THE NOTEBOOKS

Nothing of him that doth fade
But doth suffer a sea-change
Into something rich and strange

William Shakespeare, *The Tempest*

THE *CAPE DE VERDS NOTEBOOK*

The *Cape de Verds notebook* takes its name from the archipelago of the same name in the North Atlantic Ocean, off the western coast of Africa. It is bound in red leather with the border blind embossed: the brass clasp is missing. The front of the notebook has a label of cream-coloured paper (68 × 40 mm) with 'Cape de Verds Fernando Noronha Bahia Abrolhos Rio de Janeiro City' written in ink. The notebook has 56 leaves or 112 pages. The text is written in two sequences, pp. 1a–27a and pp. 1b–85b. The entries can be dated between 18 January to 29 March 1832 and 9 May to 10 June 1832. The notebook covers more or less the first half year of the voyage, although it overlaps, in April 1832, with the second notebook, *Rio*. The first dated entry in the *Cape de Verds notebook* is 18 January 1832, three weeks after the *Beagle* left England, and the last is 10 June 1832. The notebook therefore covers Darwin's birthday in February when a very seasick young man turned twenty-three.

Holes were through pp. 1a–16a (coast of Brazil, March 1832) and pp. 17a–26a (Rio de Janeiro, May–June); pp. 77b–85b (Rio de Janeiro, May–June) were bound together by string through single pierced holes and pp. 21b–back cover (Rio de Janeiro, April) were bound together via a larger hole punched through the centre of the pages. These allowed Darwin to fasten sections together, probably using string or thread so that he could easily open the notebook to make new entries on blank pages.

The notebook was the first of Darwin's *Beagle* field notebooks to be used and therefore contains some of his very first recorded observations during the voyage of the *Beagle*. The notebook begins with a rapidly written torrent of calculations, geological sections, measurements of angles, temperatures, barometer readings, compass bearings, diagrams and sketches. As such it is an extraordinary document, which vividly records how in the initial weeks and months of the voyage Darwin was maturing from a mere trainee into an accomplished geologist who had a powerful grasp of contemporary geological knowledge.

Cape de Verds, January 1832

The notebook was first used on the volcanic Cape de Verds Islands, [Republica de Cabo Verde]. The *Beagle* arrived on 16 January 1832, after twenty-one days at sea, and spent twenty-one days in the islands. In his *Autobiography*, p. 77, written for his children and grandchildren forty-four years later, Darwin recalled how 'the very first

place which I examined, namely St Jago [Sao Tiago] in the Cape de Verds Islands, showed me clearly the wonderful superiority of Lyell's manner of treating geology, compared with that of any other author, whose work I had with me or ever afterwards read.' Darwin immediately plunged himself into geological theorizing, devouring the first volume of Charles Lyell's (1797–1875) highly important book *Principles of geology* (1830), which was given to Darwin by the *Beagle*'s Commander, Robert FitzRoy.

Much has been written about Darwin's geologizing at St Jago, most recently and in most detail by Pearson and Nicholas 2007. Herbert 2005 devotes a whole section to Darwin's collecting and recording of sections and specimens and provides photographs of his specimens. These can be seen today at the Sedgwick Museum of Earth Sciences in Cambridge. Herbert explains how the young Darwin appropriated Lyell's method of geological interpretation, which was based on causes of change currently occurring (erosion, earthquakes, volcanoes etc.) a method known as actualism. Lyell's particular version of actualism, which later became known as uniformitarianism, argued that in reconstructing the geological past one should assume that the intensity of such causes of change was more or less uniform throughout time.[16] Darwin applied Lyell's method to unravelling St Jago's recent volcanic past, especially in relation to Quail Island [Santa Maria] and Flag Staff [Signal Post] Hill. There a band of limestone exposed in a cliff and obviously composed of marine fossil material and now elevated well above sea level, provided clear evidence of past subsidence and uplift.

