

# Further Remarks on Darwin's Spelling Habits and the Dating of *Beagle* Voyage Manuscripts

FRANK J. SULLOWAY

*Department of Psychology  
University College London  
Gower Street, London WC1E 6BT, England*

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In this journal I recently published (Sulloway 1982) a systematic table of certain spelling errors that are present in Charles Darwin's *Beagle* voyage manuscripts (1832–1836). My primary purpose in publishing this table was to provide a means of dating Darwin's *Ornithological Notes* (1963[1836]). Long the subject of conjecture and debate, the dating of these notes, which contain Darwin's first tentative speculations about the possible transmutation of species, has ranged from as early as 1835 to as late as 1838. By monitoring Darwin's spelling habits during the *Beagle* voyage, I was able to contribute evidence bearing on this historiographic problem. More specifically, just as the geologist can use certain fossilized forms to recognize and date strata of different geological ages, so the historian can use various spelling changes in Darwin's voyage manuscripts to provide analogous identifying "markers" for certain distinct spans of time during the *Beagle* voyage. By recording dated usages of the words *occasion*, *coral*, and *Pacific* (and their variant spellings *occassion*, *corall*, and *Pacifick*), I found it possible to divide the *Beagle* voyage into seven distinct spelling phases and, as a result, to show that Darwin's famous *Ornithological Notes* – drafted during the fifth of these seven phases – were written between late November 1835 and mid-August 1836. Further manuscript evidence, namely, comparison of Darwin's *Ornithological Notes* with eleven other similar specimen catalogues written on identical paper, allowed me to date the *Ornithological Notes* even more precisely to within a thirty-one-day period (June 18 to July 19, 1836).

When I originally published my table of Darwin's voyage spelling habits, I hoped that it might also prove useful to fellow Darwin scholars in dating other previously undatable voyage manuscripts. Since its publication, the table has indeed been put to further use.<sup>1</sup> In the process, the need has arisen for certain minor corrections, as well as

1. See Burkhardt (in press); Sloan (in press); and Sulloway (in press).

for some amendments; in this article I shall detail these refinements and discuss their historiographic implications.<sup>2</sup> Although I am now in a position to revise and expand the spelling table, none of the changes affect the basic argument that I have already presented regarding the dating of Darwin's *Ornithological Notes* and the other eleven "J. Whatman 1834" specimen catalogues. Nevertheless, one refinement in the table – the addition of a new word – has allowed me to distinguish the dates of composition of two of the catalogues and thereby to shed further light on Darwin's mid-1836 thoughts about the mutability of species.

In the process of reinvestigating Darwin's voyage spelling habits, I have also discovered that the number of words Darwin spelled incorrectly far exceeds my published list of nine. Besides *occasion*, *coral*, and *Pacific* (used in my original table), the nine words included *neighbourhead*, *thoroughly*, *yatch*, *mæneuvre*, *Portugeese*, and *broard*. The additional six words were not used in my spelling table because they all appeared to have been spelled incorrectly throughout the *Beagle* voyage.<sup>3</sup> I have since discovered, however, that Darwin began to spell the last of these six words – *broard* – correctly in mid-1836, just a few months prior to his return to England. I have therefore added this word to my revised spelling table (Table 1).

The five-year *Beagle* voyage can now be divided into eight distinct spelling "phases," averaging 7.1 months each. Inasmuch as most of these spelling phases belong to the latter part of the voyage, the average phase from March 1834 on is just 5.0 months; the average spelling phase from mid-July 1835 on is only 2.9 months; and the average phase from mid-February 1836 to the end of the voyage (October 2, 1836) is a mere 2.5 months. In short, as the voyage drew to a close, Darwin began to correct his spellings at an increasingly rapid

2. I am grateful to both Frederick Burkhardt and Phillip R. Sloan for bringing to my attention several usages of *Pacifick* and *corall* that I had previously overlooked. It is extremely difficult (if not impossible) for one person, surveying several thousand manuscript pages (and looking for a number of different words), to be absolutely sure that all the relevant words have been identified. In constructing both my original spelling table and the revised version in this article, I have not attempted to record every voyage usage of the words concerned, but only to note as many as possible (certainly at least 90 percent), and especially to pinpoint the dates of first and last usage of correct and incorrect spellings.

3. Nora Barlow (1933:xix) claimed that *neighbourhead* was corrected toward the end of the *Beagle* voyage; but all such corrections actually were made after Darwin's return to England.

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Table 1. Variations in Darwin's voyage spellings, 1832 to 1836 (N = 563).<sup>a</sup>

| Year | Word and variants           |                           |                          |                           |
|------|-----------------------------|---------------------------|--------------------------|---------------------------|
|      | Occasion                    | Coral                     | Broad                    | Pacific                   |
| 1832 | Occasion (13)               | Coral (4)                 | Broard (9)               | Pacific (2)               |
|      | Occassion (4)               | Corall (5)                |                          |                           |
| 1833 | Occasion (11)               | Coral (1) <sup>e</sup>    |                          |                           |
|      | Occassion (11)              | Corall (2)                | (3)                      | (8)                       |
| 1834 | Occasion (3)                |                           |                          |                           |
|      | Occassion (25) <sup>b</sup> | (6)                       | (9)                      |                           |
| 1835 |                             |                           |                          | Pacific (9)               |
|      | (33)                        |                           |                          | Pacific (1) <sup>m</sup>  |
|      |                             | Corall (5)                | Broard (12)              | Pacific (7)               |
|      |                             | Corall (1) <sup>f</sup>   | Broad (1) <sup>j</sup>   |                           |
| 1836 |                             | Corall (14)               | Broard (21)              | Pacific (6) <sup>n</sup>  |
|      |                             | Corall (16)               |                          | Pacific (22) <sup>o</sup> |
|      |                             | Corall (61) <sup>g</sup>  |                          | Pacific (1) <sup>p</sup>  |
|      |                             | Corall (1) <sup>h</sup>   |                          | Pacific (10) <sup>q</sup> |
|      |                             | Corall (164) <sup>i</sup> |                          |                           |
|      |                             |                           | Broard (12) <sup>k</sup> |                           |
|      | Occassion (22) <sup>c</sup> |                           | Broard (4) <sup>l</sup>  | Pacific (18) <sup>r</sup> |
|      | Occassion (4) <sup>d</sup>  |                           |                          | Pacific (2) <sup>s</sup>  |

a. Solid lines indicate continuous periods of correct spellings; broken lines indicate continuous periods of incorrect spellings. Figures in parentheses show numbers of times the particular spelling occurred.

b. *Occassion* became the exclusive spelling in March 1834 (DAR 32.2:137, 147). All DAR numbers refer to the Darwin manuscripts at Cambridge University Library.

c. *Occassion* was last used between August 12 and mid-September 1836, probably toward the end of this interval (DAR 32.1 [series 2]: MS p. 3; *Red Notebook* [Darwin 1980(1836–1837)], MS p. 93e, Cambridge University Library; see also Sulloway 1982:380n74). Owing to the frequent mistranscriptions of spellings in Darwin's published voyage manuscripts, I here cite, whenever possible, the original MS pages.

d. *Occasion* was first used again sometime after August 6, 1836 (probably during the following two weeks), and was used again on September 20, ca. September 25, and on October 24, 1836 (DAR 32.1 [series 2]: MS p. 7; *Diary*

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[Darwin 1933], MS p. 759, Down House, Downe, Kent; *Red Notebook*, MS p. 107; and de Beer 1958:111).

e. *Coral* was last used in 1833 in July (Darwin 1967:76).

f. *Coral* was used again, once, on May 21, 1835 ("Valparaiso to Coquimbo," Down House, Downe, Kent).

g. *Coral* was first used again on November 17, 1836 (*Diary*, MS p. 630).

h. *Corall* was last used in February 1836 (DAR 31.2: MS p. 279v; see also note 18).

i. *Coral* became the exclusive spelling in February 1836 (DAR 38.1:843).

j. *Broad* was first used on April 2, 1835 ("Buenos Ayres; St Fe & Parana; Cordillera of Chili," Down House, Downe, Kent). This usage, however, is almost certainly a carelessly written *broad*. See note 22.

k. *Broard* was last used between June 18 and July 19, 1836 (*Ornithological Notes* [Darwin 1963(1836)], MS pp. 31, 52).

l. *Broad* was first used again shortly after July 9–13, 1836 (*Diary*, MS p. 741).

