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ORIGINAL RESEARCH

"Pray Observe How Time Slips By:" Collaborators, Assistants, and the Background Dynamics in the Publication of Darwin's *Cirripedia Project*

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Abstract
This study investigates nineteenth century natural history practices through the lens of the Actor-Network Theory, which posits that scientific practice is shaped by an intricate network of interactions between human and non-human actors. At the core of this research is the analysis of correspondence between Charles Darwin and his collaborators during the *Cirripedia Project,* which unveils a complex landscape of negotiations with illustrators, funders, specimen owners, and translators, among other stakeholders and interested parties. The study goes beyond the final outcomes of scientific research, delving into behind-the-scenes interactions, and hidden constructions, shedding light on the complex dynamics and actors that conventional scientific narratives often overlook. In general, this approach provides a detailed and insightful view of the underlying processes of nineteenth-century scientific practice, underscoring the importance of epistolary correspondence as a central element in producing scientific knowledge at the time, and in particular it reveals to us how much Darwin was himself involved in the production of his famous work on barnacles. By emphasizing the intricacies of research, this study enriches our understanding of Darwin's work as well as natural history practices in the 19th century, highlighting the complexity and diversity of actors and agents involved in shaping scientific knowledge.

Keywords Darwin · The *Cirripedia* · Epistolary Correspondence · Actor-Network Theory

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When the HMS *Beagle* set sail on its second expedition to the southern hemisphere in 1831, it was for a number of reasons. It was a British Royal Navy ship whose main objective was to map the coastline to guarantee better access for British merchant ships, as well as to identify any economic potential and deepen commercial and diplomatic relations with the residents of the areas surveyed (Passetti 2014). Among the crew of seventy-three, there were also four Indigenous people from Tierra del Fuego; they had been captured during the first expedition, taken to England by the captain of the *Beagle*, Christianized and returned as potential missionaries, hoping to convert their own people (Barlow 1933). Similar expeditions were financed by Great Britain with the goal of blending science, politics, and economics. Expeditions spread along all known coasts and reached many hitherto unknown ones. Equipped with the most modern instruments available, these expeditions recruited prominent scientists, trained promising young people and gathered an unparalleled natural history database for the time (Passetti 2014).

Expeditions like that of the *Beagle* carried diverse objectives, yet their significance for the field of natural history is particularly noteworthy. The historiography of this period highlights travels as one of the three key elements in the practice of natural history, along with items from nature (specimens and information collected in the field) and letters (here meaning long-distance communication systems).[1] Items from nature, such as gigantic heaps of bones and fossils, often revealed fortuitously by agropastoral activities, were once relegated to mundane uses or discarded altogether (Podgorny 2013). The new scientific interest in these items gave them different meanings; things that had once been discarded or disposed of, became instead things of political, scientific and commercial value. Two types of travels contributed to this resignification of nature's items. These were the trips of naturalists and their agents or assistants to the backlands in search of such items; and then there are the journeys of the items themselves, generally towards distinguished, wealthy naturalists who were producing knowledge in large cities of Europe and in places such as North America. Recent historiography, however, argues that local as well as working class populations, also began to take a place in the practice of natural history with the concomitant formation of scientific centers in the southern hemisphere.[2] In this context, letters assumed a central role, as they enabled the mobilization of items, the organization of expeditions, the sending of instructions to less experienced travelers, the discussion of ideas, and as well as the taking of action from a long distance. Letters thus enabled collaboration between physically and culturally distant actors and were made possible, albeit partially, because natural history was an area of great interest in the nineteenth century, without the kinds of institutional mechanisms that regulated the participation of interested parties.

[1] See for example, the works of Mackay (1985); Montgomery (1987); Secord (1994a, 1994b); Desmond and Moore (1995); Horta (2003); Browne (2011); Tomio (2012); Duarte (2013); Podgorny (2013); Passetti (2014); Rodrigues (2016), among others, which demonstrate the role played by the three elements mentioned in the circulation of knowledge about nature in the nineteenth century.

[2] See for example, the works of Antunes (2015), Antunes (2019); Duarte (2013); Podgorny (2013); Secord (1994a, b), and Tomio (2012).

Bearing in mind the relevance of these three elements, we believe that Actor-Network Theory (ANT) can provide a reading key for the nineteenth-century natural history. Bruno Latour and John Law, two of the main formulators of this theory, consider that science, and more broadly all of society, is made up of networks of heterogeneous materials, or human and non-human actors that are organized to generate the desired effects. Law (1984), for example, argues, based on the analysis of Portuguese maritime expansion in the fifteenth and sixteenth centuries, that the remote control of the route between Lisbon and Calcutta was possible thanks to three classes of emissaries—documents, devices and trained people. The emissaries interacted and circulated from the center to the periphery in a way that maintained or forced other actors to behave in accordance with Portuguese interests. Therefore, ANT focuses on the interactions between different actors, not just elite scientists, but also common people as sailors, astronomers and navigators, as well as non-human actors such as vessels, winds, maps, compasses and charts. The list of actors will continue to grow as we look closer, but regardless of whether they are human or non-human, they are in a dynamic relationship that demands an adaptation to other actors and produce conformities or the desired results. Epistolary communication, which will be explored in this article, is a non-human actor that imposes limitations and possibilities different from those imposed by other means of communication. The costs, transport time, the construction of the text, the service availability, and the risk and the possibility of loss are profoundly different if we compare the communication by letters with the communication via newspapers, for example. Such attributes lead the other actors to adapt to these characteristics.[3]

The complex networks that intersect in the production of scientific knowledge are often rendered invisible once the final product appears, as for example, materialized in the form of a chart or book. In a nutshell, Actor-Network Theory proposes precisely an approach to scientific practice which is not based on its products, but rather on its production, when it still can be observed in the intricate relationship between human and non-human beings. The letters exchanged between naturalists can provide entry points for us to reveal science under construction. For example, letters between Charles Darwin and his collaborators that can reveal the process of seeking new evidence and specimens alongside the discussion of ideas and theories that take place in secrecy. Thus, such letters have served as an archive of unpublished ideas and have been used widely as a historical source.[4]

[3] Rudwick (1985) and Secord (1994b), along with other scholars, emphasize the crucial role of letter writing in 19th-century natural history debates. They also highlight how the high cost of postage compelled even the wealthy to find cheaper ways to send letters and parcels. For instance, Rudwick (1985, p.36) mentions strategies such as leveraging friendships with members of parliament for free postage privileges or condensing letters to reduce weight and cost. Given the vital role of correspondence in shaping scientific knowledge, it is notable that naturalist John E. Gray advocated for postal reform in 1834, culminating in the establishment of the penny post in 1840.

[4] See for example, Darwin to James Smith, January 28, 1848. *Darwin Correspondence Project*, "Letter no. 1148," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1148. Also published in The Correspondence of Charles Darwin, vol. 4. In this letter, Darwin, shortly after introducing himself, asked James Smith if he could trust him with his specimens to describe. Darwin mentions that the renowned Mr. Lyell and Mr. Stutchbury had already done the same with their collections. In this way,

Only recently have scholars begun to focus on the subsidiary actors' correspondents and their interests, considering that an epistolary exchange only continues if the interests of both parties are satisfied (Secord 1994b). This approach highlights the actions of the invisible, unsung "scientific commoners" (technicians, assistants, servants) and for everyday scientific practice (Johnson 2016). Steven Shapin identified as *invisible* those persons who worked in support of activities for the chief scientist, those people who, for example performed the labor of experiments or used or maintained scientific instruments who were considered only incidental and minor compared to the work of elites, and who emerged from invisibility only when a failure occurred (Shapin 1989). The flaws allow us to draw a parallel between the analyses of Shapin and Latour, for whom scientific artifacts function as a *black box*, or a *data recorder* that "no matter how controversial their history, how complex their inner workings, how large the commercial or academic networks that hold them in place, only their input and output count" (Latour 2000, p.144). However, when a failure occurs, that artifact reveals its complexity and brings to light a series of hitherto unnoticed actors. Both authors consider that these artifacts, when functioning accordingly, outshine different actors and dynamics; nevertheless, when failures occur, the complexity becomes evident and enables the perception of the networks. An approach to the epistolary correspondence between naturalists that is attentive to the questions raised by these authors allows us to access the behind-the-scenes science in search not only of invisible characters, but also of the dynamics left in the background.