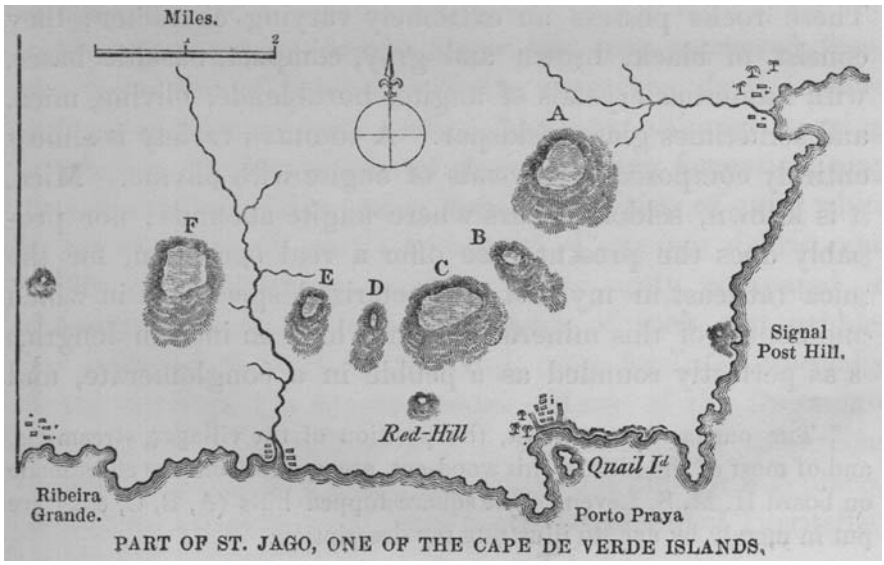


Fig. 1 from *Volcanic islands*.
Part of St Jago, one of the Cape de Verds.

16 CD's response to Lyell is brilliantly summarized in Rudwick 2008.

The *Cape de Verds notebook* records Darwin's on-the-spot geological section on the very first page (p. 1b). After his disappointment at not being able to go ashore at the Canaries, to see for himself the wonderful sights described there by Humboldt and so long dreamed of in Cambridge, Darwin was ecstatic to find that his geological skills were good enough to understand almost immediately the geological history of the Cape de Verds.

Darwin's field training the previous summer in North Wales with Adam Sedgwick (1785–1873), combined with his reading of Lyell and other works and what he was seeing with his own eyes intoxicated him with the realization that he too could become a geologist and explain the past events that had shaped the natural structures before him. In his *Autobiography*, p. 81, he recalled the moment when he first imagined his own geological book: 'That was a memorable hour to me, and how distinctly I can call to mind the low cliff of lava beneath which I rested, with the sun glaring hot, a few strange desert plants growing near and with living corals in the tidal pools at my feet.'

In the long run Darwin's Lyellian conversion was perhaps unfortunate for John Stevens Henslow (1796–1861), who recommended Darwin to read Lyell's book, and who acted as his scientific champion before and during the voyage. Henslow might have taken FitzRoy's offer of a place onboard himself if domestic commitments had not prevented him, and may in some ways have regretted that Darwin's experiences on the voyage eventually turned him away from a view of the Earth's history as a series of 'revolutions'. Henslow had, after all, asked Darwin to read Lyell's book, but 'on no account to accept the views therein advocated'.[17] Which of Lyell's views were not to be accepted is not entirely clear.

When Darwin revisited the Cape de Verds in September 1836, he struck through parts of his foolscap 1832 geology notes from the islands (now in DAR 32), especially their discussion of 'the long disputed Diluvium' i.e. deposits which might be evidence of a widespread catastrophe. This suggests the extent of his increased commitment to Lyell's actualistic methodology. Lyell, who adopted the term 'diluvium' from William Buckland (1784–1856), used it in the sense of a certain type of local superficial deposits. Lyell's methodology was to remain a cornerstone of Darwin's own for the rest of his life. He saw (and experienced) enough evidence of the forces at work on the Earth's surface to accept Lyell's explanations.[18]

Although Darwin accepted Lyell's actualistic methodology, he did not accept Lyell's uncompromising belief in a steady state or non-directional (uniformitarian) Earth history. In the second volume of *Principles of geology*, which Darwin read at the end of 1832, Lyell argued, applying actualism, that since no one had ever seen a

17 *Autobiography*, p. 101.