m. *Pacifick* was first used on August 17, 1834 (*Diary*, MS p. 472). The date of this usage, which is almost immediately followed by two *Pacifics*, must remain suspect, since the word was inserted above the line, possibly at a much later date. The color of the ink of this addition cannot be distinguished either from that used in the *Diary* in August 1834 or from that later used after July 19, 1835, when Darwin altered his spelling of *Pacific* to *Pacifick*.

n. *Pacific* was last used sometime shortly after July 19, 1835 (DAR 36.1: 449).

o. *Pacifick* became the exclusive spelling shortly after July 19, 1835 (DAR 36.1:443, 450, 453; "Geological Specimens from 2864–3742," specimen no. 3148, Cambridge University Library).

p. *Pacific* was used again by Darwin, once, in October 1835 (DAR 37.2:791).

q. *Pacifick* became the exclusive spelling again in October 1835 (DAR 37.2: 792).

r. *Pacifick* was last used sometime between August 12 and mid-September 1836, probably toward the end of this interval (*Red Notebook*, MS p. 97e; see also Sulloway 1982:380n74).

s. *Pacific* was first used again on September 25, 1835 (*Diary*, MS p. 769).

rate, resulting in correspondingly shorter spelling phases for this part of the voyage. Since most undated voyage manuscripts of particular interest to Darwin scholars were drafted during the last eighteen months or so of the voyage, the spelling table proves most useful precisely where it is most applicable.

## DARWIN AS A SPELLER

I have already mentioned that Darwin misspelled more than nine words during the *Beagle* voyage. In fact, Darwin misspelled nearly fifty words; and I have no doubt that he made other spelling mistakes or

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occasional slips of the pen in his voyage manuscripts. Darwin's older sister Susan, after reading the early portions of Darwin's personal diary (which he had sent home for safekeeping) was apparently the first person to point out his various idiosyncrasies and errors in spelling. In a letter of February 12, 1834, which Darwin received at Valparaiso on July 29 of the same year, Susan drew attention to seven spelling errors: *lose* (instead of *loose*), *lanscape* (instead of *landscape*), *higest* (instead of *highest*), *profil* (instead of *profile*), *cannabal* (instead of *cannibal*), *peacible* (instead of *peaceable*), and *quarrell* (instead of *quarrel*). Some of these mistakes, like *lanscape* and *higest*, are relatively infrequent; but they are repeated more than once in the diary. To her list of misspelled words Susan added the comment: "I daresay these errors are the effect of haste. but as your Granny [Susan's nickname] it is my duty to point them out" (DAR 204.6.1).

Heedful of his sister's criticisms, Darwin made certain that he spelled all seven of these words correctly after he had received her letter in July 1834. In a letter of November 22, 1835, Susan pointed out another mistake in spelling — *tun* (instead of *ton*) — adding, "When I have corrected the spellings it [the diary] will be perfect. . . . You see I am still your granny" (DAR 97 [series 2]:24–25). Darwin did not receive this letter until his arrival at Ascension Island in July 1836; in any event, he never used *tun* again after October 1833. It is not clear whether Susan made, as she had promised, any spelling corrections in the diary manuscript. Nevertheless, Nora Barlow, when transcribing the diary for publication (1933), followed all spelling corrections, including Darwin's own (most of which, however, were postvoyage). Moreover, Barlow inadvertently corrected many spellings herself, changing *harbor* to *harbour*, *occassion* to *occasion*, and so forth. Thus the published *Diary* does not accurately reflect Darwin's voyage spelling habits.

Other errors and inconsistencies in spelling that I have encountered in Darwin's personal diary, letters, and scientific notes during the *Beagle* voyage include (in alphabetical order): *Ascencion* (instead of *Ascension* [Island]); *Azzara* (instead of *Azara*, the eminent Spanish naturalist); *Baldivia* (in Chile, usually spelled correctly as *Valdivia*); *barrell* (instead of *barrel*); *before hand* (spelled as two words); *berrys* (instead of *berries*); *bivouaced* (corrected in November 1834 to *bivouaced*, and later corrected in the published *Journal* [1839] to *bivouacked*); *Bizcatcha* or *Biscatcha* (instead of *biscacha* or *viscacha*, a South American mammal somewhat resembling a large rabbit); *Caucovado* (instead of *Corcovado*, the famous mountain peak overlooking Rio de Janeiro);

*Callandra* (instead of *Calandria*, the common name of *Mimus saturninus*, the La Plata mockingbird); *Chili* (instead of *Chile* – spelled incorrectly throughout the voyage); *clothese* (which alternated with *clothes* until November 1835); *color* (which alternated with *colour* throughout the voyage);<sup>4</sup> *Conception* (instead of *Concepcion*, in Chile, which Darwin began to spell correctly by early 1835); *cruize* (instead of *cruise*, which was used until May 1832); *eat* (intended for *ate*); *epock* (usually spelled correctly as *epoch*); *expence* (used exclusively until October 1834, when it began to alternate with *expense*); *fantastick* (instead of *fantastic*, which was used until February 1834 and then replaced by *fantastick* in August 1836); *gaz* (which alternated with *gas*); *geologising* (used infrequently, instead of the more usual *geologizing*); *harbor* (used exclusively after April 1832, but suddenly replaced by *harbour* on September 25, 1836); *heretick* (spelled *heretic* prior to July 1835, and kept as *heretick* in the published *Journal*); *labor* (which alternated with *labour* throughout the voyage); *mollusque* (also correctly spelled *mollusc*); *muscle* (instead of *mussel*); *New Zealand* (instead of *New Zealand*, which Darwin initially spelled correctly and then alternated between correct and incorrect spellings, finally getting the spelling consistently right in the published *Journal*); *planck* (which alternated with *plank* until April 1833); *priviledge* (instead of *privilege*); *prœcipices* (instead of *precipices*), *untill* (instead of *until*); and *vapor* (instead of *vapour*).<sup>5</sup>

4. I have listed words like *color*, *harbor*, *labor*, and *vapor* as “misspellings” because, in British usage, they are spelled *colour*, *harbour*, and so on, and because Darwin later changed all of them to this form in his *Journal of Researches* (1839). (The terminal *-our* form, which derives from late Anglo-French, has been the accepted spelling in England since the fourteenth century, although the *-or* form, which derives from Latin, has occasionally been used and has become the preferred spelling in the United States.) Actually, the point of listing all of Darwin’s inconsistencies in spelling, even if they involve dictionary “variants” acceptable by nineteenth-century standards, is simply to document any changes in Darwin’s spelling habits that might be useful in dating voyage manuscripts.

5. It is hardly surprising that in manuscripts and other documents that had yet to be revised for publication, Darwin should have misspelled so many words. Although I have become a keen student of Darwin’s spelling errors, I have had to correct several spelling errors in the rough draft of this article – the most common of which (ironically) was the word *misspelled*. (I often omit the second *s* in the word, and I probably would never have noticed this error had not a copy editor caught it in a previous publication.) Darwin’s own spelling errors can also be quite contagious. Ever since noticing Darwin’s misspellings of the words *occasion*, *occasional*, etc., I have sometimes had to stop myself to ask whether *occasion* has two *c*’s or two *s*’s. And the extra *r* in *broard*, which I previously considered rather odd, has recently crept into my own spelling of the word and has even begun to seem fairly natural.

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Of these thirty-two words, only the changes in *bivouaced* to *bivouaced* in November 1834 and in *clothese* to *clothes* in November of the following year are potentially useful for dating voyage manuscripts; but the relative infrequency with which Darwin used these two words (and their restriction primarily to nonscientific texts) makes them, like the eight spelling errors pointed out by Susan Darwin, rather inefficacious sources of dating information. Thus the four commonly used words in Table 1 remain the most useful overall guides to dating any of Darwin's hitherto undated voyage manuscripts.

Before reviewing further historical applications of this table, I should make one final remark regarding Darwin's spelling habits. When someone has misspelled a word for several years, it is not always easy to effect a sudden transition to the correct spelling. In Darwin's case, at least three general influences were operative in determining how quickly he was able to rid himself of incorrect spellings once he finally recognized the need to rectify them. First, the more frequently Darwin had used a word in the past, the more inclined he was to relapse into an incorrect spelling. Second, relapses were more common if the next usage of the word, following initial recognition of the misspelling, occurred after a considerable gap in time. Finally, relapses (as well as carelessly written words, sometimes ironically resulting in *correct* spellings) appeared most frequently in field notes. It is important to bear these three circumstances in mind when judging the utility of Table 1 in dating previously undated voyage documents. The table, while surprisingly reliable as a dating guide, is by no means infallible; and the three considerations just mentioned are useful in assessing problematic documents and also in judging how much weight to give to the table.