The present article, thus, does not focus on the products of knowledge, or the elite scientists involved, but rather on the process of production in which lesser-known collaborators play critical roles in the science practiced behind the appearance of the final products. In this study, the examination focuses on Charles Darwin's epistolary communication related to the *Cirripedia Project* (1846–1854) precisely to render visible previously hidden actors, both human and non-human involved in the final product.[5] These letters clearly show the assistance of several collaborators throughout the project, some of whom are renowned men of science, such as Thomas H. Huxley, Charles Lyell, Joseph D. Hooker, Louis Agassiz and James Dwight Dana. The focus, however, is on four other, less celebrated correspondents: James S. Bowerbank (1797–1877), Edwin Lankester (1814–1874), James de C. Sowerby (1787–1871) and George B. Sowerby Junior (1812–1884).[6] How did Darwin

Footnote 4 (Continued)

Darwin sought to prove himself a faithful guardian of Smith's specimens. See also Darwin to Agassiz, October 22, 1848. *Darwin Correspondence Project*, "Letter no. 1205," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1205. Also published in The Correspondence of Charles Darwin, vol. 4. This letter is Darwin's response to Agassiz, who wanted to know Darwin's results on the cirripedes. Darwin asked his correspondent for secrecy because: "I should like to have the satisfaction of publishing myself what few new points I have found out, and partly because one is more free to alter one's own views, when they are confined to one's own breast."

[5] Herein we use the term "*Cirripedia Project*" for what is variously described by previous workers for all the work done on barnacles by Darwin between 1846–1854. See for example, by Richmond (1988); Veak (2003); van Wyhe (2007); Buchanan (2017).

[6] A search carried out in March 2022 in the Web of Science, for terms referring to these correspondents associated with Darwin, resulted in only 9 articles. Another search, along the same lines, resulted in 72 articles related to Thomas H. Huxley.

manage to mobilize his collaborators to act as he desired? What does Darwin's relationship with them show about the materialization of the *Cirripedia Project*? What precisely were the interests of these men when corresponding with Darwin, and how do they appear in the letters? These are some of the questions we hope to answer by analyzing the documents in question.

The *Cirripedia Project*

Upon returning from his celebrated voyage aboard the HMS *Beagle* (1831–1836), Darwin settled into London and was able to take advantage of his proximity to the British scientific elite and its institutions to coordinate the examination of the natural items collected by him during the trip (Desmond and Moore 1995, p. 218).[7] In the following years, Darwin developed different projects, such as the edition of the *Zoology of the Voyage of the HMS Beagle, Under the Command of Captain Fitzroy* (1837–1843), the elaboration of a rough draft on the transmutation of species (1837–1844), *The Geology of the Voyage of the HMS Beagle* (1837–1846), and the publication of his travel diary. In October 1846, already living with his wife Emma (1808–1896) and their children at Down House since 1842, the work on the material collected on the *Beagle* being nearly completed, Darwin wrote to FitzRoy, the former captain of the ship, to tell him that he had concluded everything he had proposed to do with the *Beagle* collection, from which only a few marine invertebrates remained.[8] Darwin intended to describe them in a paper to be published within a year, after which he would then dedicate himself to his theory of species and varieties, which would culminate in the publication of *Origin of Species* in 1859.[9]

One of these marine invertebrates was a cirripede collected off the coast of Chile in 1835, nicknamed "Mr. Arthrobalanus." It was the study of this one specimen that led to the subsequent work that took some eight years of his life. Here, it should be noted that the *Cirripedia* are a taxonomic unit of crustaceans, which includes small marine animals commonly known as barnacles, of which there are around a thousand described species. They have two life stages: first, as larvae, they float through

[7] Since Darwin did not have all the necessary experience to identify his collection, he relied on several collaborators, once again using epistolary communication for contact, especially those who were outside London. Specialists in different branches of natural history who helped Darwin to identify specimens, include John Stevens Henslow, Robert Brown, Thomas Bell, Leonard Jenyns, Richard Owen, John Gould, and George Brettingham Sowerby. George B. Sowerby was the brother of James de C. Sowerby, who would illustrate the first volume of *Fossil Cirripedia*.

[8] Darwin to Robert FitzRoy. October 2, 1846. *Darwin Correspondence Project*, "Letter no. 1002." Also published in The Correspondence of Charles Darwin, vol. 3.

[9] The extension of the *Cirripedia Project* from one to eight years is pointed out by van Wyhe (2007) as one of the reasons that led Darwin to postpone the publication of his book on species variation. According to van Wyhe, Darwin had committed to an agenda of work related to the *Beagle*, completed with the *Cirripedia* project, after which he immediately began writing *Origin of Species*. There would therefore have been no intentional delay by Darwin in publishing his ideas about evolution. To Joseph Dalton Hooker, October 2, 1846. *Darwin Correspondence Project*, "Letter no 1003," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1003. Also published in The Correspondence of Charles Darwin, vol. 3.

the water and make up plankton; at the end of this stage which becomes their second stage, they attach themselves to a surface (such as rocks, turtle shells, ship hulls, docks, buoys, or any other submerged surface) and form a limestone shell around their bodies, when they become easily noticeable (Checa et al. 2019).[10] Despite the *Cirripedia* having a certain economic and ecological relevance, especially for a maritime power like Great Britain, Darwin became interested in them due to questions that were more internal to science. Until 1830, the cirripedes were considered mollusks by most naturalists, until John Vaughan Thompson began to advocate the inclusion of the *Cirripedia* as a taxonomic unit of crustaceans. Thompson's proposal, justified by the similarities between the larval forms of crustaceans and the *Cirripedia*, was accepted, but until 1846, a review of the taxonomy of the *Cirripedia* as crustaceans had not been carried out (Richmond 1988).

When Darwin decided to examine "Mr. Arthrobalanus," he found that there was a disruption in the taxonomy of the cirripedes, that there was no standardization in the nomenclature of taxonomic units, and that shells and many species were described superficially (Deutsch 2010). It was this scenario that prompted him to expand his study to include the entire taxon, which was positioned as a subclass of crustaceans.[11] This undertaking lasted eight years and led him to mobilize collaborators around the world who helped him in various activities, such as loaning specimens, discussing scientific issues, supplying microscopes and providing drawings and illustrations. All this work materialized with the publication of four books (Darwin 1851a, 1851b, 1854a, 1854b) and produced an intense epistolary exchange, of which there are 284 extant letters recovered by the *Darwin Correspondence Project*, discussed in the next section.

