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ORIGINAL ARTICLE

Charles Darwin's final transect aboard HMS *Beagle*: Cape Town to Shrewsbury May-October 1836

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ABSTRACT

There is some evidence that Charles Darwin was somewhat tired and homesick on the last leg of the *Beagle*'s voyage, from Cape Town to Falmouth, May to October 1836. However, his geological observations remained at a high level, and numerous rock specimens were collected in Cape Province, at Bahia and Pernambuco in Brazil, and on the volcanic islands of St. Helena, Ascension, St. Jago (Cape Verde Islands), and Terceira in the Azores. Throughout the voyage, he frequently adopted a comparative approach. Thus, he noted similarities amongst the granite landscapes of South Africa, Australia (seen earlier in the voyage), and South America both from his fieldwork and his reading of Humboldt's *Personal Narrative*. He also saw similarities (and differences) among the volcanic islands in topography, petrology, and mineralogy. By this stage, steeped in the doctrine of uniformitarianism from his reading of Lyell's *Principles of Geology*, he understood that processes of both land formation and denudation had been at work throughout long periods of geological time. Frequently *Principles and Narrative* must have been open alongside his notes as HMS *Beagle* sailed homewards. Thus did Charles Darwin embrace the conceptual framework of gradualism, later of such importance.

KEYWORDS

Charles Darwin; Atlantic Ocean; HMS *Beagle*; Granite; Volcanic islands; Comparison

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Introduction

In a series of recent papers, I have analyzed Charles Darwin's time on the voyage of HMS *Beagle* in terms of a consideration of the major oceanic transects of which the circumnavigation was constituted. That from Plymouth to Tierra del Fuego and the Falklands (December 1831-1833) could be seen, in some respects, as a logical continuation of his sojourn in Cambridge [1]. The materials he was reading, the matters he was thinking about, and his activities were to a considerable extent extensions of those of his time at Christ's College and the summer vacation that followed (1828-1831) [1]. He was also corresponding with his friend and mentor John Henslow, and sending him specimens: an umbilical cord to Cambridge persisted [1]. In considering his transects across the Pacific (September 07, 1835 - January 12, 1836) and Indian (March 15 - May 31, 1836) Oceans I attempted to analyze how he worked while on land on remote islands and while at sea, most particularly in his development of the 'Coral Atoll Theory' [2,3]. The paths of ideas through his various bodies of notes and other writings can be very precisely traced (Figures 1 and 2) [2].

Here I offer a comparable discussion of the final Atlantic, northbound, limb of the journey, from Simon's Bay, Cape Town (where the *Beagle* arrived May 31, departing June 18) until he arrived at his home in Shrewsbury on October 05, 1836.

Although in many instances Darwin's note-taking, analysis, and collecting was proceeding in a similar manner to that at other ports-of-call, there is some evidence that he was tired, homesick, and somewhat less diligent in his inquiries and the collection of specimens in the last part of the voyage than previously. For example, in a letter to his sister Catherine, written shortly after he arrived at Cape Town he declaimed:

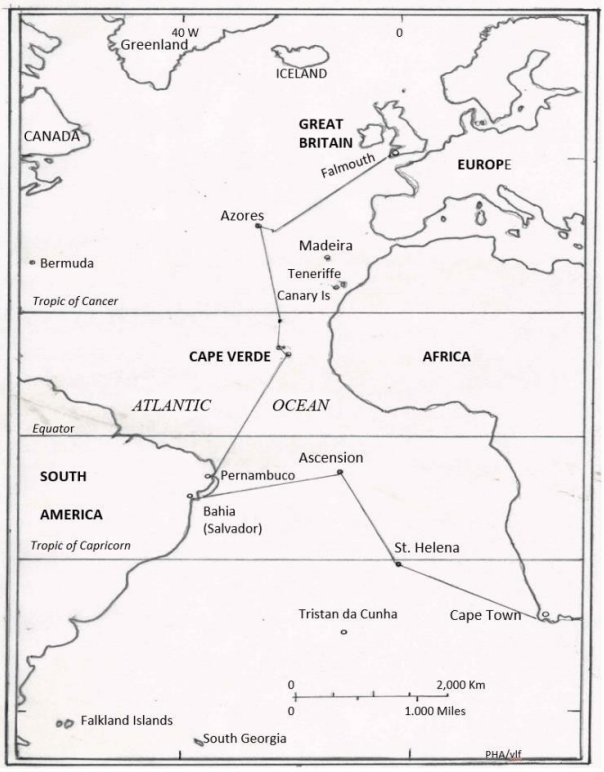

Figure 1. HMS *Beagle's* route northwards through the Atlantic, 1836.