I now consider three such applications of the table. In doing so, I not only discuss how the table can be used to date the previously undated documents in question, but I comment on the wider implications of these datings for understanding Darwin's voyage intellectual development.

### FURTHER HISTORIOGRAPHIC APPLICATIONS OF DARWIN'S VOYAGE SPELLING HABITS

#### *The "Santiago" Notebook and Darwin's Theory of Coral Reef Formation*

In his *Autobiography* Darwin claimed that he first developed his theory of coral reef formation before he left the coast of South America

and saw his first true coral reef. “No other work of mine,” Darwin remarked, “was begun in so deductive a spirit as this” (1958[1876]: 98). Hitherto there has been no way to confirm Darwin’s retrospective claim by manuscript evidence. The dating of the one voyage notebook (Darwin’s “Santiago” notebook) in which he first explicitly referred to his new theory, apparently so puzzled Nora Barlow that she made almost no reference to it in her otherwise detailed review of the voyage notebook series (1945). At the urging of Frederick Burkhardt, coeditor of the Darwin Collected Letters Project, I have carefully reexamined this notebook in the light of Darwin’s voyage spelling habits.<sup>6</sup>

Darwin’s “Santiago” notebook, which measures roughly 10 cm by 16.5 cm, consists of eighty-seven unnumbered pages followed by thirty-five numbered pages, an excised sheet, three unnumbered blank pages, one unnumbered page with writing at the top, and four excised sheets.<sup>7</sup> The original notebook contained 136 pages in all, the last eight of which were excised and have never been found.

Dating the early parts of the notebook presents little problem. On the very first page Darwin referred at the top to “Biscatches making a noise” – evidently a note later incorporated into his *Diary* entry for August 16, 1834: “The evening was so calm & still; the shrill noise of the mountain Biscatcha [later corrected to *bizcacha*] & the faint cry of the goatsucker were only occasionally [later corrected to *occasionally*] to be heard” (1933:238). The same page of the notebook refers to Darwin’s plans for leaving Santiago, Chile. (Darwin spent nearly a week there from August 28 to September 2.) Thereafter the

6. I am deeply grateful for Burkhardt’s considerable assistance in this regard, especially for suggesting that the spellings in the “Santiago” notebook might help to pinpoint the date of those passages that discuss the coral reef theory, and for helping to recheck a number of voyage manuscripts for spellings relevant to this issue. As long ago as 1970 I had recognized the role that Darwin’s voyage spelling habits might play in dating this notebook, although I was then largely convinced by internal evidence that those portions of the “Santiago” notebook in which the first coral reef discussions occur could be assigned to the general period of Darwin’s passage of the Cordilleras in March and April of 1835. Nevertheless, to *prove* the dating of the contents of this notebook is a much more complex task than I had initially believed; and Darwin’s spellings, rather than merely reinforcing my earlier intuitions, have turned out to be the only indisputable means of dating the coral reef discussions. The origins of Darwin’s theory of coral reefs will be discussed more fully by Burkhardt (in press).

7. Darwin numbered two pages of the “Santiago” notebook “28,” so although the last numbered page of this notebook is “34,” there are actually thirty-five numbered pages. The “Santiago” notebook is kept with the other *Beagle* voyage field notebooks at Down House, Downe, Kent.

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notebook was dated by Darwin fairly regularly, recording the details of his overland trip to Valparaiso, arriving there via a circuit to the south on September 27, 1835 (unnumbered pages 2–67). Darwin, who became severely ill on this journey, remained in bed in Valparaiso for a month, staying at the home of an old English schoolfriend, Richard Corfield. Six subsequent pages in the “Santiago” notebook record occasional geological thoughts and speculations until the notebook again began to be used, on February 10, 1835, to record field notes during Darwin's trip to Valdivia. The last dated entry in the notebook, on unnumbered page 85, records the *Beagle's* arrival at the island of Mocha on February 24, while en route from Valdivia to Concepcion.

It was at this point that Darwin began using the “Santiago” notebook exclusively for geological reflections and reading notes. Although the first two pages of this portion of the notebook, written in pencil prior to his arrival at Concepcion on March 4, are really the beginning of the new section, these two pages are not numbered. Nevertheless, the ensuing numbered pages, which are in ink, contain the tail end of the previous two pages of discussion in pencil and deal with the same subject – namely, Darwin's and De La Beche's (1831) contrasting views on the transportal of large blocks and gravel. This discussion continues until the end of numbered page 4. Only two pages later, Darwin's first mention of his theory of coral reefs appears (Fig. 1).

Dating this particular passage (or indeed, dating any of the early portions of the numbered pages of the “Santiago” notebook) presents many problems. It is perhaps not so surprising, then, that Nora Barlow skipped over this section when transcribing the most interesting portions of the voyage field notebooks in 1945. The passage in question reads:

As in Pacific a Corall bed. forming as land sunk. would abound with. those genera which live near the surface. (mixed with those of deep water) & what would more easily be told [by the presence of] the Lamelliform. corall forming. Coralls. – (MS p. 6)

This brief remark contains, in a nutshell, the essence of Darwin's theory of coral reefs. The theory rested on the key assumption that corals – especially actively growing species like the Lamelliform corals – must live relatively near the surface of the sea (1839:554; 1842). Hence subsidence of an oceanic island already surrounded by a fringing coral reef would inevitably induce the upward growth of coral, which cannot survive below twenty to thirty fathoms. The result would eventually

~~Mr. Calley's saw-fish  
has. Crinoid rings~~

~~Again I think Mr. Hervey  
had. coral with Pagan  
9. p. This coral. (as before  
may be present of  
L. V. coral?~~

~~As in Pacific a coral  
had forming as land  
bank. water about water.  
then grass which have  
been the surface. (mixed  
with some deep water) &  
what had been may be  
the the Lacelliform coral  
Smith. Corals.~~

Fig. 1. Numbered page 6 from Darwin's "Santiago" notebook, showing at the bottom his first discussion of his theory of coral reef formation. (Courtesy of Down House and the Royal College of Surgeons of England.)

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be a lagoon island and finally an atoll. So important to Darwin's theory was this basic assumption about the limited depths within which corals can live that Darwin, one page later in the "Santiago" notebook, specifically asked himself: "Is there a large portion of those Coralls which only live near surface. — If so we may suppose the land [is] sinking" (MS pp. 7–8).

When were these two significant passages written? Darwin's use of the word *Pacific* in the first of the two, and again on the following page, provides an important clue. Sometime between April 23 and about July 19, 1835, when Darwin arrived in Callao (the seaport of Lima, Peru), he suddenly altered his spelling of the word *Pacific*, adding a terminal *k*.<sup>8</sup> Hence the coral reef passages in the "Santiago" notebook definitely predate July 19, 1835,<sup>9</sup> and Darwin's claim in his

8. It is certainly curious that Darwin should have switched to an archaic spelling like *Pacifick* when, for three and one-half years, he had spelled this word (and also *Atlantic*) in its modern manner. (Although the spelling *Pacifick* was the dominant form in travels and voyages published prior to about 1750, thereafter it was rapidly replaced by *Pacific*.) One is therefore tempted to wonder what led Darwin to adopt this change in spelling, which he retained for the next fourteen months.

One possible stimulus would have been Darwin's readings in preparation for his visit to the Galapagos Islands. After sailing from Copiapó on July 6, 1835, Darwin expected the *Beagle* to make only brief visits to Iquique (in northern Chile) and Lima, Peru, where the *Beagle* arrived on July 19. Captain FitzRoy delayed sailing from Lima, however, until September 6, owing to his discovery of a number of old charts.

After arriving in Lima, Darwin probably alternated between writing up his personal and scientific diaries and reading Dampier's (1729) and Colnett's (1798) accounts of their visits to the Galapagos. Not only did Dampier, whom Darwin later cited in his published account of the Galapagos Islands (1839:456, 462, 476), use the archaic spelling *Pacifick*, but he began the very chapter on the Galapagos that Darwin would have read with a disquisition as to what should properly be called the *Pacifick Sea* (1729:94). According to Dampier, the term "Pacifick Sea" was applicable to that body of water extending from just below the equator to 30 degrees south in latitude, and from the coast of South America to about five or six hundred miles to the west. It is also worth mentioning that FitzRoy occasionally spelled *Pacific* (as well as *Atlantic*) with a terminal *k* during the *Beagle* voyage; so Darwin may also have been influenced by FitzRoy in this spelling. (See Captain Robert FitzRoy to Captain Francis Beaufort [the Admiralty hydrographer], letter of July 16, 1833 [Ministry of Defence, Hydrographic Department, Taunton]; and FitzRoy to Darwin, letter of October 4, 1833 [DAR 204.7]).

