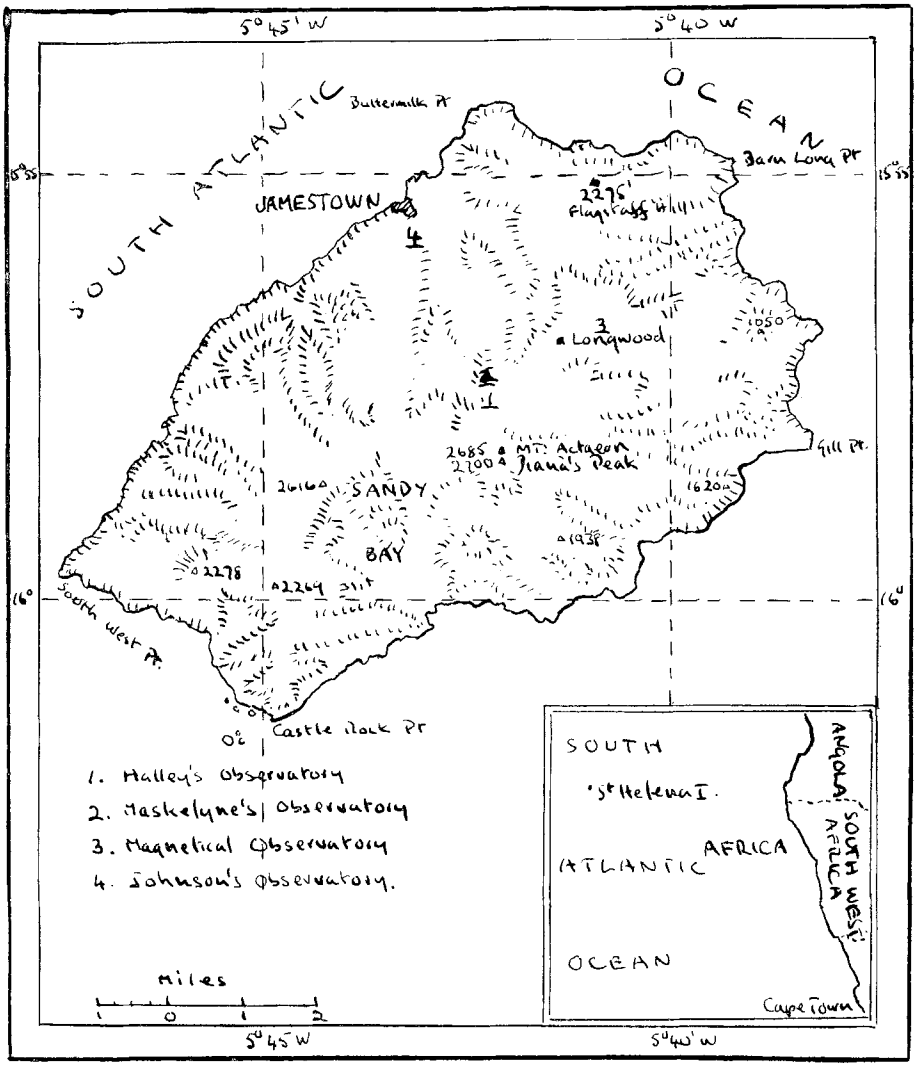

Plate 4. Map showing principal sites.

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