Correspondence about the *Cirripedia*

This article is based on all 284 letters recovered by the *Darwin Correspondence Project* dated between 1846 and 1854, and which contained the terms *cirri** and/or *barna** in the body of the text or in footnotes produced by the project team.[12] These letters, distributed as shown in Table 1, make up the correspondence of the *Cirripedia Project.* Table 1, below, shows an increase in the number of letters exchanged since the beginning of the project in 1846. Darwin's decision to expand his analysis from one specimen to the entire subclass *Cirripedia* took place at the end of 1847. It required him to do an intense search for information and specimens and intensified

[10] Some species such as *Capitulum mitelia* and *Pollicipes pollicipes* are edible, although others are parasitic. From an economic point of view, the attachment of barnacles to the hull, and to mechanical parts of vessels leads to an increase in aerodynamic drag, and, therefore, an increase in fuel consumption. It also leads to a reduction in the useful life of the hulls.

[11] Currently crustaceans are ranked as a subphylum, and cirripedes as an infraclass (Checa et al. 2019).

[12] The use of the search terms *cirri** and/or *barna** allows the retrieval of all words starting with these terms, which includes: cirripede, *Cirripedia*, barnacle and *barnacles*. Dated between January 1, 1846 and December 31, 1854, the *Darwin Correspondence Project* recovered 738 letters, of which 285 met the research criteria, with letter number 1001 being discarded because it did not directly address the terms searched.

Table 1 Correspondence of the *Cirripedia* Project, by Year

Year	Number of Letters
1846	8
1847	11
1848	32
1849	33
1850	72
1851	48
1852	19
1853	32
1854	29
Total	284

Based on data from *Darwin Correspondence Project*, 2022

his epistolary exchange that reached its peak in 1850. The preparations for the publication of the first volumes in 1851 are also responsible for part of this collection of letters, as it required intense negotiations with sponsoring societies as well as with the illustrators. Between 1851 and 1854 there was a reduction in the epistolary exchange. Montgomery attributes this to the fact that, in 1851, Darwin had already gathered and examined a large collection of *Cirripedia* and had consolidated his analyses on the subject; thus, from 1851 onwards, he could concentrate on writing the second volumes (Montgomery 1987, p. 16).

Another factor that contributed to this reduction in the volume of letters was the almost complete repetition of the 1851 preparations for the 1854 publications, as can be seen in the Table 2, with the same societies as sponsors. One of the few differences is the role played by George B. Sowerby Junior, as an illustrator of both recent and fossil *Cirripedia*.

The Palaeontographical Society, sponsor of the volumes relating to fossil *Cirripedia*, had its relationship with Darwin mediated by James S. Bowerbank. *The Ray Society* was in charge of the recent cirripedes and was represented by its secretary Edwin Lankester, and by Bowerbank, its treasurer.[13] In the *Cirripedia* project letters, Darwin was the active correspondent for about 90% of the letters.[14] He sent 261 missives to 62 identified recipients, an average of 4.20 letters per correspondent. [15] This suggests the occurrence of a more intense epistolary exchange than could be imagined based on the low volume of surviving letters received (only 20 letters from

[13] *The Ray Society* was founded in 1844, and *The Palaeontographical Society* in 1847. Bowerbank participated in the founding of both. These are still active institutions that aim to produce and publish a series of lavishly illustrated books on natural history based on a self-financing model: their members pay subscriptions and receive compilations of works produced throughout the year. *The Ray Society* dedicates itself to works with scientific relevance, but without economic viability; *The Palaeontographical Society* promotes studies on British fossils (Platts 1944; Anonymous 1877, 2020a, 2020b).

[14] Throughout his life, Darwin was the active correspondent in approximately 52% of the letters, that is, there was a certain balance between the total number of letters received and sent.

[15] The letters numbered 1204, 1464 and 13872 did not have their recipients identified by Darwin, nor by the *Darwin Correspondence Project* team.

Table 2 Preparations for the Publication

Publication Title	*Fossil Cirripedia V. 1*	*Fossil Cirripedia V. II*	*Living Cirripedia V. I*	*Living Cirripedia V. II*
Conclusion Year	1851	1854	1851	1854
Sponsor	*Palaeontographical Society*		*Ray Society*	
Representative	James S. Bowerbank		James S. Bowerbank & Edwin Lankester	
Illustrator	James de C. Sowerby	George B. Sowerby Junior	George B. Sowerby Junior	

Based on data from the *Darwin Correspondence Project*, 2022

10 correspondents). It is likely that this large difference between the number of letters received and sent is a distortion, based on the survival of these letters and their recovery by the *Darwin Correspondence Project* team.[16]

However, as shown in Fig 1, the period from 1837 to 1859—between the return of the *Beagle* and the publication of *Origin of Species*—is the only interval of time in which Darwin is the principal sender, thanks to the correspondence exchanged during the *Cirripedia* years. During this period, there was a notable disparity between the number of letters sent and received, coinciding with expansion of his network of collaborators, the number of Darwin's correspondents jumping from 70 to more than 400.[17] This expansion primarily aimed at advancing his works derived from the *Beagle* voyage, the *Cirripedia Projec*t and *Origin of Species*. The return to balance occurred post-1859 and is linked to Darwin's international fame, when a significant increase in epistolary exchanges occurred, as indicated by the substantial increase in the number of recovered letters (Montgomery 1987). Dating up to 1859, there are 2721 letters, after that, there are 11484 letters.[18]

Table 3 presents the main correspondents of the *Cirripedia* project. This table shows 10 correspondents who in total exchanged 150 letters with Darwin, around 50% of the total selected letters. Montgomery (1987, p. 20) created a similar table with the 40 main correspondents for the entire collection of letters. Indeed, the comparison between the two tables reveals that Joseph D. Hooker (1817–1911), appears as the only name in common, holding the first place in both tables; the other correspondents achieved a higher position in this table, as it only includes letters from the *Cirripedia Project*. Gingras (2010) listed the 10 most cited people in Darwin's letters between 1837–1847 and between 1849–1858: again, the only name in common with our table was Hooker's. Despite the substantial differences in the construction of the tables, especially with that of Gingras, the variation between the main correspondents suggests that Darwin strategically managed his network of collaborators to align with the specific objectives and interests of each project. In the case of the *Cirripedia Project*, the selection of correspondents indicates Darwin's deliberate efforts to engage individuals with expertise or insights relevant to this particular area of study. This is also corroborated by the information contained in the fourth column under the section titled "period," which contains the span of time for the epistolary

[16] The survival of letters written by Darwin can be attributed to several factors. Darwin's habit of making copies of some of the letters he sent likely contributed to their preservation. Additionally, as Darwin's fame grew, the letters he wrote became increasingly valuable to their recipients. In contrast, Darwin routinely burned most of the letters he received until 1862. This practice helps to explain the disparity between the number of surviving letters sent by Darwin and those received. To K. M. Lyell, December 26, 1875. *Darwin Correspondence Project*, "Letter no. 13826," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-13826, Also published in The Correspondence of Charles Darwin, vol. 23.

[17] According to data from the *Darwin Correspondence Project*, until 1837, Darwin had relationships with around 70 correspondents. Between 1837 and 1860, his epistolary exchange involved 412 correspondents; after 1860, this number remained stable with 413 correspondents.

[18] In Fig. 1, the sum of letters received and sent between 1860 and 1882 is 11,485, but the total number of letters is 11,484; this is due to the fact that one of the letters—number 4832—was written by Charles and Emma for themselves, as a kind of archive.