9. This conclusion is reinforced by the fact that Darwin referred on numbered MS p. 16 of the "Santiago" notebook to "Alison's notes" about earthquakes in Chile (notes probably sent by R. E. Alison to Darwin in a letter of June 25, 1835, and received by Darwin sometime after July 19 – DAR 36.1:427–427a). Darwin also mentioned on this "Santiago" notebook page, which is the first of

*Autobiography* that he developed his theory of coral reef formation prior to leaving the coast of South America is confirmed.

It is much more difficult to determine exactly when, between February 24, 1835 (Darwin's last dated entry in the unnumbered portion of the "Santiago" notebook) and July 19, he might have drafted these passages setting forth his theory of coral reefs. Several points of circumstantial evidence are worth mentioning. First, at the very top of the page on which Darwin first mentioned the theory, he also wrote "Mr. Cal[d]cleugh saw. Guanaco near. Cordovese range" (MS p. 6). This memorandum, evidently a personal communication, was probably jotted down while Darwin was living in Santiago at Alexander Caldcleugh's house.<sup>10</sup> Darwin stayed twice at the home of Caldcleugh

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the numbered pages to be written in pencil, his belief that the earth was undergoing a continual "circle of [geological] change." In a letter to John Stevens Henslow of July 12, 1835, Darwin further alluded to this theory that "the crust of the world goes on changing in a Circle" (1967:110). One of Darwin's notebooks for geological specimens records a specimen (no. 3148) collected "In the Trade winds of the Pacifick," shortly after arriving at Callao on July 19, 1835 (Cambridge University Library). This is the first datable usage of *Pacifick* in 1835.

Between April 23, 1835, when Darwin last used the spelling *Pacific* in a dated document (1945:120), and July 19, it is impossible to be more precise about when Darwin began to spell the word with a *k*. This is because all of Darwin's scientific notes, as well as his personal diary for these four months, were written after his arrival at Callao (see Darwin 1933:298, 302, 332, and 437n40; and 1945:122). Hence, with the exception of Darwin's field notebooks for this period (which unfortunately contain no references to the Pacific Ocean), all of his manuscripts postdate his arrival in Callao and therefore, with one exception (see Table 1), spell *Pacifick* with a terminal *k*.

10. In his *Travels* (1825, 1:253, 257), Caldcleugh reported having seen two guanacos on the plains near La Cruz Alta, on the border of the Santa F  and Cordova provinces. La Cruz Alta, however, is more than one hundred fifty miles from the foothills of the Sierra de Cordova and only about two hundred miles from the Atlantic Ocean. Although Caldcleugh, who was traveling from Buenos Aires to Mendoza (and then over the Cordilleras to Chile), later entered the Sierra de Cordova en route in order to escape from Indians, he made no mention in his *Travels* (DAR 42:43, 49, 52). Thus Darwin's "Santiago" notebook reference if Darwin's reference to Caldcleugh on MS p. 6 of the "Santiago" notebook was drawn – albeit somewhat inaccurately – from Caldcleugh's *Travels*, Darwin would almost certainly have recorded the page and volume number of this reference, as he systematically did in taking other notes while reading Caldcleugh's *Travels* (DAR 42:43, 49, 52). Thus Darwin's "Santiago" notebook reference to guanacos appears to be a personal communication, perhaps prompted by an inquiry on Darwin's part while he was staying at Caldcleugh's house in Santiago. It

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– between March 14 and 18, 1835 (just before his passage of the Cordilleras) and between April 10 and 15 (just after his return passage).<sup>11</sup> The fact that Darwin was probably staying with Caldcleugh when he jotted down the memorandum about the guanacos suggests that he may also have written the rest of that page, and perhaps all of the material through the top of page 16, at roughly the same time.<sup>12</sup>

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would have been natural, in fact, for Darwin to question Caldcleugh – especially before crossing the Cordilleras – about the route he planned to take across these mountains to Mendoza, and also to have asked Caldcleugh about the geology and natural history of the regions he had visited.

Had Darwin been on board the *Beagle* and only later recollected something Caldcleugh had said to him about the northern range of guanacos in South America, Darwin would almost certainly have entered this information in his zoology diary – not his “Santiago” notebook – as an addendum to one of his several discussions of guanaco habits. Darwin later cited Caldcleugh’s information about the northern range of the guanacos in his *Journal of Researches* (1839: 195), although Caldcleugh’s name is not mentioned in this connection. The fact that numbered pages 6–16 of the “Santiago” notebook contain references to Phillips’s *Elementary Introduction to the Knowledge of Mineralogy* (1823) is not inconsistent with their having been written at Caldcleugh’s house in Santiago. Caldcleugh was a member of both the Royal Society of London and the Geological Society of London, having been elected to the latter society in 1822. Author of several geological articles as well as his *Travels in South America* (1825), Caldcleugh owned a well-stocked library of geological books. After sailing from Rio de Janeiro to England in 1821, he had recognized the need for bringing a large scientific library with him when he decided to return to Chile in the late 1820s to head a mining consortium. This library was almost entirely destroyed in a fire after Caldcleugh’s death; but a very rough inventory, made in 1858 shortly after his death, has survived (Donoso 1966:222–231). Although most titles of books are given in Spanish in the inventory, and only rather vaguely, such entries as “mineralogía, en inglés. 1 vol. ” and “29 vols de ciencia, en inglés” could possibly include Phillips’s work, which was generally considered an indispensable resource on mineralogy in the 1830s (Darwin 1967:90).

11. Darwin probably also met Caldcleugh when he stayed in Santiago between August 28 and September 2, 1834. Two references to Caldcleugh appear on the very first page of the “Santiago” notebook: “Caldcleugh geology of Concepcion” and “Return book Caldcleugh.”

12. The color of the ink, a sepia brown, is constant throughout numbered pages 1–16 of the “Santiago” notebook. On field trips Darwin did not use ink in his field notebooks – preferring pencil for obvious reasons. Nevertheless, he did use ink during field trips when staying at houses. Thus the “Santiago” notebook contains a previous sixteen-page essay, primarily devoted to the gold mines at Yaquil (about forty miles south of Santiago), written in ink on September 18, 1834, while Darwin was staying with “Mr Nixon, an American gentleman” (Darwin 1933:246). The color of the ink in this section is similar, if not identical, to that used in Darwin’s voyage manuscripts during this period and also to the

(On page 16 Darwin suddenly changed from writing in ink to writing in pencil; and on that same page he also mentioned information sent to him by R. E. Alison in a letter of June 25, 1835, which was not received at the earliest until his arrival in Callao on July 19.)<sup>13</sup>

The question is, then, which of the two periods when Darwin stayed with Caldcleugh is the more likely one for Darwin to have penned the passages containing his theory of coral reefs. A more thorough study of the "Santiago" notebook is needed to answer this question — if it is answerable at all. In any event, one point should not be forgotten. Just because Darwin first mentioned his theory of coral reefs in March or April of 1835 does not mean that he first *conceived* the theory at this time. Indeed, the whole foundation for Darwin's theory was laid, as he himself later remarked in his *Autobiography*, by the numerous observations he had made during the previous two years regarding the intermittent elevation of the land in South America and the accompanying denudation of strata. "This necessarily led me to reflect much on the effects of subsidence," Darwin elaborated, "and it was easy to replace in imagination the continued deposition of sediment by the upward growth of coral. To do this was to form my theory of the formation of barrier-reefs and atolls" (1958[1876]): 98–99). Darwin was probably in a position to make this intellectual connection by early 1835, even before he happened to express it in his "Santiago" notebook in March or April of that year.

Darwin's "Santiago" notebook is unique among the twenty-seven voyage notebooks in another respect. With its largely theoretical orientation, its total lack of dated entries after unnumbered page 87, and its frequent references to books that Darwin was reading, the latter parts of this notebook can be considered the first of the series of twelve notebooks that includes the *Red Notebook* as well as the postvoyage geology and transmutation notebooks.<sup>14</sup> Not only are the contents

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ink used on numbered pages 1–16 of the "Santiago" notebook. This circumstance suggests that Darwin carried a small supply of pens and ink with him on field trips in case he should reach a house and wish to write up his notes in ink. Portable writing kits were commonly available in Darwin's day for just such use by travelers.