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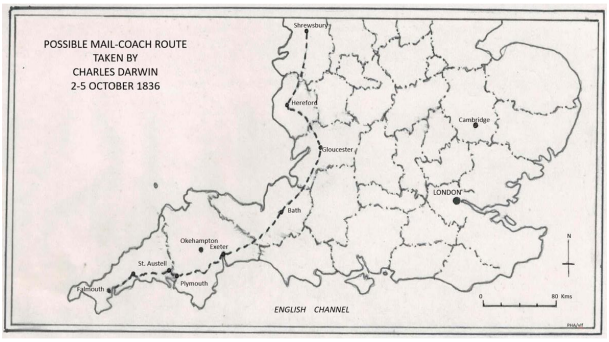

Figure 2. Darwin's probable mail-coach route.

Every country has its peculiar character; & every country is worth seeing, but oh the country of countries; the nice undulating green fields & shady lanes. (DAR 222, June 03, 1836) [4].

Darwin collected several insects in his three weeks at the Cape of Good Hope, but very few vertebrates, and he made minimal observations of the plant life. In the *Voyage of the Beagle*, his published account of the voyage, he barely mentions his African sojourn. Good collections (particularly of beetles, flies, and ants) were made at St. Helena, and also at Bahia, where he spent two days with a sweep-net after the recent rains, but much poorer insect collections were made at Ascension Island and none was made at Terceira in the Azores [5]. Rock collecting at these locations was somewhat more conscientious. It does seem that in this latter part of the voyage, while his concern for biological collecting fell away, his interest in geology remained at a high level.

Comparisons

From Cape Town, the *Beagle* proceeded to St. Helena (July 09 - July 13) and thence to Ascension Island July 19 - July 23), and then to Bahia (August 01 - August 06) on the coast of Brazil to 'complete a chain of meridians around the world'. The voyage, under Captain Robert FitzRoy, RN, was primarily one of a survey, and visiting the same point twice in the circumnavigation enabled other points to be firmly fixed. This was followed by a brief call at Pernambuco to the northeast. One of the few other places that the *Beagle* visited twice on the voyage was Santiago (St. Jago) in the Cape Verde Islands (August 31 - September 04). From there, it was but two weeks northwards to Terceira in the Azores (September 20 - September 23). Darwin went ashore at Falmouth on the stormy evening of October 02, 1836, walking into the family home in Shrewsbury in time for breakfast three days later.

In the last four months of the circumnavigation Charles Darwin, therefore, visited two of the southern continents (one of them at a port of call he had visited before), and four volcanic islands, one of which on his outward journey caused something of a geological awakening in his mind. He had previously visited the continental mass of Australia, and many places in South America, and had called at numerous other volcanic isles and island groups (including Fernando da Narondha, the Galapagos, Tahiti, New Zealand, and Mauritius). It would not be surprising, therefore, if this leg of the voyage was a time of recapitulation and comparison.

There is ample evidence that Darwin was, in his mind, comparing many things at this time. While on an extended excursion over the mountains and through Sir Lowry Cole's Pass, Cape Province, he comments:

[S] ome large dirty white Vultures, like the Condor of [South] America wheeled over the place where probably some dead animal was lying (Diary, June 06, 1836) [6].

They were probably Cape vultures (*Gyps coprotheres*). He also compared the rectangular, planned layout of Cape Town to that of 'a Spanish city' (meaning those of South America).

The comparative approach is shown particularly in his impressions of two ports of call that he had visited on the outward journey. He thought that Bahia (visited August 01 - August 06, 1836) had 'lost part of its charms' as compared to the previous visit. The colors of the scenery seemed to have diminished, at least partly as the result of 'the loss of some of the finest Mango trees', which had been destroyed during 'the late disturbances', although he was glad to find that his 'enjoyment of tropical scenery, from loss of novelty' had not 'decreased in the slightest degree.' The 'gay butterflies' the 'singular cicadas' and the vegetation - wild, unruly, and luxuriant - excited him as much as on the occasion of his first acquaintance with tropical environments four years before.