18 For further discussion of Diluvium see the introduction to the *B. Blanca notebook* and Herbert 2005, p. 397 note 59.

new species appear by natural means the origin of species must be some sort of supernatural process. Since new species seemed to appear regularly in the strata to replace those which became extinct (to maintain his steady state Earth), there must be 'centres of creation' to explain the appearance of new species in new environments.

Cape de Verds were previously uninhabited islands when they were discovered and colonized by the Portuguese in the fifteenth century. Darwin later realised that the animals and plants exhibited a close relationship to those of the neighbouring continent of Africa. When visiting the volcanic Galapagos Islands [Islas Galápagos] three and a half years later, he recognized how the animals and plants there were different from those in the Cape de Verds, yet obviously bore an identical relationship to those on the neighbouring continent of South America. The significance of these relationships became clearer to Darwin in the months leading up to his return visit to the Cape de Verds in September 1836, as he pondered why these otherwise similar volcanic archipelagos were populated by such different animals and plants.

By 1836 Darwin realised that the fact that the plants and animals on the Cape de Verds were of an African cast was because that is where they had originated. Any Lyellian Cape de Verds 'centre of creation' was a fiction.

The diagram on the inside front cover shows how FitzRoy used his sextant to help Darwin calculate the height of a Baobab tree. A very similar diagram occurs in the *Beagle diary*, p. 29, and the accomplished sketch on p. 5a is almost certainly the one Darwin mentioned in the *Beagle diary*: 'Cap FitzRoy made a sketch which gave a good idea of its proportion'. There are also references on pp. 10a and 40b to Robert McCormick, the *Beagle*'s surgeon (the role normally doubling with naturalist). The first known use by Darwin of 'entangled' occurs on p. 17b.[19] This word is evocatively used in the last paragraph of the *Origin of species*, p. 489.

St Paul's Rocks, February 1832

From the Cape de Verds the *Beagle* crossed the equator and called at St Paul's Rocks [Penados de Sao Pedro e Sao Paulo] on 16 February. There Darwin could immediately see that the Rocks were not volcanic.[20] The Rocks are in fact still of great geological interest since unlike almost all oceanic islands they are indeed non-volcanic and for this reason Darwin's specimens are still valued today.[21] On p. 77b Darwin compared a gneiss rock he saw on St Paul's to one from Bahia, and on p. 49b he noted the layer of St Paul's 'dung' [guano] which coats the rocks there, later described in *Volcanic islands* p. 45.

19 See Herbert 2005, p. 397 note 7.
20 See Armstrong 2004.
21 See Barlow 1967, p. 54, and Herbert 2005, p. 116.

Fernando de Noronha, February 1832

The *Beagle* remained almost entirely in the southern hemisphere for the next four and a half years. She next called briefly at the islands of Fernando de Noronha, which appeared to be based around a plug of volcanic rock, on 20 February (see p. 44b). The lichen mentioned on p. 45b is recorded as Darwin's dry specimen 309 'from the highest peak of Fernando Noronha'.[22] Darwin jotted a note on p. 53b wondering if the lack of active volcanoes on the Atlantic side of South America indicated 'no volcanic influence East of Andes!'. The wonderfully evocative line from p. 46b is from the sea passage south after this stop, and is dated 25 February. The following ten pages of the notebook seem to be reflections on geological features previously seen, with Darwin exercising his strengthening theoretical muscles while cruising at sea.