13. DAR 36.1:427–427a; see also DAR 36.1:422–425, 427.

14. Herbert (1980:13–14) has assigned to the *Red Notebook* the distinction of occupying the position "midway" between the voyage field notebooks and the postvoyage theoretical notebooks. The last portions of the "Santiago" notebook, however, really mark the beginning of this transition and moreover occupy roughly a year of the *Beagle* voyage. In comparison, the voyage portions of the

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of the "Santiago" notebook consistent with this historical perspective, so are its spellings, which undergo transitions from *Pacific* (MS pp. 6–7) and *corall* (MS pp. 6–7, 12, 14, and 15) to *Pacifick* (MS p. 21) and *coral* (MS p. 30). This later usage of *coral*, which postdates Darwin's observations at King George's Sound (February 6–14, 1836), comes in the brief remark: "The Coral theory rests on the supposition of depressions being very slow & at small intervals" (MS p. 30). It is likely that this entry was written around April or early May of 1836. (The notebook terminates soon after, with the thirty-fifth numbered page – four subsequent leaves having been excised.)

Inasmuch as it is generally accepted that the *Red Notebook* was begun in May or June of 1836 (Herbert 1980:6), it apparently took up where the "Santiago" notebook left off. Both notebooks have an almost identical format (references to numerous geological publications, an abundance of theoretical statements and questions, and alternations between pencil and ink). In addition, the "Santiago" notebook contains two late references to Mauritius, which the *Beagle* visited between April 29 and May 9, 1836 (MS pp. 27 and 28). Finally, the latter parts of the "Santiago" notebook take up the problem of cleavage (MS pp. 27, 28, 29, and 33), a topic that is also discussed on the very first page of the *Red Notebook* (1980[1836–1837]: MS p. 5e).<sup>15</sup> In the "Santiago" notebook, a paper Darwin was writing on

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*Red Notebook* were drafted during the last four or five months prior to Darwin's return to England, although they encompass about three times as much text. Frederick Burkhardt (personal communication) has pointed out that the page numbers of the latter parts of the "Santiago" notebook were entered in a different pen and ink, apparently *after* Darwin had filled the notebook (see Fig. 1). This circumstance supports the notion that Darwin himself considered these portions of the notebook to be of a rather different character from the totally unpaginated field notebooks. Darwin also numbered the pages of all subsequent "theoretical" notebooks and often referred to such page numbers in the margins or verso pages of his voyage scientific diaries when revising them for publication. For instance, references to numbered pages 29 and 31 of the "Santiago" notebook appear in Darwin's "Cleavage" essay (DAR 41 [series 5]: MS p. 2v; see also note 15).

15. The original first four pages of the *Red Notebook*, like the last eight pages of the "Santiago" notebook, were excised and have not been found. Darwin began to write an essay entitled "Cleavage" probably after leaving Mauritius (May 9, 1836), where he apparently bought some new stocks of paper to augment his dwindling supply (DAR 41 [series 5]: MS pp. 1–36; and Darwin to William Darwin Fox, February 15, 1836, Christ's College Library, Cambridge University). The undated "Cleavage" essay is written on paper that alternates among four

cleavage is mentioned as not yet being finished (MS p. 33). On the first page of the *Red Notebook*, Darwin reminded himself to “quote this,” regarding some remarks about cleavage; and on page 38e of this notebook (probably written in early July 1836), Darwin was still engaged in writing the same paper, since he told himself to incorporate another relevant observation. In short, the “Santiago” notebook flows both conceptually and temporally into the opening pages of the *Red Notebook* and was, for over a year, its direct intellectual precursor.

*From the “Coral Islands” Essay to the “J. Whatman 1834” Specimen Catalogues*

Darwin’s coral islands theory, although first set forth in his “Santiago” notebook, was discussed in more detail in a formal essay entitled “Coral Islands.” In this twenty-two-page essay Darwin argued that fringing reefs, lagoon islands, atolls, and barrier reefs could all be explained by subsidence of the surrounding ocean floor. The essay, probably drafted between December 3 and December 21, 1835 (when the *Beagle* reached New Zealand),<sup>16</sup> marks an important transition in Darwin’s spelling of the word *coral*. For almost two years, until a *Diary* entry of November 17, 1835, Darwin had consistently spelled the word *coral* with a double *l*.<sup>17</sup> Darwin’s *Diary* entry for No-

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different watermarks: “RM 1831,” “Edward Smith 1833,” “G. Wilmot 1834,” and “GW” (the latter two papers perhaps being watermark variants of the same manufacturer). That the early portions of the “Cleavage” essay were written in May or June of 1836 (and definitely prior to mid-July) is supported by Darwin’s usage of the spelling *broard* on MS p. 9. See page 380.

16. Stoddart (1962:2) originally proposed this range of dates for the composition of the coral islands essay, based on the fact that Darwin did not pass Aitutaki Island, on the way from Tahiti to New Zealand, until December 3, 1835 (1933:358–359). Darwin mentioned in his essay having seen both Aitutaki (misspelled *Whytootacke*) Island and Eimeo – the latter having been viewed from the mountains of Tahiti. The year “1835” is written on the upper left-hand side of the first page of Darwin’s coral islands essay, so there can be no doubt that the essay was written sometime in 1835, and after December 3. Upon arriving in New Zealand on December 21, Darwin would have been occupied with field researches for the next ten days, so it is unlikely that the coral islands essay was drafted after December 21.

17. There is one exception to this statement, namely, Darwin’s use of the word *coral* in a field notebook in May 1835. On the same page, and also just a few pages later, Darwin used the spelling *corall* a total of three times (“Buenos Ayres; St Fe & Parana; Cordillera of Chili,” Down House, Downe, Kent). Darwin most

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ember 22 also contains the word *coral* (used twice — one usage apparently corrected at the time from *corall*, by looping together the two *l*'s after the incorrect spelling had “slipped out”). In a December 3 *Diary* entry, however, Darwin reverted to the double-*l* form of the spelling, which he did not correct. Darwin's December 1835 essay on coral islands exhibits a similar but more concerted pattern of transition in spelling from *corall* to *coral*. Of seventy-two usages of the word *coral*, fifty-seven were spelled correctly by Darwin; eleven were later corrected from *corall* to *coral* (most of them apparently while Darwin was writing the essay, to judge by the ink); and only four were spelled *corall* and remained uncorrected. The latter half of the essay contains far fewer *coralls*, both corrected and uncorrected, than the first half. It is thus evident that Darwin had almost mastered a complete transition to the single-*l* spelling before finishing the essay.

After December 1835 Darwin used the word *corall* only once more in a dated document (Hobart Town, in Tasmania, February 1836 [DAR 31.1: MS p. 162v]). After leaving Hobart Town, Darwin spelled *coral* correctly four times in his personal and geological diaries before reaching Keeling Island on April 1, 1836.<sup>18</sup> Thereafter *coral* was used exclusively (more than one hundred fifty times) in Darwin's remaining voyage manuscripts.

Sometime after his arrival in Mauritius (on April 29, 1836) or Cape Town (on June 1), Darwin purchased nearly three hundred sheets of “J. Whatman 1834” paper. Unlike most of his other voyage papers, these sheets were faintly ruled and ideal for listing, in clear and orderly

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likely spelled the word *corall* with a double *l* owing to his frequent usage of the words *coralline* and *corallina* — which he simply shortened to *corall* when referring to true corals, which are animals (as opposed to corallines, which are algae).