Later, on his arrival at St. Jago in the Cape Verdes in early September, Darwin was again recollecting his earlier visit - in the hot, dry weather of early 1832:

[A]s some rain had fallen, a most faint green tinge was just distinguishable. Our old friend the Baobab tree was clothed in a thick green foliage which much altered its appearance.

When the *Beagle* visited the island in 1832, Darwin and Fitzroy studied the baobab tree (*Adansonia digitata*) in some detail, carefully measuring it. And Darwin recalled:

I feel some goodwill to the Island…I shall never forget the delight of first standing in a certain lava cavern & looking at the swell of the Atlantic lashing the rugged shore. (Diary, September 04, 1836,) [6].

For it was here he had become inspired to write a book on the geology of the places visited on the voyage! By examining the sequence of sedimentary and volcanic rocks Darwin was able to speculate on the relative importance of upward and downward movements of the sea relative to the land. The incident had thus had a significant impact on the subsequent course of his life.

Nostalgia influenced some of the young naturalist's comparisons on this final leg. The landscape of parts of the isle of St. Helena he compared with parts of North Wales, and on Terceira in the Azores he wistfully remarked 'a few broken down stone walls completed the resemblance to the mountains of Wales'. In the flatter landscape of the north of the island:

The square, open fields, & small villages gave … an aspect resembling the less picturesque parts of central England.

I saw moreover, some old English friends amongst the insects, & of birds, the starling, water wagtail, chaffinch, and blackbird. (Diary, September 20-23, 1836) [6].

That his mind was constantly working along these comparative lines we have confirmation in the last few paragraphs he wrote in his Journal or diary of the voyage, written between departure from Terceira and stepping ashore in England.

[T] here is a growing pleasure in comparing the character of the scenery in different countries...

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Moreover, as several isolated facts soon become uninteresting, the habit of comparison leads to generalization. (Dairy, late September 1836) [6].

It was this habit of comparison that stood him in good stead throughout his scientific career.

Granite landscapes

As well as from the diversity of humanity he encountered in Cape Town, and his meetings with Sir J Herschel (the Astronomer) one of the most vivid impressions that Charles Darwin had at the Cape of Good Hope was displayed in his description of the granite landscapes.

Darwin's observational powers remained at a very high level. At one point he noted:

The granite is coarse-grained & contains very large crystals of feldspar; it is in many parts traversed by veins; … it contains balls of dark color [sic] which consist of minute scales of black mica (DAR 38.904) [4].

He was interested in the relationship of the granite to the adjoining rocks, noting, at Green Point, the existence of a metamorphic aureole where the granite had intruded into the Pre-Cambrian sedimentaries, and how the granite fingered into the country rock was also noted.

Within a hundred yards of the nearest granite, the clay slate is changed to a dark-colored [sic] compact rock … the junction is spread over a considerable space of nearly 200 yards (DAR 38.2/908) [4].

He also described how the more-or-less horizontal Ordovician Table Mountain sandstone overlaid the granite; there was a layer of granite fragments intermixed with red shale at the junction. There had been a period when the older granite had been eroded before the sandstone was deposited. Darwin clearly understood not only the mineralogical nature of the granite but also its three-dimensional relationships with surrounding strata.

Darwin was perhaps the first to explain the origin of aspects of that characteristic landform of southern Africa, the kopje - rounded granite forms - including near-spherical boulders produced through the decomposition of massively joined granite, including the spheroidal weathering of resulting corestones (Figures 3 and 4), at Paarl, to the north-east of Cape Town.

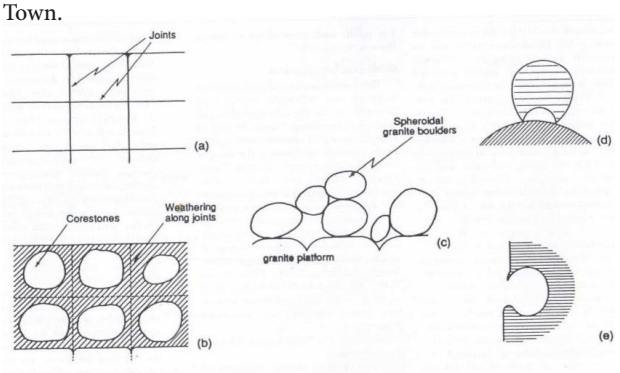

Figure 3. (a-c) Formation of rounded granite boulders as the result of deep weathering along rectilinearly arranged joints as described by Charles Darwin in his geological notes on Paarl, South Africa. (d) Rounded 'ball' of granite with a cavern beneath, based on Darwin's rough sketch. (e) Granite boulder with a cavity formed by weathering, based on a rough sketch by Darwin.