Bahia, March 1832

The *Beagle* was next stationed for nineteen days at Bahia [Salvador] in Brazil where, at the end of February, Darwin experienced the euphoria of his first visit to a tropical rain forest. There are many traces of his exhilaration at the time of writing and which were developed in classic pages in the *Beagle diary*. Many of these he published to great acclaim in *Journal of researches* in 1839, or have since been published in the letters he wrote home (see CCD1). In Bahia Darwin had his first taste of the New World proper. Here he first encountered the 'Primitive' [i.e. ancient] igneous and metamorphic rocks of the Brazilian continent (see for example p. 56b), albeit covered with the more recent 'Diluvium'.[23] On p. 72b he switched to 'gen[eral] obs[ervations', i.e. not geology, describing a delightful interaction with some apparently aggressive ants, and attempting a sketch of a spider's web.

Abrolhos Islets, April 1832

The *Beagle* left Bahia on 18 March for a cruise down to Rio de Janeiro where she arrived, via an examination of the Abrolhos Islets, on 4 April. There is a dramatic demonstration of the enduring value to Darwin of his field notebooks in the 1 November 1839 letter he wrote to Humboldt in which he copied out the depths and temperatures of the sea off the Abrolhos from p. 13a of the notebook.[24] Darwin expanded on this in his section on Rio de Janeiro in *South America*, pp. 142–4.

Rio de Janeiro, April–June 1832

There is a letter from Darwin to his second cousin William Darwin Fox (1805–80), dated May 1832 and today preserved at their old Cambridge College, Christ's. In it Darwin tried to convey his excitement at geologizing: 'it is like the pleasure of

22 See *Zoology notes*, p. 372, and Armstrong 2004.
23 See Pearson 1996.
24 CCD2: 239.

gambling, speculating on first arriving what the rocks may be; I often mentally cry out 3 to one Tertiary against primitive, but the latter have hitherto won all the bets.'[25]

Henslow received a letter from Darwin written in Rio de Janeiro on 18 May 1832 from which he read extracts (together with extracts from other letters from Darwin) to the Cambridge Philosophical Society on 16 November 1835. These were printed as a pamphlet in December 1835 which could be counted as Darwin's first true scientific publication.[26] Henslow sent copies to Darwin's father and these had the affect of convincing Dr Darwin that his son would one day make a handsome return on his paternal investment in the voyage. The pamphlet also ensured that Darwin was being discussed in scientific circles back home. Darwin first learnt of the pamphlet in a letter from his sister Catherine (1810–66) which he received in June 1836. He was at first horrified by the news as he would have preferred the chance to check the extracts for accuracy, but quickly realized that this was a minor issue: 'after reading this letter I clambered over the mountains of Ascension with a bounding step and made the volcanic rocks resound under my geological hammer!'[27]

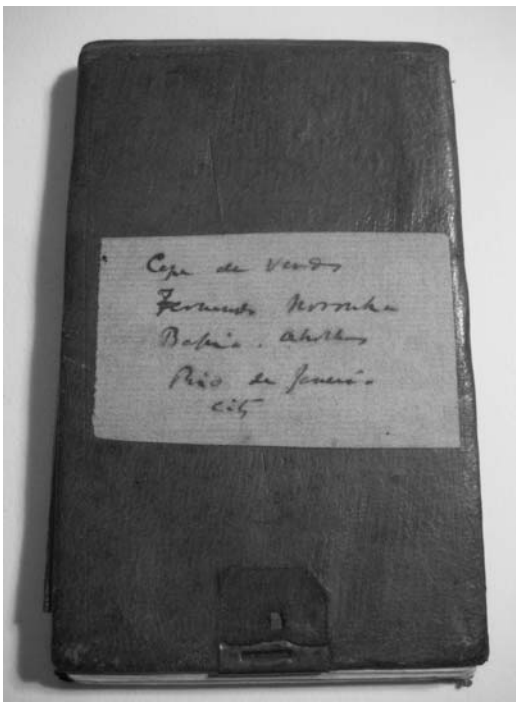
The pamphlet was important in preparing the scientific community to receive Darwin as an accredited geologist and naturalist when he returned to Britain in 1836. Sedgwick also read the letters to The Geological Society two days after Henslow's reading, and this event was singled out by Charles Lyell in his Presidential Address to that august body in February 1836. Lyell realized that Darwin was going to be a great asset to him as a rare early convert to his own gradualist principles.