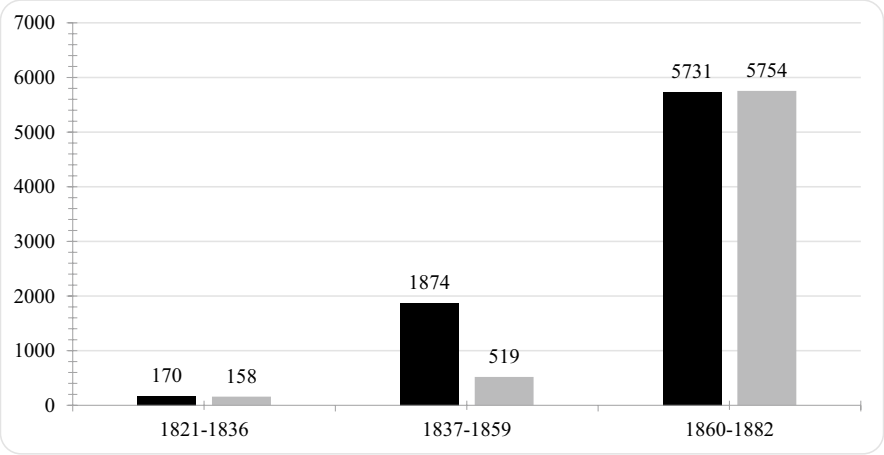


Fig 1 Letters received and sent by Darwin. Based on data from the *Darwin Correspondence Project,* 2022

exchanges. It reveals that several correspondents initiated their exchange with Darwin during the project, indicating the dynamic nature of Darwin's network.[19]

The fifth column highlights that three of the correspondents lived abroad, indicating Darwin's international engagement with correspondents. The epistolary exchange with foreigners, which began aboard the *Beagle* in 1839, would intensify with the publication of 1859, but already during the *Cirripedia Project* there was

Table 3 Main Correspondents of the *Cirripedia Project*

Correspondent	Received	Sent	Period	Country of Residence	Main Area of Activity
Joseph D. Hooker	21	8	1843–1882	England	Botany
Albany Hancock	19	1	1849–1869	England	Zoology and Paleontology
James de C. Sowerby	19	0	1850–1851	England	Scientific Illustration
Robert Fitch	15	0	1849–1851	England	Pharmacy
Ray Society (E. Lankester)	12	2	1850–1865	England	Natural History
J. J. S. Steenstrup	12	1	1849–1881	Denmark	Zoology
James Dwight Dana	12	0	1849–1874	USA	Geology and Zoology
James S. Bowerbank	10	0	1848–1867	England	Beverage Industry
J. A. de Bosquet	9	0	1852–1857	The Netherlands	Pharmacy
John Edward Gray	8	1	1840–1873	England	Botany and Zoology

Source: Based on data from the *Darwin Correspondence Project*, 2022

[19] Of the eight correspondents whose first letters date from the *Cirripedia Project* period, those sent to Bowerbank and Sowerby, in 1848 and 1850 respectively, testify to the existence of an earlier epistolary exchange.

the inclusion of 18 correspondents from nine countries besides England.[20] The last column of the table presents the main area of activity of the correspondents, some of whom were not fully dedicated to natural history, such as the illustrator James de C. Sowerby and the businessman James S. Bowerbank.[21]

Table 4 presents the list of all correspondents who were not fully dedicated to natural history, which includes 30 people in total.

There is also another group of correspondents (Table 5), which we call logistical collaborators. They are those to whom Darwin turned not for their knowledge of natural history, but rather to assist him in various activities, such as illustrating his books, translating texts and providing equipment. Some of these could in another context appear as naturalists, such as the James de C. Sowerby, collectors and experts in shells, but who worked on the project as illustrators. The classification adopted, therefore, relates specifically to their main role within the *Cirripedia Project*.

The individuals presented in Table 4 and Table 5 totals 37 people. Among them 36 are Darwin's correspondents, who exchanged 115 letters in total. This highlights the crucial role played by these collaborators in the study of the cirripedes. In fact, scholars such as Montgomery (1987), Jardine (2009), Anderson and Lowe (2010), further confirm this. In our research, correspondence from the *Cirripedia Project* was systematically analyzed using coding techniques referenced in the works of Bardin (2000) and Saldaña (2013). The analysis was carried out in the *Atlas.ti* software environment, where documents were coded to extract valuable information about Darwin's relationship with his correspondents and other relevant aspects of the project. The coding process involved organizing and grouping the codes into three main categories, each one related to the different uses of letters throughout the project. In this article, we chose to address one of these categories, which concerns the role of the letters in the background preparations for the publication of the books of the *Cirripedia Project.*

Preparations for Publication

Between January 1850 and September 1851, Darwin concurrently pursued his research on cirripedes while also making plans and arranging for the publication of the first volumes of the monographs associated with this work. His focus was centered on the production of illustrations. They played a crucial role in Darwin's classification work, for the anatomical and morphological details of the specimens defined their taxonomic location. The quality of the illustrations was also important because the publications were to function as a catalog, capable of replacing physical collections. They thus were given uniqueness and mobility, since the books would bring together the collections, and enable their circulation in a faster and more economical

[20] This included Australia, a British colony until 1901.

[21] Information obtained from the *Darwin Correspondence Project*'s list of correspondents, available at: https://www.darwinproject.ac.uk/letters/list-correspondents. Accessed on 16 December 2021.

Table 4 Correspondents Non-Naturalists or Part-Time Naturalists

Correspondent	Country of Residence	Profession/Main Activity
Augustus Addison Gould	England	Physician
Charles Spence Bate	England	Dentist
Daniel Sharpe	England	Merchant
Edward Cresy Junior	England	Surveyor and Civil Engineer
Edward Sabine	England	Army Officer and Physician
Edwin Lankester	England	Physician
Ernst Dieffenbach	Germany	Physician
Francis Boott	England	Physician
George Crawford Hyndman	Ireland	Auctioneer
George Newport	England	Physician
James Clarck Ross	England	Navy Officer
James Hilton	England	Stockbroker
James Scott Bowerbank	England	Industrial
James Smith of Jordan Hill	Scotland	Architect
James Stewart Dismorr	Australia	Fabric Merchant
John Frederick William Herschel	England	Astronomer, Mathematician, Chemist
John Gwyn Jeffreys	England	Attorney
John Lubbock	England	Banker and Politician
John Richardson	England	Physician
John Stevens Henslow	England	Cleric
Joseph Augustin Hubert de Bosquet	The Netherlands	Pharmacist
Nathaniel Thomas Wetherell	England	Physician
Philip Gidley King	Australia	Farmer and Miner
Richard Thomas Lowe	England	Cleric
Robert Ball	Ireland	Civil Servant
Robert Fitch	England	Pharmacist
Robert FitzRoy	England	Navy Officer
Robert Patterson	Ireland	Merchant
Syms Covington	Australia	Personal Assistant to Darwin Until 1839 Farmer
William Darwin Fox	England	Cleric

Based on data from the *Darwin Correspondence Project*, 2022

way. However, the production of illustrations required intense negotiations—regarding deadlines and costs—with the sponsoring societies, illustrators, and owners of the specimens, who pressured Darwin in demanding their return.