18. Darwin probably used the word *corall* twice more in Hobart Town, on an undated piece of paper having a “£” watermark, since this same paper was also used for field notes at Hobart Town on a sheet dated February 12, 1836 (DAR 5:98–99; DAR 40:48–49). The two usages of *corall* in this document, which is fully discussed by Sloan (in press), were preceded by twelve usages of the words *coralline(s)*, *corallinum*, and *corallina*. Between mid-December 1835 and mid-February 1836 Darwin did not use the words *coral* or *corall* at all. Thus, after a hiatus of about two months, and with so many *corallines* and the like preoccupying his Hobart Town thoughts, Darwin apparently relapsed into the double-*l* spelling a total of three times. The undated “£” notes are not in essay form and are filled with questions and conjectures apparently jotted down as memoranda. These penciled notes contrast with the essaylike diary entries for Hobart Town, written in ink and apparently at leisure, during the voyage to King George's Sound.

fashion, numbered specimens in the different subdivisions of his voyage biological collections. It was this "J. Whatman 1834" paper that Darwin used to draft all twelve of the specimen catalogues, which were intended for use by systematists after his return to England. The same paper was also used for copying two geological essays, the first of which was a fair copy of the 1835 "Coral Islands" essay. Drafted by Syms Covington, Darwin's voyage servant and amanuensis, the essay is characterized by the spellings *coral*, *ocassion*, *ocassionally*, *Pacifick*, and *broad*. Once recopied, this essay was given to several people (probably including FitzRoy) to read; and these readers made a number of comments in the margins. One of them crossed out the superfluous *s* in the words *ocassionally* and *ocassion* (DAR 41 [series 2]: MS pp. 8, 9). Covington evidently took note of this spelling error, since he spelled the word *ocassionally* correctly in the second of the two geological essays he wrote on "J. Whatman 1834" paper. This essay, entitled "Recapitulation and concluding remarks," is a twenty-nine-page fair copy of a manuscript originally written by Darwin "before finally leaving the shores of South America" and now lost (DAR 41 [series 3]: MS p. 1). Darwin, for his part, did not correct his own spelling of *ocassion* until mid-August 1836; and all of the "J. Whatman 1834" specimen catalogues that he personally drafted employ the double-s spelling of the word and its derivatives.

By virtue of these various spellings, two dating sequences suggest themselves for the twelve "J. Whatman 1834" specimen catalogues and the two geological essays. The first possibility is that Covington drafted a fair copy of the coral islands essays prior to any of the twelve specimen catalogues and that only he (and not Darwin) noticed the corrections of the spellings *ocassion* and *ocassionally* by another of their *Beagle* shipmates. Granting this possibility, we must further assume that Covington, on his own, corrected the spelling of *broard* to *broad*, since this word was not spelled correctly in the original December 1835 draft of the essay and was not corrected by any subsequent reader.<sup>19</sup> This

19. This supposition is quite possible, since Covington of his own accord corrected Darwin's spelling of *neighbourhead* to *neighbourhood* in the "Plants" catalogue (MS p. 9; Cambridge University Library) and in the *Ornithological Notes* (1963[1836]: MS p. 1). Darwin, however, continued to misspell *neighbourhood* throughout the *Beagle* voyage. It is not known precisely when after the voyage Darwin first came to recognize this spelling error. He *did* use the correct spelling for *neighbourhood* on MS p. 142e of the *Red Notebook* (datable to about May 3, 1837 – see Sulloway 1982:383) and again in a June 22, 1837, letter to F. W. Hope (DAR log number 7204).

possible dating scenario leads to the rather unlikely conclusion that Darwin did not look over the coral islands essay after his reader(s) had made their various comments in the margins of the fair copy. (Not only was the second *s* in *occasionally* and *occassion* crossed out by one of the readers, but this reader also put two conspicuous *X*'s in the margin to call attention to the errors.)

The second and more likely dating scenario for the use of the "J. Whatman 1834" paper is that Darwin initially employed it exclusively for the twelve specimen catalogues. As I have shown elsewhere, all twelve catalogues (totaling 219 pages) appear to have been composed during a fifty-six-day interval from June 18 to August 12, 1836, as the *Beagle* was sailing from the Cape of Good Hope to Pernambuco, Brazil (Sulloway 1982:336–337). Having completed the last of the specimen catalogues by about August 12, 1836, Darwin was then in a position to have Covington use the remaining "J. Whatman 1834" paper to recopy the two geological essays.<sup>20</sup> The correction of the spellings *occasionally* and *occassion* in the coral islands essay would coincide, by this dating, almost exactly with Darwin's own adoption of the correct spelling of these words (Table 1). Therefore Darwin, like Covington, must have noticed the spelling corrections by one of his readers; afterward he spelled *occasion* and its derivatives correctly.

It is frankly more difficult to account for Darwin's spelling correction of *broard* to *broad*, although FitzRoy may well have played a role.<sup>21</sup> For nearly five years Darwin consistently spelled this word

20. On the assumption that Darwin purchased about twelve quires (or 288 sheets) of "J. Whatman 1834" paper, his stock would have been virtually exhausted after Covington had recopied the second of the two geological essays around mid-August 1836. A possible fifteen sheets of the paper, however, are unaccounted for. Duncan M. Porter believes that a catalogue for plants in spirits of wine must have been drawn up along with the other specimen catalogues (Porter 1982:505); but no such catalogue has yet been discovered. This particular catalogue would not have exceeded fifteen sheets of paper. Aside from the twelve specimen catalogues and the two geological essays, Darwin did not use "J. Whatman 1834" paper, either during the *Beagle* voyage or afterward.

21. In a letter to his sister Caroline, written from Mauritius on April 29, 1836, Darwin mentioned that FitzRoy, who had recently read over those parts of Darwin's *Diary* that were still on board, had invited him to publish a joint account of the *Beagle* voyage (1945:138). The word *broard* – used in the *Diary* on January 20, February 6, and March 6, 1836 – is corrected in these entries for the first time, as is the double *s* in the December 23, 1835, and the January 17, January 22, and April 6, 1836, usages of *occasionally*, *occasional*, and *occasions*. Two of the three corrections of the word *broard* are in pencil, made

with an extra *r*.<sup>22</sup> The first correct usage of the word *broad* occurs in Darwin's *Diary* entry of July 9–13, 1836, while the *Beagle* was at St. Helena. Darwin probably did not make this entry, however, until a day or two after leaving St. Helena on July 14. In a letter to his sister Caroline dated July 18, the day before he arrived at Ascension Island, Darwin again spelled the word *broad* correctly. A slightly later geology

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with a vertical stroke slanting left to right, as are the corrections of the extra *s* in *occasions* and similar usages. The spelling corrections in the fair copy of the coral islands essay are also in pencil – one made with a vertical stroke slanting left to right, the other done with two vertical lines.

It thus seems likely that FitzRoy was responsible for making these penciled corrections, both in the *Diary* and in the fair copy of the coral islands essay. Darwin may subsequently have noticed the penciled corrections of the word *broard* as he was revising or amending these sections of his voyage *Diary*. It is less likely that Covington, who definitely knew how to spell the word *broad*, brought this spelling error to his master's attention, since he probably did not come across the mistake until recopying the 1835 "Coral Islands" essay sometime after Darwin himself had begun to spell the word correctly.

At the end of Darwin's field notebook labeled "Sydney Mauritius," there is a reminder to purchase a "Spelling Dict.:" Darwin could have made this purchase at any time between his visits to Sydney (January 12–30, 1836) and the Cape of Good Hope (June 1–18, 1836).

22. In spelling the word *broard* (and many other words ending in *ed*), Darwin often tended to combine the last two letters, allowing the *r* or the *e* to stand for the bottom loop in the subsequent *d*. It is therefore not always easy initially to tell whether Darwin wrote *broard* or *broad*, although the two spellings usually are distinguishable.

Two criteria are helpful in resolving the most doubtful cases. First, when writing an ambiguous second *r* in *broard*, Darwin always left a considerable gap between the *a* and the *d*, generally allowing the *r* to serve as part of the *d*; whereas in writing the word *broad* he tended to join the *a* and *d* rather closely. Second, in the spelling *broard*, Darwin always extended the tail end of his *a* toward the top of the loop in his *d*. On the other hand, when he was writing *broad* without an extra *r*, Darwin would join the *a* near the base of the loop in the following *d*. Using these two criteria, I have counted one dubious May 1835 usage as *broad* (although carelessly written in a field notebook, surrounded by *broards*, and surely intended by Darwin as a *broad*). By the same criteria I have scored an ambiguous May 1836 usage in the geology diary as *broard*, even though at first glance the word appears to be spelled without the superfluous *r*. This instance is immediately preceded and followed by two *broards*, both clearly written (DAR 38.2:892 [later corrected], 899 [the ambiguous case], and 901 [uncorrected]). It is perhaps worth mentioning that the hurried and somewhat ambiguously written *broards* in the field notebooks were later spelled clearly as *broards* when the passages were incorporated into Darwin's personal and scientific diaries.

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diary entry for the Ascension visit exhibits an incorrect spelling of *broad*, but this error appears to have been corrected at the time.<sup>23</sup> In short, Darwin seems to have mastered the correct spelling of *broad* just before reaching Ascension Island in July 1836.