Figure 4 . Granite domes and rounded boulders near Paarl, South Africa. Wikipedia (Creative Commons).

The granite is subject to extreme decomposition … At the village of the Paarl, there are some extraordinarily fine examples of an enormous size lying on the summits of mammiform hills of granite. Parallel & vertical fissures cross the mountains in directions at right angles to each other. These may now be seen of various widths & it would appear the great balls are only the remnants of original vertical masses. Besides the general decomposition, circumscribed patches of the granite yield to the weather much more readily than the adjoining parts. As we see in some granites spherical masses projecting outwards from possessing a harder & slightly different structure, so here cavities exist on the sides of steep rocks … it appears certain that no cause other than the quiet action of the weather has removed the central parts. A very large hollow, forming a cave, exists on the lower surface of one of the great balls on the Paarle. This globular mass is perhaps about 30ft. high, it rests on several points within which is a smooth arched cave … On the sides of some steep masses, the granite is worn away into extensive cavities of irregular forms… (DAR 38.902-904, Figure 3 c, d) [4].

This study of weathering processes shows that Darwin understood the very long time scales over which geological processes operate. He was by now fully familiar with the doctrine of uniformitarianism, having been reading throughout the voyage Charles Lyell's *Principles of Geology* (1830-1833) [7], which strongly emphasizes the idea that the features of the earth's surface are to be interpreted by reference to long-continued, gradual changes. Such gradualist ideas were of course of great significance to Darwin in his later work.

Darwin also encountered granite a few weeks later on the coast of Brazil, and he had of course encountered comparable granite landscapes in South America previously. While in South America, he had frequently seen and interpreted landscapes through the eyes of Frederic von Humboldt [8], whose *Personal Narrative of a Voyage to a New Continent (1814-1825)*, Darwin had in his cabin (in translation). And a few months earlier in March 1836, at King George's Sound in south-west Australia, he had encountered a landscape in some respects similar:

The basal rock in the whole of this neighborhood is granite. It varies exceedingly in its nature … In several places the crystals of Mica and Hornblende are very obscurely arranged in vertical planes, the arrangement is sufficiently developed to cause the rock to wear away in thick plates. … where this structure occurs, the rock would be denominated, according to Humboldt a gneiss-granite [8]. Indeed on entering the sound in the Vessel, I

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saw that form of bare smooth conical hills appearing to be composed of great folding layers which is found in Brazile … I at once suspected that the observation of Humboldt of the frequency of this form of hills [8] … would be verified in this part of Australia (DAR 38.864) [4].

And also:

The country viewed from an eminence, appears a woody plain, with here & there rounded and partly bare hills of granite.

Darwin to a considerable extent used Humboldt as his guide: he had been reading the *Personal Narrative* before and throughout the voyage [8]. In South America and Australia, he saw granite landscapes through the lens of Humboldt's accounts [8]. At the Cape of Good Hope, he blended Lyellian uniformitarian ideas, particularly on erosion, with his similarly detailed observations of very similar landforms elsewhere. In comparing what he saw in the field at different stages of the voyage, with Humboldt's accounts [8], grafting on what he had picked up from Lyell (he had a copy of *Principles of Geology* with him), we see Darwin's remarkable powers of integration at work.

Notes on geology made on the second visit to Bahia, Brazil are fragmentary, but something of his comparison with other sites can be discerned: he seems to be observing how granite and gneiss appear to grade into each other:

Stratification is very obscure, parts near town, like King Georges Sound mere waving lines; granite there siliceous. - where gneiss appears, sometimes even horizontal, in great circles:

Vast number of dikes. Many 3 and 4 yards wide close together -have an aspect of true dike. parallel seams angular pieces of embedded granite. … minute crystal of glassy feldspar. many faults. - dike of this formation: one side as if fault, pieces removed, and [defressenated] within a foot of space, in [flocculent] pieces in granite. Certainly appears as if granite has been melted - Mem last year's section. - yet hard to believe not part of great neighboring - stone of dike as at K. Georges Sound. Blueish grey compact gneiss, in parts silicious fine-grained quartz (NB. Specimen of black angular fragments in dike granite, in some of the decomposed granite.).