Regarding this subject, there are 41 surviving letters with four key collaborators, namely: James de C. Sowerby, illustrator of the first volume on fossil *Cirripedia*, his nephew, George B. Sowerby Junior, illustrator of the other volumes and translator of the descriptions, and the two societies that sponsored the publications, *The Palaeontographical Society* and *The Ray Society*. James

Table 5 —List of Logistical Collaborators

Correspondent	Country of Residence	Profession/Main Activity
Emma Darwin	England	Darwin's Personal Assistant/Translator
Hannah Louisa Stutchbury	England	Samuel Stutchbury's Personal Assistant
George B. Sowerby Junior	England	Scientific Illustrator/Translator
James de C. Sowerby	England	Scientific Ilustrator
James Smith[a]	England	Optical Instrument Manufacturer

Based on data from the *Darwin Correspondence Project*, 2022

[a]James Smith did not exchange any letters with Darwin, or at least no letters between them have survived. Letter number 1148 was sent to James Smith (1782–1867), a Scottish architect, geologist and biblical historian known as James Smith of Jordanhill, a reference to the region in which he resided (Darwin, 1854a, p. v). On the *Darwin Correspondence Project* website, the link related to the recipient's name directed the user to James Smith (1800–73), an English manufacturer of optical instruments. The research that led to this article focused on Darwin's correspondents. Consequently, James Smith might not have received much attention if not for the aforementioned misidentification. This error turned out to be fortuitous, as it highlighted the sociotechnical networks involving the microscopes of the *Cirripedia Project*. This dynamic was so intriguing that we chose to keep James Smith in our study, despite the fact he was not a Darwin correspondent. The error was corrected after the authors informed the *Darwin Correspondence Project* team.

S. Bowerbank represented both societies in their relationship with Darwin, and Edwin Lankester also worked with *The Ray Society*. In relation to the 1854 publications, there is only one surviving missive, addressed to Edwin Lankester in his capacity as a representative of *The Ray Society*. The 41 letters will be discussed in more detail below. First, those concerning the preparations for the publication of *Fossil Cirripedia* (1851), will be addressed, with a focus on the production of engravings. Subsequently, the letters related to the publication of *Living Cirripedia* (1851) and on the intense negotiations with the *Ray Society* regarding the costs and deadlines of this work will also be examined. To enhance comprehension of this process, letters sent to other correspondents will also be utilized, in addition to publications from the *Cirripedia Project* and other relevant documents.

The analysis of this collection of letters provides valuable insights into the intricate dynamics underlying the production of illustrations for *Fossil Cirripedia* (1851). The process, broadly outlined, can be described as follows: Darwin, when investigating and describing the specimens, defined which ones should be illustrated in the publication and sent them to James de C. Sowerby, who in turn drew the illustrations and sent them for Darwin's approval. Once approved, each illustration was then engraved, preferably on copper plates, but also on wooden plates to compose the publication. After the specimen had been utilized for the illustration process, it was released to return to its owner. Although this process of creating illustrations may seem simple, it also generated some tension behind the scenes. This was especially true when it came to the relationship between the actors who collaborated in the transport and security of the specimens involved. The analysis that follows will explore these aspects.

James de C. Sowerby, a scientific illustrator and naturalist. remained actively engaged in various other activities during the years of the *Cirripedia Project*. In 1825, he continued his father's work with the publication of the final three volumes of *The Mineral Conchology of Great Britain* (Sowerby et al. 1812), a comprehensive catalog spanning 1812 to 1846 documenting British Isles shells across seven volumes. Sowerby formed a group of collaborators under Richard Owen's leadership to complete the work initiated by Frederik Dixon (who died at the end of 1849). Their efforts culminated in the publication of *The Geology and Fossils of the Tertiary and Cretaceous Formations of Sussex* in December 1850. Within this work, he acted as naturalist in describing mollusks (Dixon et al. 1850). He also played a pivotal role in the establishment of *The Royal Botanic Society of London* in 1839, serving as its secretary until 1869, during which time he used one of the Society buildings as his residence. Finally, he was employed by *The Palaeontographical Society.* In January 1850, when James S. Bowerbank suggested to Darwin that he seek sponsorship from *The Palaeontographical Society* for the publication of the volumes on fossil *Cirripedia*; Darwin had already engaged him, at his own expense, as illustrator.[22] However, he was unaware that Sowerby was an employee of the Society. Thus, when the Society agreed to finance the publications in February 1850, they also agreed to compensate him.

The correspondence with James de C. Sowerby reveals that since February 1850, Darwin was concerned with establishing a workflow with his illustrator while also aiming to minimize his time spent in London. The specimens would be sent in batches to be illustrated; as soon as the illustrations were completed, Darwin hoped to receive a communication from Sowerby to go up to London with other specimens and validate the illustrations before they were engraved. In the same letter in which he sought to establish this workflow, Darwin asked his illustrator to obtain "a proof-sheet of Mr. Dixon's Plate with Cirripedes for me."[23] Mr. Dixon is a reference to the aforementioned book authored by Frederik Dixon in collaboration with Sowerby and others (Dixon et al. 1850). The proof-sheet request aimed for its subsequent reproduction in *Fossil Cirripedia* (1851), possibly as a cost-saving measure to reduce publication expenses. The figure from Mr. Dixon was ultimately used in *Living Cirripedia* (1851), as we will see later. (Fig 2)

In the letter of March 3, 1850, the request was reinforced, as well as Darwin's concern about the workflow: "do not think I shall have finished all the pedunculate fossil cirripedia for 10 days or a fortnight [...]. I will let you know when I will come up; & I will then come early in morning & examine the drawings made, & leave specimens & rough sketches of the others."[24] In the same letter, Darwin informed

[22] To J. S. Bowerbank, January 19, 1850, *Darwin Correspondence Project*, "Letter no. 1294," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1294. Also published in The Correspondence of Charles Darwin, vol. 4.

[23] To J. C. Sowerby, February 12, 1850, Darwin Correspondence Project, "Letter no. 1303," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1303. Also published in The Correspondence of Charles Darwin, vol. 4.

[24] To J. C. Sowerby, March 3, 1850, *Darwin Correspondence Project*, "Letter no. 1306," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1306. Also published in T*he Correspondence of Charles Darwin,* vol. 4.

James de C. Sowerby of *The Palaeontographical Society*'s decision to publish his work on the fossils, as well as his intention to ask the *Society* to employ him in engraving the drawings too. Darwin therefore seemed satisfied with the quality of service provided by Sowerby. Later in March, Darwin wrote to Bowerbank to carry out the appointment and take other measures:

> [...] in a few weeks, when I have got all my drawings & manuscript ready, I will communicate again with you [...]. The drawings must be on copper for all depends on lines of growth. James de C. Sowerby is making my drawings, & he would undoubtedly engrave them best.[25]

Darwin sought to justify the need for the drawings to be engraved on copper (Fig 3), as this technique, chalcography, would ensure finer detail to the shells' growth lines compared to lithography, a less expensive illustration technique. The use of lithography in natural history incurred a negative connotation for Darwin, who perceived it as prioritizing artistic effects over meticulous attention to detail. This sentiment was evident in a letter dated April 13, 1850, addressed to James de C. Sowerby, wherein Darwin critiqued the illustrator's work by unfavorably comparing it to lithography. Darwin asked Sowerby to correct most of the drawings analyzed at that time, and wrote "what I now write for, is to beg you to do them a little harder & with the lines of growth more distinct. Some of the drawings have the muzziness of Lithography, a style of art [...] which in my opinion has been highly insulting to Natural History."[26] The drawings were criticized, therefore, for having the imprecision of lithography,[27] with indistinct and shadowed details, especially in the growth lines. Following the letter, Darwin expressed his expectation for work of the same level as that executed in the seventh volume of *The Mineral Conchology of Great Britain*, which was published in 1846.