Whatever the cause of this spelling change, it is also reflected in one of the two longest "J. Whatman 1834" specimen catalogues written in Darwin's own hand. Of the twelve such catalogues, Darwin took over the bulk of the writing of the "Animals" and "Ornithology" catalogues shortly after Covington began them. Covington was left in charge of the other ten catalogues, which were all relatively short and which Darwin evidently did not consider worth revising during the recopying process. From the sequence of specimens recorded at the end of "Animals" and "Ornithology," both catalogues appear to have been drafted prior to Darwin's arrival at Ascension Island — almost certainly within the previous thirty-one days (Sulloway 1982: 334–337). Hitherto there has been no way of telling which of the two catalogues was drafted first. "Animals," however, contains one correct spelling of the word *broad* (and no *boards*), whereas the *Ornithological Notes* contain two incorrect spellings of this word — both of them with the extra *r* — and no *broads*. Thus the *Ornithological Notes* appear to have been drafted prior to the "Animals" notes;<sup>24</sup> and this circumstance has certain implications regarding the interpretation that should be given to Darwin's famous conjecture in his *Ornithological Notes* regarding the possible mutability of species.

23. The geology diary entry in question was initially written with the spelling *board*; but it would appear, from an examination of the ink, that Darwin immediately realized his momentary "relapse" and corrected his error by turning the *ar* in *board* into a large *a* (DAR 38.2:937). Although the color of the ink of the correction is a bit darker than that of the text, this difference appears to be solely the result of the double impression made when correcting the spelling, since the *tint* of the ink used in the correction appears to be the same as that of the text.

24. One cannot, of course, be absolutely certain of this conclusion; but until Darwin drafted the "Animals" catalogue and the *Ornithological Notes*, his record for 1836 was 10 *boards* and no *broads*. Moreover, prior to July 1836, Darwin had used *board* 64 times and *broad* only once (in a field notebook, surrounded by *boards*, and evidently a hastily written "misspelling" of a misspelling). The presumption must be that the *Ornithological Notes* were written earlier than the "Animals" notes, which apparently reflect the mid-July 1836 change in the spelling of *broad* just prior to Darwin's arrival at Ascension Island.

*Darwin's "Vague Doubts" about the Permanence of Species: How Vague Were They?*

If Darwin's "Animals" notes were drafted before the *Ornithological Notes*, in which Darwin first explicitly raised the question of the possible transmutation of species, then one would not necessarily expect the "Animals" notes to comment on this issue. On the other hand, if the "Animals" notes were drafted after the *Ornithological Notes* (as now appears to be the case), one might well expect the "Animals" notes to give some further indication as to how extensively Darwin thought the curious facts he had observed about the birds and tortoises of the Galapagos Archipelago were applicable to his collections of animals from all over the world. The famous passage in Darwin's *Ornithological Notes*, which occurs as part of his discussion of the three different island forms among his specimens of the Galapagos mockingbird, states:

When I recollect, the fact that from the form of the body, shape of scales & general size, the Spaniards can at once pronounce, from which Island any Tortoise may have been brought. When I see these Islands in sight of each other, & possessed of but a scanty stock of animals, tenanted by these birds, but slightly differing in structure & filling the same place in Nature, I must suspect they are only varieties. The only fact of a similar kind of which I am aware, is the constant asserted difference between the wolf-like Fox of East & West Falkland Islds. – If there is the slightest foundation for these remarks the zoology of Archipelagoes – will be well worth examining; for such facts [would *inserted*] undermine the stability of Species. (1963 [1836]:262)

I interpret this passage as a tentative consideration, culminating in an apparent rejection, of the possibility of transmutation. The principal basis for this interpretation is Darwin's emphatic statement that "I must suspect they [the Galapagos mockingbirds] are only varieties."<sup>25</sup> First of all, Darwin knew perfectly well that only if local varieties were capable of breaking the "species barrier" could the doctrine of the

25. Precisely why Darwin was inclined to suspect his mockingbird specimens were "only varieties" has been elaborated in greater detail within the context of Darwin's Galapagos observations as a whole (Sulloway 1982). I shall not repeat these arguments here.

## Further Remarks on Darwin's Spelling Habits

immutability of species be considered as truly "undermined." The existence of local geographic *races* was absolutely no obstacle to the theory of creation. To understand Darwin's hesitancy in thinking that any of the island forms of the Galapagos mockingbirds (or tortoises) were indeed distinct species, one must further appreciate that both Galapagos taxa are today ranked as "only varieties" by many competent systematists (Davis and Miller 1960:447–448; Thornton 1971:115). Thus neither the mockingbirds nor the tortoises could be considered as obvious examples of distinct species; and Darwin, who saw only two of the most similar Galapagos races of tortoise, did not even bother to collect specimens from the different islands he visited.

Furthermore, Darwin, who had confused as a single species all three species of mockingbirds that he had previously collected on the South American continent, was definitely a "lumper" in his own tendencies as a systematist (Sulloway 1982:375–377). Even after John Gould (1837) later insisted that three of Darwin's four island forms of Galapagos mockingbirds were distinct species, Darwin himself remained somewhat skeptical – both about the mockingbirds and about the hearsay evidence regarding the tortoises (1845:397). His most frank confession of doubt was expressed in a letter to Joseph Hooker in July of 1845, just after Darwin had learned how many distinct plant species of the same genera were confined to separate islands within the Galapagos group. To Hooker he enthusiastically replied: "I cannot tell you how delighted and astonished I am at the results of your examination; how wonderfully they support my assertion on the differences in the animals of the different islands, about which I have always been fearful" (1887, 2:22). Thus the meaning of Darwin's *Ornithological Notes* remark "I must suspect they [the mockingbirds] are only varieties" is best interpreted within the context of his continued doubts on this issue, long after his return to England.

In short, Darwin was apparently unwilling, at least in mid-1836, to abandon the doctrine of the immutability of species based on limited as well as dubious evidence, evidence that he personally (in spite of Gould's later pronouncements) persisted in considering somewhat suspect. It eventually took other evidence (the Galapagos plants), a decade later, to put Darwin's doubts to rest about the *specific* status of various closely related forms on the different islands of the Galapagos Archipelago.

Darwin's "Animals" notes, especially if written after his *Ornithological Notes*, confirm this general interpretation of Darwin's mid-1836 thoughts regarding the degree to which species might or

might not be mutable. To begin with, the “Animals” notes impress one as much by what they do not say (especially if Darwin was leaning at this time toward a belief in the mutability of species) as by what they do say.<sup>26</sup> In his discussion of the two island forms of the Falklands foxes, for example, Darwin was surprisingly restrained – making no cross-reference to the analogous Galapagos case and stating simply that “an accurate comparison of these specimens will be interesting” (DAR 29.1: MS p. 23). Later, in his *Journal of Researches*, Darwin was forced to admit that of the four specimens of fox brought back to England on the *Beagle* “there was some variation, but the difference with respect to the islands could not be perceived” (1839: 250–251). Obviously, the differences in the foxes from the two islands, just like those among the Galapagos mockingbirds and tortoises, were not all that great. In fact, Darwin had been misinformed regarding the supposedly “constant” differences between the foxes from the East and West Falkland islands. In 1844 Darwin’s old *Beagle* shipmate Lieutenant James Sullivan, then Captain of H.M.S. *Philomel*, wrote to him from Patagonia: “It is quite incorrect what we were told respecting the difference in the Foxes of the two [Falkland] Islands. They are the same both in size and color[.] we have never been able to detect any difference” (DAR 46.1:88). Darwin deleted all reference to this topic in the second edition of his *Journal* (1845:194); and he remained equally silent on the subject in the *Origin of Species* (1859).

One is reminded of Darwin’s remark in the first edition of his *Journal*, just a page before his discussion of the Falklands foxes, regarding the supposed existence of an endemic, black-colored Falklands rabbit. After discussing (just as he had done in his “Animals” notes) how the black variety was known to interbreed with an introduced gray form (resulting in piebald offspring), he added: “This circumstance shows how cautious naturalists should be in making species; for even

26. Such negative evidence – namely, what Darwin did *not* say in his voyage manuscripts – has generally been ignored by scholars like Hodge (1983) who continue to believe that Darwin became an evolutionist during the last year of the *Beagle* voyage. Yet such evidence counts in some ways more heavily than seemingly “positive” historical evidence, since many statements made by Darwin in 1836 are consistent with both a creationist and a transmutationist point of view. One need only turn to Darwin’s *Journal of Researches* (1839:400n) to see how evidence that he once considered as favoring creationism (1933:236, entry of August 5, 1834) could later be turned on its head and shown to be consistent with *both* theories.