Small rounded quartzy pebbles. - a spherical; decomposing structure visible … Decomposed granite capped with [illeg] bright quartz clay, which is generally capped with few quartz pebbles or rounded pieces of Granite (DAR 38.954-955) [4].

Difficult to interpret though the above annotations are, in the several comparisons with King George's Sound (where he also noted the vast number of dykes in granite country), in the acknowledgment that there is a gradation between granite and other rocks, particularly gneiss, as well as in the reference to 'decomposed granite' and 'a spherical decomposing structure' in these later notes from South America, it is tempting to see links with observations and analysis with granite landscapes elsewhere - in Australia and Africa.

Volcanic Islands

Darwin's interest in volcanic islands, during the voyage, was perhaps only slightly lower than his enthusiasm for coral reefs and atolls [9]. He made thorough geological studies of about a dozen such islands, viewing several others from the deck of the ship. His *Geology of the Voyage of the Beagle: volume II - Volcanic Islands* was one of the major scientific outputs of the circumnavigation [10]. It has already been remarked that although Darwin's observation and collection of some biological groups was perhaps less intense in the last few months of the voyage than thereto, his geological work remained at a high level. St. Helena and Ascension Island both warranted full chapter descriptions (along with the Cape Verde Islands) in the volume. Terceira in the Azores was given more brief treatment.

In his companion volume on coral islands (volume I, *Coral Reefs and Atolls*) the Cocos (Keeling) island groups provide a case study, at the opening of the volume, to which other studies can be compared. The detailed description of the Isle of St. Jago performs a similar role in Volume II. Ascension and St. Helena also were given very full treatment in chapters 3 and 4. The Atlantic Ocean islands were clearly of major importance.

At an early point in his geological notes on St. Helena, the first volcanic isle on his northward traverse, Darwin recorded:

The coast in the greater part of the circuit of the Isd is formed by high & great masses of black, thinly stratified rocks. These in the few parts where I examined them … consist of Trachyte (3701) … or of Basalts (3700) with crystals of Augite & Olivine. (DAR 38.920; the four-digit numbers are specimen numbers) [4].

Modern accounts of the geology of the island confirm that these are indeed the common rock- types. He also went on to describe 'dark colored lavas … which appeared to have been of submarine origin'. Again this appears justified. He noted two distinct series of lavas.

Elsewhere in the account, he comments on a mountain ridge:

The highest part of the ridge is exceedingly narrow. Frequently presenting a steep wall this last fact I observed in several craters in the Galapagos Isd. - From these facts & the general appearance, I conceive, there can be little doubt, but that we see here the remnant of a large crater, from which a series of lavas issued.

In several places on the island, he claims to have found evidence for elevation, in the form of marine deposits away from the beaches, as well as in the submarine 'pillow' lavas. In his use of the term 'remnant,' he understood that the island had been profoundly affected by erosion, both by marine and subaerial action. The cliffs that now surround much of the island, and the deep 'V' shaped valleys that cover much of it (Figure 5) show that this was well placed.

Figure 5. Satellite image of St. Helena; NASA image. North is towards the upper right-hand corner.

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Darwin regretted that 'he only stayed [sic] five days on the island', but he did seem to grasp the complexity of the sequence of its volcanic lavas, and its erosion history. In his identification of both minerals and rock types (the numbers in the above quotations designate specimens collected) and in his observation of the relations between rock masses he was working at a high level (he had a local man as a guide). More recent geologists confirm that the rocks of St. Helena accumulated over the period 14 to 7 million years ago (Figures 6 and 7) [11].

The first of Darwin's geological annotations on Ascension read:

During our short visit of three days I chiefly confined my attention to some singular facts respecting the mineralogical nature of certain rocks, & thus was not able to understand but very little of the general structure of the Isld. -Its form is that of a slight irregular triangle, each side being about 6 marine miles long. The whole is volcanic; & from the absence of any proof to the contrary, is I suppose of subaerial origin (DAR 38.936) [4].