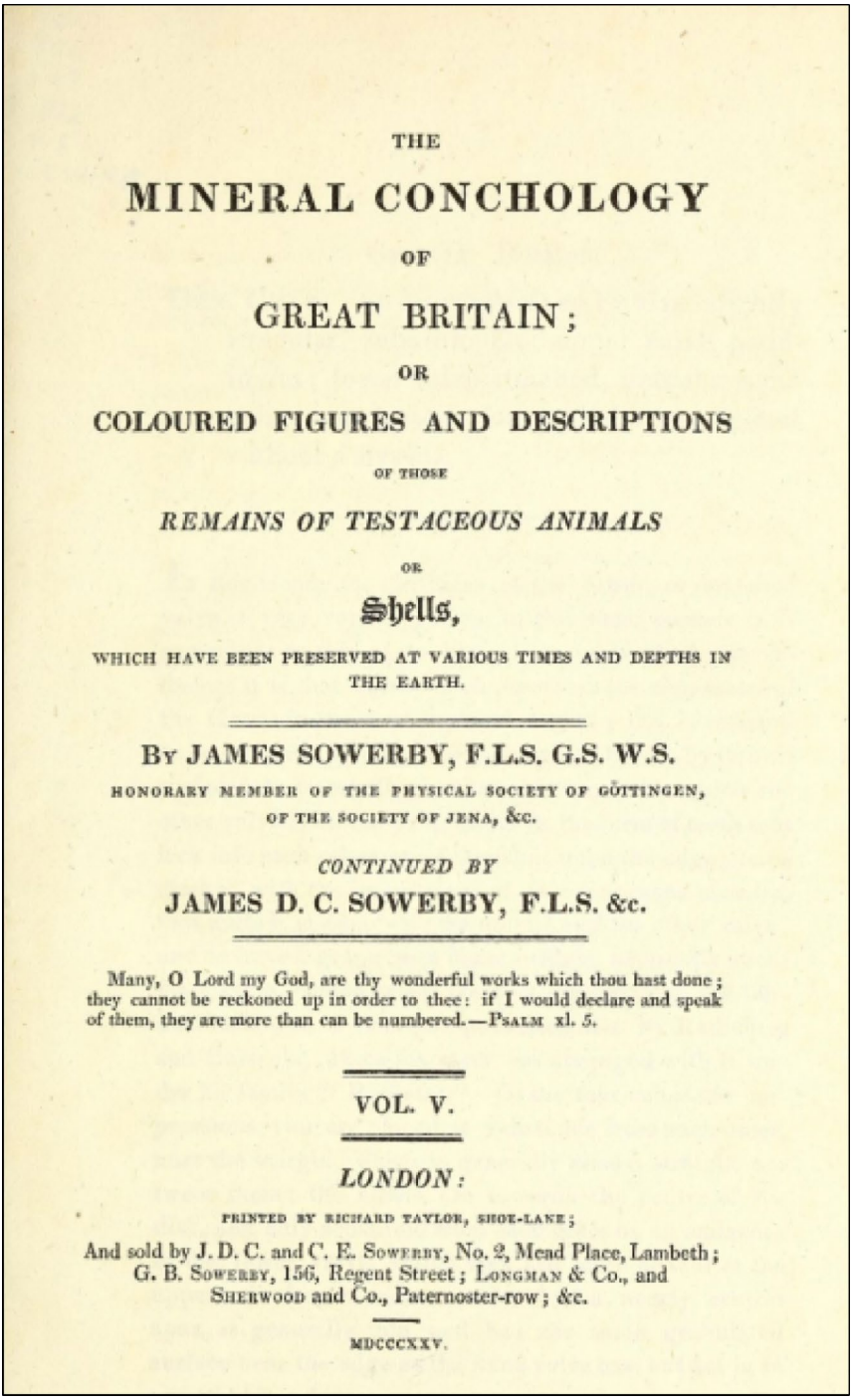
In early May 1850, Darwin urged James de C. Sowerby to hasten his work for two reasons: the necessity to return the specimens to their owners and pressure from *The Palaeontographical Society* to publish promptly.[28] By May 26, Darwin had finished

[25] To J. C. Sowerby, March 8, 1850, *Darwin Correspondence Project*, "Letter no. 1310," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1310. Also published in *The Correspondence of Charles Darwin,* vol. 4.

[26] To J. C. Sowerby, April 13, 1850, *Darwin Correspondence Project*, "Letter no. 1336," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1336. Also published in T*he Correspondence of Charles Darwin,* vol. 4.

[27] Lithography is a printing technique developed in the nineteenth century in which the design is made in high relief on a flat stone plate/matrix that is later inked and pressed against the paper, as if it were a stamp, and the matrix can then be reused for other designs. In the *Cirripedia Project*, the techniques of chalcography (engraving on a copper matrix) and xylography (engraving on a wooden matrix) were used, in which the designs are engraved on the plates with the formation of grooves. In chalcography, the image is produced from the ink that is deposited in the grooves, whereas in xylography the image is produced from the ink that is deposited in the high relief. Chalcography produced an illustration of higher quality and definition; however, as its matrix is more expensive than the others and cannot be reused, it became more expensive (Alvarez 2017, pp. 30-60).

[28] To J. C. Sowerby, May 4, 1850, *Darwin Correspondence Project*, "Letter no. 1324," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1324. Also published in The Correspondence of Charles Darwin, vol. 4.



THE

MINERAL CONCHOLOGY

OF

GREAT BRITAIN;

OR

COLOURED FIGURES AND DESCRIPTIONS

OF THOSE

REMAINS OF TESTACEOUS ANIMALS

OR

Shells,

WHICH HAVE BEEN PRESERVED AT VARIOUS TIMES AND DEPTHS IN THE EARTH.

BY JAMES SOWERBY, F.L.S. G.S. W.S.

HONORARY MEMBER OF THE PHYSICAL SOCIETY OF GÖTTINGEN, OF THE SOCIETY OF JENA, &c.

CONTINUED BY

JAMES D. C. SOWERBY, F.L.S. &c.

Many, O Lord my God, are thy wonderful works which thou hast done; they cannot be reckoned up in order to thee: if I would declare and speak of them, they are more than can be numbered.—PSALM xl. 5.

VOL. V.

LONDON:

PRINTED BY RICHARD TAYLOR, SHOE-LANE;

And sold by J. D. C. and C. E. SOWERBY, No. 2, Mead Place, Lambeth; G. B. SOWERBY, 156, Regent Street; LONGMAN & Co., and SHERWOOD and Co., Paternoster-row; &c.

MDCCCXXV.

Fig 2 Title page of the fifth volume of *The Mineral Conchology*, a collection begun by James Sowerby and continued by his son, James de Carle Sowerby (Sowerby et al. 1834)