In Rio de Janeiro Darwin was finally able to settle down for a period of three months, partly as an unplanned bonus from the *Beagle*'s needing to return north to Bahia to check a longitude discrepancy.[28] It was while the *Beagle* was away that three of Darwin's ship-mates, including the young Charles Musters, died of malaria. The last entries in the *Cape de Verds notebook*, from about p. 76b, were made in Rio de Janeiro as Darwin started to collect new species of animals and plants as well as rock samples.[29] These Rio de Janeiro entries overlap with the *Rio notebook* which deals with Darwin's famous excursion to the plantation where he encountered the realities of slavery.

On p. 84b there is a vague but very tantalizing entry that seems reminiscent of some of Darwin's later speculations about species: 'Scale in nature amongst spiders kept up by hymenopt[era] in absence of Carabid [beetles] supplied by the Ants. — may after been less of insects & caterpillars'. The last lines in the notebook, on p. 85b and dated 10 June 1832, are among of the most poetic and beautiful Darwin ever wrote.

25 CCD1: 232.
26 Darwin 1835; *Shorter publications*, pp. 2–15.
27 *Autobiography*, p. 82.
28 See CCD1: 227.
29 See the excellent summaries of his zoological and botanical collecting from Rio de Janeiro provided by Barlow, Keynes, Porter, Smith, Steinheimer *et al.* and the largest collection of published scientific descriptions and identifications of CD's specimens on *Darwin Online*.

[FRONT COVER]



Cape de Verds
Fernando Noronha
Bahia Abrolhos
Rio de Janeiro City

[INSIDE FRONT COVER]

C. Darwin

13/4
35
20
26 — 20
63 - 20 60 — 30
26 - 30
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11, 95 4 2 4
10. 30 2 5
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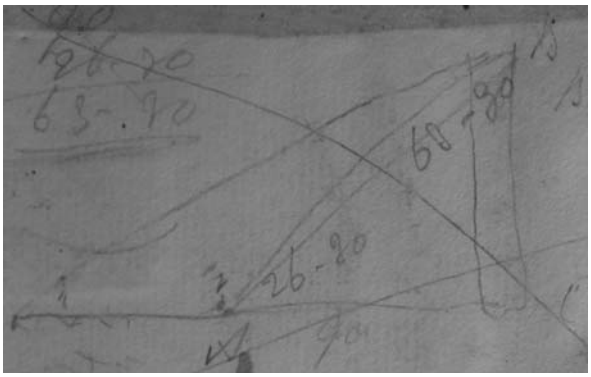
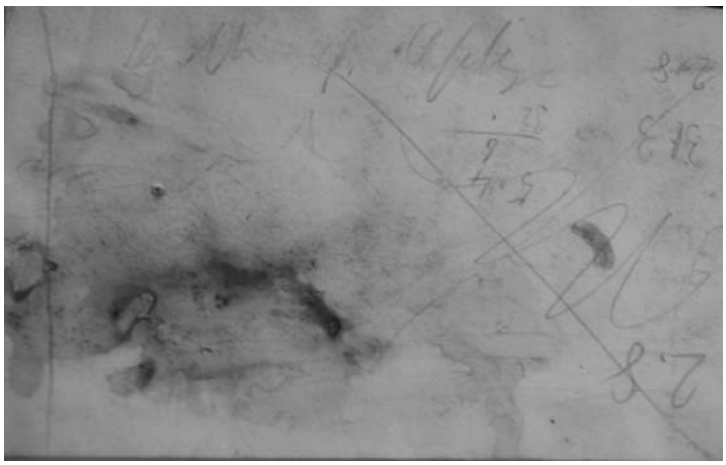


[right angled triangle for calculating height of Baobab tree]

[1a] length of *[illeg]*



[possible sketch of a coastline or mountain range]

2.8 5.4

6

36.3 32

2.8