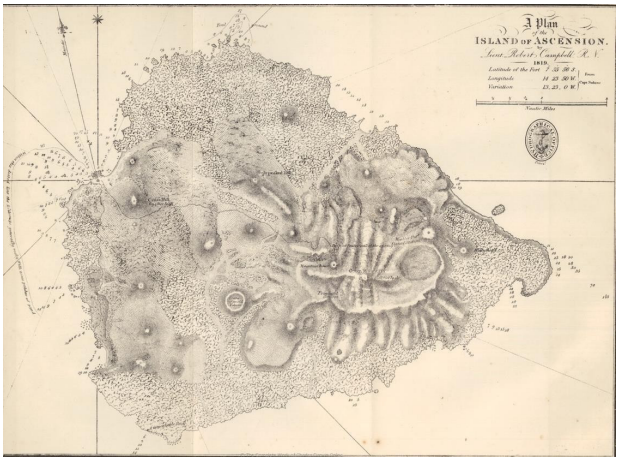

Figure 6. Map of the Isle of Ascension from Charles Darwin's *Volcanic Islands* (1844) showing the volcanic topography [10].

Figure 7. Ascension Island from the sea, showing multiple volcanic cones. The highest peak is Green Mountain, 859m (Blue Belt Programme, Ascension Island, 2018).

A page or two later:

From the summit of the Green Mountain, looking around the Island. between 20 and 30 hills of various sizes may be counted in which a truncated or slightly hollowed top indicates the former existence of a crater. … In several of the truncated hills, the summit has a slope directed to the SE or windward. -… I suppose it must be owing to an original inequality caused by the action of the trade wind on the ashes or lighter ejected matter (DAR 38.938) [4].

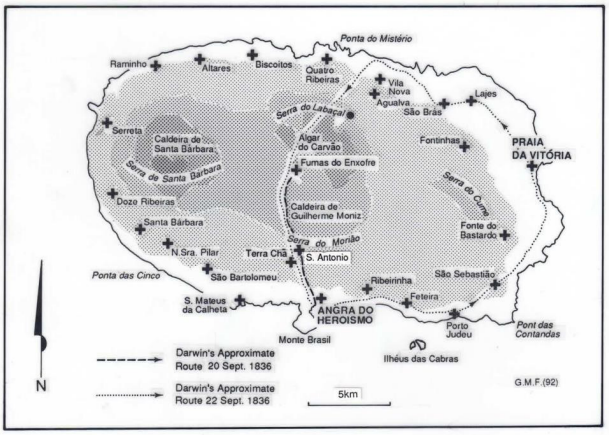

Figure 8. Terceira, Azores, showing Charles Darwin's routes (Map: Geography Department, University of Western Australia).

Darwin is careful to note the geomorphology of the island (landforms), as well as the petrology (rock type) and mineralogy. He supposed that in the arid climate, the processes of weathering and erosion would be slow: 'the lava would long remain in its original state'. But he continued in a note possibly added later: 'On the other hand the Isld. is extremely modern. In no part has the sea worn the rocks into cliffs.- and from the absence of all-natural sections of any depth I did not see even one single stony dike. -' He noted a little later that the perceived absence of cliffs was not entirely accurate. The perceived absence of deep clefts and that of recently intruded dykes, however, was.

In his short stay, Darwin noted the wide range of rocks: basalts were common, but he also noted trachytes, obsidian, and ash deposits. From the steepness of some of the lava flows he deduced that the lava must have been extremely viscous. Again all these observations accord with modern thinking: the range of rock types appears to be greater than that at St. Helena, and recent geological research and the dating of the rocks from Ascension have confirmed an age of less than a million years for the island, in contrast to the longer-continued, and more complex story for St. Helena (NERC, https://ascension-island-volcanology.com/). Darwin had it more or less right.

The Island of Terceira in the Azores was the last fragment of a foreign country upon which Darwin ever set foot (Figure 8). The *Beagle* stayed a few days at the chief port, Angra do Heroismo. He made a special study of volcanic Mt Brasil, close to the town, did a circuit around part of the coast of the island, and visited the fumaroles, or steam vents, Fumas de Enxofre, in the center of the island. The comparative approach is to the fore:

M. Brasil, close to Angra is a large & regular crater (part of which the sea has destroyed) which appears entirely to consist of thin layers of brown Volcanic sandstone [changed in a later version to

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'fine-grained, harsh brown-colored tuff'], quite similar to those of the Galapagos. The extremities of the beds overlie the termination of the coast basaltic streams. So that it is very modern (DAR 38.958) [4].