Cuvier, on looking at the skull of one of these rabbits, thought it was probably distinct" (1839:249).

Returning once again to the contents of Darwin's "Animals" notes, I find it curious also (that is, if Darwin really *was* leaning toward the theory of transmutation at this time) that he did not discuss the question of how the endemic Falklands fox, and also a rat, had gotten to these islands in the first place. In his earlier zoology diary entry, Darwin had considered the presence of an endemic fox, a rat, freshwater fish, and earthworms as evidence that these islands were "what appears to be a centre of creation" (DAR 31.1: MS p. 237). In his "Animals" notes the phrase "centre of creation" is not repeated; but Darwin did state that "this tract of land, although so small, boasts of at least one species of Quadruped as peculiar to itself. (also Rat?)" (DAR 29.1: MS p. 22). The absence of the phrase "centre of creation" in this context is hardly significant. About the time Darwin drafted his "Animals" notes he described St. Helena in his geology diary as "so very remarkable as being a centre of distinct creation" (DAR 38.2:920). Darwin used this same creationist expression about St. Helena in a July 9, 1836, letter to Henslow (1967:115).

What is important, then, is not so much Darwin's use (or nonuse) of the phrase "centre of creation" in his "Animals" notes, but rather his failure to ask the two main questions that a convinced evolutionist would have asked: (1) How did the Falklands fox(es), endemic rat, and other possible endemic forms reach these islands? and (2) What were the closest mainland relatives of these forms (that is, what were their potential ancestors and closest codescendants)? These are precisely the kinds of questions that Darwin did ask himself, after March of 1837, when he finally became converted to the theory of transmutation (Sulloway 1982:362, 371–373).

There is one last passage in the "Animals" notes that is particularly interesting — not only for its contents but also for the unusually late date at which it must have been written. Added at the very end of the "Animals" notes, the passage in question contains the spelling *Pacific*, which Darwin did not begin using again until about mid-September 1836 at the earliest (see Table 1). Thus this addendum, which deals with the problem of geographic distribution among Darwin's voyage collections of rats and mice, was probably drafted within the last two weeks of the *Beagle* voyage and represents his last voyage comment on the species problem. Having remarked that "Mice & Rats appear to be the first animals which arrive at any place," Darwin listed as examples St. Helena; New Zealand (where "the Norway Rat, has destroyed

throughout the Northern part of the Island, the proper inhabitant”); the Abrolhos Islands, off the coast of Brazil; the Galapagos and other islands in the Pacific; the Chonos Archipelago; Tierra del Fuego; Keeling Island; the Falklands; and the Cape Verde Islands. At the end of this list, Darwin asked the question (which concludes the addendum): “Are the various specimens of Mice which I have collected varieties or species? Their geographical distribution often causes me to doubt” (DAR 29.1: MS p. 31).

To doubt what? Darwin’s problem was quite simple. He had collected numerous specimens of rats and mice from oceanic islands — specimens that were either identical to, or only slightly different from, the domesticated rats and mice that are so often transported to islands by ships. If many of the specimens he had collected were new species, then he had to assume either that transmutation had taken place since their arrival or that the islands in question were centers of creation. On the other hand, if most of these rats and mice were merely “varieties,” slightly altered by transport to a new and different environment, neither “centres of creation” nor the possibility of transmutation had to be considered at all. Thus when Darwin wrote in his “Animals” notes of his rats and mice that “their geographical distribution often causes me to doubt,” he was effectively saying that most of these specimens, like his Galapagos mockingbirds, would probably turn out to be “only varieties.” In any event, he clearly knew he was in no position to resolve this taxonomic issue while still aboard the *Beagle*.

More than forty years later, in reply to a letter from Otto Zacharias (the only person known to have actually asked Darwin *when* he became an evolutionist), Darwin remarked: “When I was on board the *Beagle* I believed in the permanence of species, but as far as I can remember vague doubts occasionally flitted across my mind” (F. Darwin 1909: xv). From Darwin’s *Ornithological Notes* and from his subsequently drafted “Animals” notes, it can be seen that Darwin’s “vague doubts” about the permanence of species were actually of two distinct kinds. The first kind of occasional vague doubts were those, exemplified by the Galapagos mockingbirds, that hinged on whether species might under certain circumstances be able to break through the “species barrier.” Were such cases ever to be discovered, they would indeed “undermine the stability of Species” — although this is still not quite the same as establishing a full-fledged theory of transmutation.<sup>27</sup>

27. A number of previous naturalists, beginning with Linnaeus, had considered species to be mutable but had maintained that genera, from which all present

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Even more important in helping to decide this crucial question about the “stability of Species” were the far more frequent and justified doubts that Darwin entertained about his own ability, while still on the *Beagle*, to discriminate between varieties and species. This all-important distinction – and the numerous doubts that it introduced into Darwin's mind as he tried to assess the occasional evolutionary “hints” that came his way during the voyage – was ultimately the more important of the two sorts of doubts that prevented Darwin from endorsing transmutation until his return to England. Only after he had completed the *Beagle* voyage was Darwin finally able to set aside some (but not all) of these taxonomic doubts and thus allow his occasional “vague [theoretical] doubts” about the permanence of species to grow into an enthusiastic endorsement of the theory of transmutation. This is why Darwin's eventual conversion, in the spring of 1837, was ultimately dependent not only on his numerous voyage observations and collections, but also (and perhaps just as importantly) on the authoritative decisions by numerous systematists, spread out among a dozen or so specialized fields, as to what really constituted “a species” among his collected specimens.<sup>28</sup>

Although Darwin's belief in the mutability of species was quickly to become ironclad after March of 1837, his *taxonomic* doubts about where to draw the line between varieties and species – doubts that had long impeded his conversion to a transmutationist position – retained an important position in his postconversion thinking.<sup>29</sup> Indeed, it might be said that these doubts were eventually to emerge among Darwin's strongest arguments in *favor* of the theory of evolution, freeing both himself and many of his readers from “the vain search for the undiscovered and undiscoverable essence of the term species” (1859:485).<sup>30</sup>

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species subsequently arose, were the original biological units of “creation” (and themselves incapable of transgeneric change). See Sulloway 1979:40; and Mayr 1982:259, 262.

28. This point has been emphasized by Herbert (1980:12) and also in my own account of Darwin's conversion (Sulloway 1982:378).

29. Reflecting back on this subject in the *Origin*, Darwin wrote: “Many years ago, when comparing, and seeing others compare, the birds from the separate islands of the Galapagos Archipelago, both one with another, and with those from the American mainland, I was much struck how entirely vague and arbitrary is the distinction between species and varieties” (1859:48; see also p. 52).

30. In his concluding chapter of the *Origin of Species* Darwin wrote: “When the views entertained in this volume on the origin of species . . . are generally accepted, we can dimly foresee that there will be a considerable revolution in

But then, the history of science is full of such ironies; for “vague doubts,” conjectures, and hypotheses are always changing their meaning and significance as the broader theoretical matrices in which they are imbedded undergo their own conceptual transformations.

In conclusion, Darwin’s spelling habits during the *Beagle* voyage are a fairly reliable guide to dating many voyage manuscripts, especially those written during the last eighteen months prior to his return to England. Darwin’s first voyage theoretical notebook, in which he set forth his novel theory of coral reefs; his earliest formal essay on this subject; his subsequent “J. Whatman 1834” specimen catalogues; and, finally, Covington’s two fair copies of previously drafted geological essays – all these manuscripts can now be arranged in an orderly sequence, from about March or April of 1835 to mid-September of 1836. In addition, because Darwin’s “Animals” notes seem to have been drafted after his *Ornithological Notes*, it is also possible to place Darwin’s occasional “vague doubts” about the “stability of Species” within a wider historical context of other integrally related zoological issues. Darwin’s *Beagle* voyage spelling habits thus shed further light on Darwin’s voyage intellectual development and, in particular, on the circumstances associated with his conversion to the theory of evolution.

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natural history. Systematists will be able to pursue their labours as at present; but they will not be incessantly haunted by the shadowy doubt whether this or that form be in essence a species. This I feel sure, and I speak after experience, will be no slight relief” (1859:484). Elsewhere I have traced Darwin’s postconversion adoption of a biological species concept and have shown how he was motivated, in part for strategic reasons, to give up the last remnant of his voyage belief in the reality of species for the view that the term “species” is simply an arbitrary one denoting well-marked varieties (see Sulloway 1979; Beatty 1982; and Darwin 1859:52, 55, 469, 475).

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