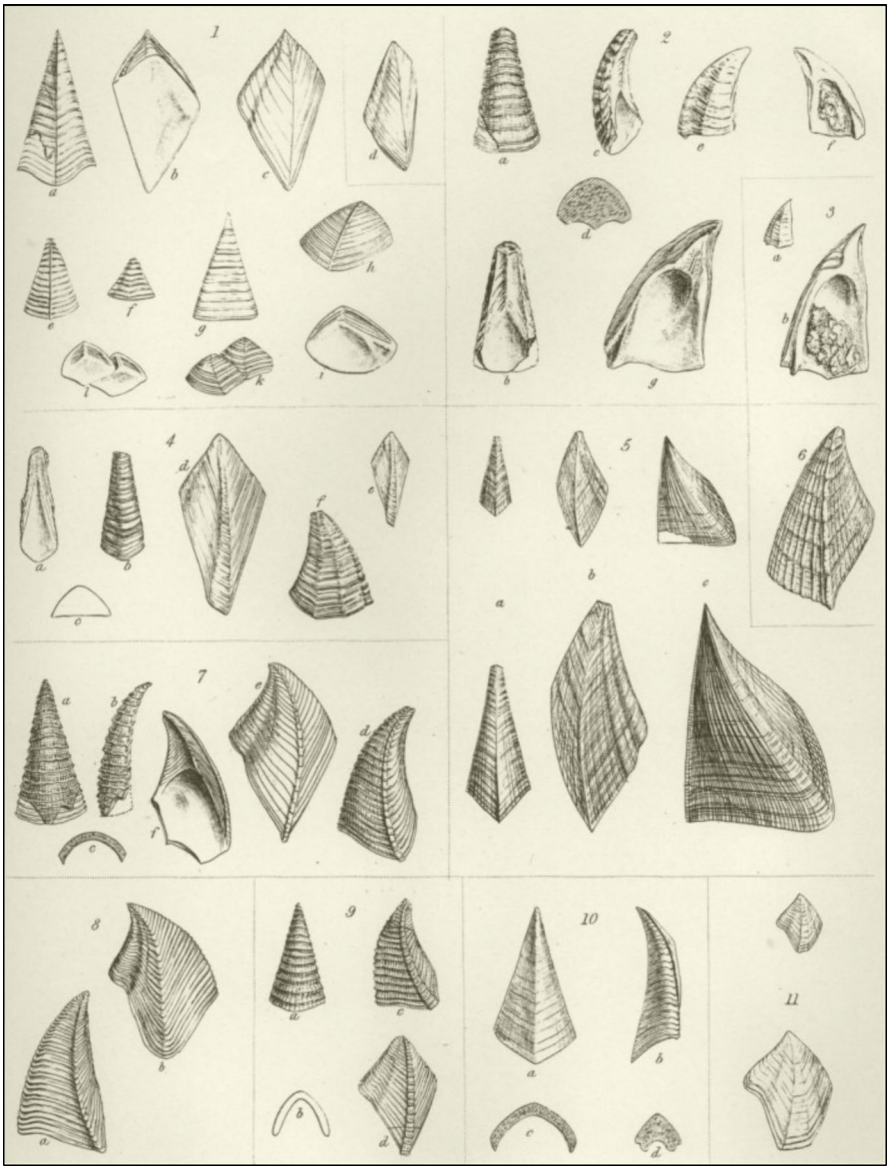


Fig 3 Chalcographies produced by James de Carle Sowerby for the first volume of *Fossil Cirripedia* (Darwin 1851a, Tab II)

the manuscript but requested further corrections to the drawings. He also wrote that his response to all parties, including specimen owners and *The Palaeontographical Society,* was that "my manuscript [...] has been for some time ready, and all depends

on you."[29] Darwin pressed his illustrator further in two letters exchanged over the subsequent months. First, on July 8, 1850, he thanked him for the progress, but asked that he move forward as quickly as possible.[30] By August the demands became more intense; at the beginning of the month, Darwin said he was disappointed with the lack of progress and reminded him again of the pressure he received from the sponsoring society and the owners of the specimens.[31] On the 27th, Sowerby was again warned about the time, with Darwin telling him, "pray observe how time slips by."[32] In the following days, Darwin even begged the illustrator "to put your shoulder to the wheel & get the job done."[33]

Ironically, after all this period of demanding and pushing, Darwin wrote to James de C. Sowerby, on September 1st, to say that he had received a huge quantity of specimens from Scandinavia and stated that: "in all probability some of the specimens will be better than those sent to you; will you therefore be so kind as to stop engraving any of the foreign species."[34] Darwin promised to contact him again in a week, once he had finished examining the Scandinavian lot. Therefore, it is evident that at least part of the responsibility for the publication delay can be attributed to Darwin, as he continued to receive specimens from his collaborators even with the manuscript finished and the creation of illustrations already at full speed.

Later in September 10, 1850, Bowerbank received a request from Darwin to include some xylographs to illustrate points in the *Introduction on Nomenclature*. Sowerby had already made the drawings and Darwin suggested to Bowerbank that he also make the engravings, because "if they are sent to some stranger, I do not know how the expense of the drawing on wood & the cutting is to be proportioned."[35] The use of xylography in the *Cirripedia Project* publications, in figures whose precision could be left in the background, such as to illustrate the nomenclature of the valves

[29] To J. C. Sowerby, May 26, 1850, *Darwin Correspondence Project*, "Letter no. 1333," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1333. Also published in The Correspondence of Charles Darwin, vol. 4.

[30] To J. C. Sowerby, June 08, 1850, *Darwin Correspondence Project*, "Letter no. 1338," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1338. To J. C. Sowerby, July 08, 1850, *Darwin Correspondence Project*, "Letter nº 1343," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1343. Also published in *The Correspondence of Charles Darwin*, vol. 24 (Supplement) and 4.

[31] To J. C. Sowerby, August 12 or 19, 1850, *Darwin Correspondence Project*, "Letter no. 1346," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1346. Also published in *The Correspondence of Charles Darwin*, vol. 4.

[32] To J. C. Sowerby, August 27, 1850, *Darwin Correspondence Project*, "Letter no. 1347," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1347. Also published in *The Correspondence of Charles Darwin*, vol. 4.

[33] To J. C. Sowerby, August 28 or September 4, 1850, *Darwin Correspondence Project*, "Letter no. 1348," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1348. Also published in *The Correspondence of Charles Darwin*, vol. 4.

[34] To J. C. Sowerby, September 1, 1850, *Darwin Correspondence Project*, "Letter no. 1350," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1350. Also published in *The Correspondence of Charles Darwin*, vol. 4.

[35] To J. C. Sowerby, September 10, 1850, *Darwin Correspondence Project*, "Letter no. 1353," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1353. Also published in *The Correspondence of Charles Darwin*, vol. 4.

that make up the shells of cirripedes (Fig 4), seems to have been another cost-saving measure. Unlike chalk engravings, woodprints could be printed alongside the text, which made reading easier and cut costs (Chansigaud 2016). The concern with cost control is also evident in the suggestion that James de C. Sowerby made the cuts in the wood, as he had already made the drawings.

Following the same letter, Darwin questioned Bowerbank about how to present the species descriptions, whether only in English or Latin or: "in Latin & English; I thought of following the latter; do you approve? I think the Descriptions shd be anyhow in Latin, & I can give the English also if approved of."[36] George B. Sowerby Junior (nephew of James de C. Sowerby) was in charge of translating Darwin's descriptions into Latin from the early 1850s, and Darwin paid him directly for the work.[37] Therefore, the aforementioned request possibly referred to the cost for the additional pages that the addition of descriptions in two languages would entail. Darwin obtained approval from the board of *The Palaeontographical Society* for both the woodprints and the descriptions.[38]

The illustrations were finally completed in February 1851. A sequence of four letters reveals the complex dynamic and underlying tensions between Darwin and James de C. Sowerby. First on January 21, in a missive that, despite having an initial section praising his work, contains several requests for corrections and observations of flaws in the engraved plates, such as the presence of stains and dirt. There are other requests for corrections. [39] On February 10, Darwin complained about the failure to fulfill his requests and presented new ones.[40] On the 13th, Darwin lamented "that the figures which have given most trouble are those of which drawings were made!"[41] Finally, on February 19th, Darwin approved the work and thanked his collaborator for all the troubles that "you have taken, & congratulate you that I can cause no more."[42] The formality and even coldness of Darwin in thanking Sowerby

[36] To J. C. Sowerby, September 10, 1850, *Darwin Correspondence Project*, "Letter no. 1353," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1353. Also published in *The Correspondence of Charles Darwin*, vol. 4.

[37] To G. B. Sowerby Junior, January 9, 1850, *Darwin Correspondence Project*, "Letter no. 13843," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-13843. Also published in *The Correspondence of Charles Darwin*, vol. 4.