Darwin gives a good summary, in his notes, of the structure of the island:

The Island of Terceira appears to consist of an elevated central part that slopes down on all sides to the sea.- Both on the flanks and on the summit there are scattered numerous volcanic cones, which yet retain their crateriform summits.- The streams of lava that have proceeded from these can in some cases be traced.- And the surface, especially in parts of the elevated central land, is covered by hummocky & irregular depressions.- These more modern streams … consist of a blackish-grey cellular volcanic lava … Besides these streams, there are irregular ridges & large hills composed of a true white or pale grey trachyte (DAR 38.957) [4].

He later compared the trachytes of Terceira with those of Ascension: they were 'precisely similar'. Similar processes were at work in the development of different *volcanic islands*.

On every side, besides the ridges of more ancient lavas, there were cones of varying dimensions, which yet partly retained their crater-formed summits, and where broken down, showed a pile of cinders …

The fumaroles or steam vents in a crater-like depression were of special interest:

In the central part of the island, there is a spot, where steam is constantly issuing in jets from the bottom of a small ravine-like hollow, which has no exit and abuts against a range of trachytic mountains. The steam is emitted from several irregular fissures: it is scentless, soon blackens iron, and is of much too high a temperature to be endured by hand. (Volcanic Islands, chapter 2).

He also noted some damaged buildings and recorded:
During the past year, several earthquakes have been felt, and for the space of some days, a jet of stream issued from the perpendicular seaward face of M. Brazil (DAR 38. 959) [4].

Elsewhere in his account, he acknowledged the role of water action on the inland parts of the island. He specifically mentions the effects of both the sea (see above) and subaerial action on the erosion of the volcanic forms.

Darwin seems to imply, though only occasionally does he state definitively, that the volcanic rocks of Terceira are of recent geological date. Recent isotope analysis of the deposits tells of ages of about 370,000 to 380,000 years for some of the oldest rocks down to about 1000 years for some of the most recent [12].

His work on the islands of the Atlantic showed him that geological processes, are currently, and have been for a long period, at work creating land on volcanic islands, just as there are processes, on the islands and elsewhere that are weathering and eroding, and thus destroying it.

And the Final Few Days…

Darwin's Diary notes that the *Beagle* left the island of San Miguel in the Azores on September 25, 1836 (he did not set foot on the island, but studied it from the vessel: other crew-members went ashore looking for mail), and 'steered, thanks to God, a direct course for England'. However, there is evidence that there are errors in the dates in the Diary at this stage [13]. The Log of HMS *Beagle* suggests that the ship left in the late afternoon of September 23. The diary does not record a crossing of the Bay of Biscay as being as stormy and disagreeable as on the outward voyage [1], although later comments suggest that he had a pretty rough time of it.

Charles Darwin went ashore at Falmouth on the evening of Sunday October 02, 1836 - 'a dreadfully stormy one it was', and 'the same night … started by the Mail for Shrewsbury' [6].

The only apparent reason for the *Beagle* calling at Falmouth, a deflection from her route to Plymouth and onwards to the Thames, was to allow Darwin to catch the stage-coach to Shrewsbury, and return home with the minimum of delay, as Falmouth was the extreme westernmost point on the mail-coach service (Figures 2 and 9).

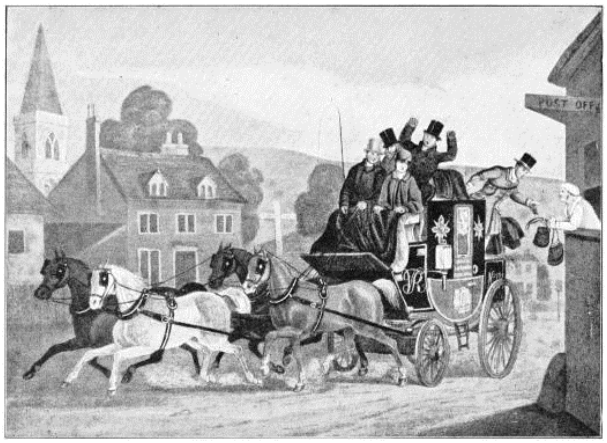

Figure 9. The Bath Mail, picking up mail-bags. This was a coach service similar to that which Charles Darwin may have used for part of his journey from Falmouth to Shrewsbury. However, the coach bears the 'VR' insignia, but in 1836 William IV was still on the throne, so this image must have been made a few years later. After a contemporary lithograph [14].

The coaching system was at its height in 1836. If Darwin had been traveling a few years later, he would have traveled in another way, as with the advent of the railways the coaching system went into decline. Nineteenth-century maps show that there was a quay quite close to the center of the town of Falmouth and coaches bound 'upcountry' and for London left the Bull and Mouth Inn. Probably he took either the Old Exeter Mail or the Devonport Quicksilver service. The route would have taken him through the small towns of Truro and St. Austell, and thence via Plymouth into Exeter. Some coaches took the route to the north of Dartmoor, through Okehampton, but this seems less likely. He probably made for Bath, an important route node in coaching days, and thence northwards through Gloucester and Hereford [14]. He traveled 'night & day': one possible combination of routes gives a total distance of around 320 miles (approx. 510km). Contemporary records show that a mail coach moved at about 10mph (16kph). He arrived at the Lion Inn, Shrewsbury, the point from which he had caught the coach for Plymouth on September 05, 1831, in the very late evening on October 04, 1836 (To complete the journey in about 48 hr, allowing for

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several changes in stage-coach was formidable, and must have been exhausting). Not wishing to disturb the household he spent the night in the Inn and walked the few hundred yards to the family home at The Mount just before breakfast the following day (October 05). His dog, as well as his sisters and father, greeted him affectionately.

And at the end of a letter to her cousin, written the same day, his sister Caroline wrote presciently:

Now we have him again home I intend to be glad he went [on] this expedition & now I can allow he has gained happiness & interest for the rest of his life. (Letter, Caroline Darwin to Sarah Elizabeth Wedgwood October 05, 1836: DAR 185.55v.) [4].

And so it was.

Conclusions

In many ways, Darwin was operating, during the last few weeks of the voyage of HMS *Beagle* in the same manner as he had earlier in the voyage. He was usually as observant as ever and maintained his notes in a broadly similar way. However, there is evidence that he was homesick and extremely eager to be home: his leaving the ship at Falmouth and traveling 'day and night' to Shrewsbury confirms this. This tiredness may have occasioned a somewhat less rigorous focus on collecting. His collections of insects (and plants, shells, and vertebrates) in some places were less thorough than theretofore. His collecting of rock specimens, however, and his geological fieldwork remained at a high level. His 'comparison' approach remained a guiding principle: as strong as, or even stronger than before. As earlier, he constantly compared geology, landscapes, and human communities: he noted affinities and differences between what he was seeing at different locations on the voyage with what he was reading about, and what he had experienced in Britain before going aboard. As he wrote up his notes on the table in the cabin of the *Beagle*, there must have been times when Humboldt's *Personal Narrative* and Lyell's *Geology* must have been open beside him [8]. His comparisons in geology were particularly important. He, with Humboldt's help, linked the granite landscapes of Africa, Australia, and South America, seeing how granitic rocks were often quite varied in structure and mineralogy, but weathered and eroded in distinctive ways [8].

In this final transect, he also visited four volcanic islands, one for the second time. He noted the differences between them, seeing that their structure was often quite complex. Darwin was often shrewdly accurate in his speculations on their age, sometimes basing these on their erosion history. These provided the raw material for several sections of the *Geology of Volcanic Islands* [10].

Darwin, during his final months aboard HMS *Beagle*, although showing some signs of tiredness and homesickness, remained an enthusiastic and perceptive observer in the field of geology. After nearly four years of a-voyaging, he adopted a comparison approach frequently. His notes frequently show signs of the addition of comments drawing attention to similarities between the geology of different locations. A careful analysis of his observations of the granite topography reveals that he was aware of similar processes at work in the granite landscapes of Australia, South Africa, and South America. Although there were differences, there had been similar continuance of volcanic action and denudation on several remote islands. The landscapes of the world had, through long periods of geological time been formed by the long-continued, but very gradual constructive and destructive forces. It was 'the habit of comparison' that played an important role in leading him to embrace the notion of gradualism that was so significant in his later work.

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