[38] Footnote no. 3 in: To J. C. Sowerby, September 10, 1850, *Darwin Correspondence Project*, "Letter no. 1353," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1353. Also published in *The Correspondence of Charles Darwin*, vol. 4.

[39] To J. C. Sowerby, January 21, 1851, *Darwin Correspondence Project*, "Letter no. 1386," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1386. Also published in *The Correspondence of Charles Darwin*, vol. 5.

[40] To J. C. Sowerby, February 10, 1851, *Darwin Correspondence Project*, "Letter no. 1388," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1388. Also published in *The Correspondence of Charles Darwin*, vol. 5.

[41] To J. C. Sowerby, February 13, 1851, *Darwin Correspondence Project*, "Letter no. 1389," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1389. Also published in *The Correspondence of Charles Darwin*, vol. 5.

[42] To J. C. Sowerby, February 19, 1851, *Darwin Correspondence Project*, "Letter no. 1391," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1391. Also published in *The Correspondence of Charles Darwin*, vol. 5.

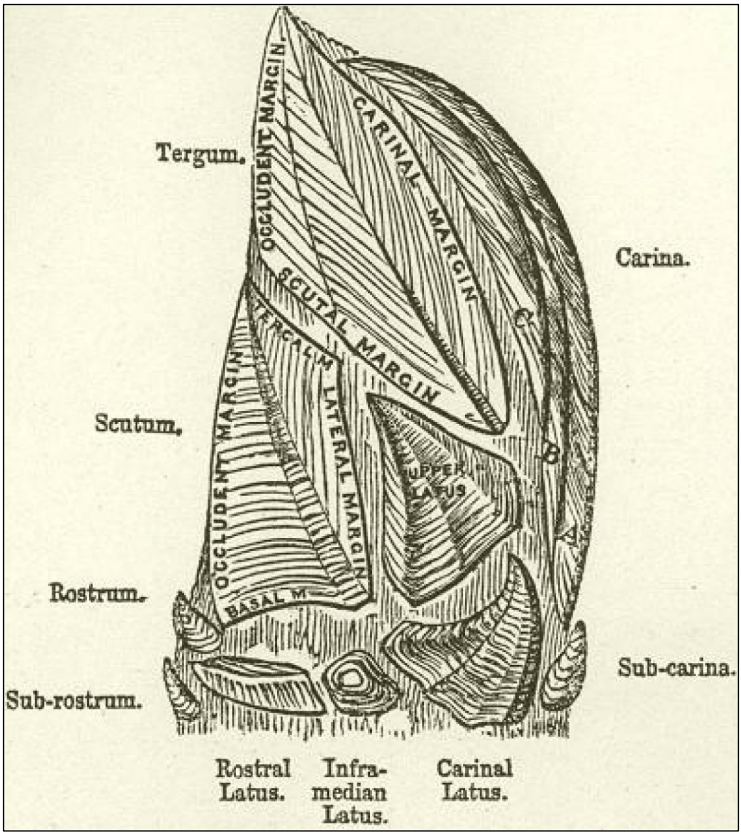


Fig 4 "Capitulum." Woodprint created by James de Carle Sowerby for the first volume of *Fossil Cirripedia* and also used in first volume of *Living Cirripedia* (Darwin 1851a, p.9)

for his service, despite several visits and letters exchanged throughout the period in which they worked together, was unusual in Darwin's letters, which were usually very flattering to his collaborators. James de C. Sowerby, however, did not receive the same treatment; on the contrary, Darwin blamed him and held him responsible for the delays in the production of the illustrations and, consequently, in the return of the specimens.[43]

In a letter to Fitch on November 11, 1850, Darwin mentioned that one of the main causes of the delay was the demolition of James de C. Sowerby's house within

[43] To R. Fitch, April 13, 1850, *Darwin Correspondence Project*, "Letter no. 1315," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1315. Also published in *The Correspondence of Charles Darwin*, vol. 4; and see also To J. J. Steenstrup, May 20, 1850, *Darwin Correspondence Project*, "Letter no. 1330," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1330. Also published in *The Correspondence of Charles Darwin*, vol. 4.

one of *The Royal Botanic Society*'s buildings.[44] Following the letter, Darwin had already indicated his intention to change illustrators for his other works remembering that "Mr. Sowerby is by no means the only Engraver employed by *The Palaeontographical Society*. I did not know how dreadfully dilatory he was, when I picked him out as most capable of doing the work well."[45] The letters exchanged between Darwin and other collaborators, which lay responsibility on Sowerby for the delays, along with those directed straight to the illustrator, not only underscore the strained relationship among them but also suggest that the illustrator's tardiness stemmed from other commitments. As mentioned earlier, in 1850, Sowerby, in addition to his work at *The Palaeontographical Society* and *The Royal Botanic Society*, was also engaged in completing Frederick Dixon's book. Fortunately, it was precisely his failures, as perceived by Darwin, that led to the production of the extensive documentation analyzed here and that provides an opportunity to understand the different actors involved in the production of the illustrations.

James de C. Sowerby's slowness and the various corrections required in his drawings justify Darwin's decision to choose another illustrator for the remaining works of the *Cirripedia Project*, namely George B. Sowerby Junior (1812-1884). Sowerby Junior had already collaborated with Darwin as a translator and alongside his father, as proprietors of a natural history emporium, that had already supplied Darwin with some cirripedes. Sowerby Junior's initial work as an illustrator for the *Cirripedia Project* was with recent cirripedes. *The Ray Society* had agreed to sponsor Darwin's work on recent *Cirripedia* in February 1848 on the condition that it be divided into two volumes.[46] Sowerby Junior had been working on the *Cirripedia Project* since the beginning of 1850, but it was only at the end of that year that Darwin asked *The Ray Society* to hire him. This request makes up a series of preliminary solicitations made to the sponsoring society in the letter of October 27, 1850,[47] which marks the beginning of the preparations for the publication of the first volume of *Living Cirripedia*.

In the long list of requests, we can notice negotiations regarding material aspects of the book, such as the number of plates, the coloring of the figures, the cost estimates and the deadlines for starting the work. In the subsequent correspondence, *The Ray Society* promptly addressed the requests. They hired George B. Sowerby Junior, and he provided the board with an estimated cost for his services. Darwin

[44] Footnote no. 2 in: To R. Fitch, November 11, 1850, *Darwin Correspondence Project*, "Letter no. 1369," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1369.xml. Also published in *The Correspondence of Charles Darwin*, vol. 4.

[45] To R. Fitch, November 11, 1850, *Darwin Correspondence Project*, "Letter no. 1369," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1369. Also published in *The Correspondence of Charles Darwin*, vol. 4.

[46] Footnote no. 2 in: From *The Ray Society*, October after 7, 1850, *Darwin Correspondence Project*, "Letter no. 1361," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1361. Also published in *The Correspondence of Charles Darwin*, vol. 4. See also: From *Ray Society*, October after 7, 1850, *Darwin Correspondence Project*, "Letter no. 1361," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1361. Also published in *The Correspondence of Charles Darwin*, vol. 4.

[47] To E. Lankester, *Ray Society*, October 27, 1850, *Darwin Correspondence Project*, "Letter no. 1364," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1364. Also published in *The Correspondence of Charles Darwin*, vol. 4.

also reported an estimate of the number of pages he intended to require, between 175 and 192 pages.[48] In December 1850, *The Ray Society* granted Darwin eight plates, two of which were colored.[49] In March 1851, after completing preparations for the publication of the first volume of fossils, Darwin wrote again to *The Ray Society*, mediated by Edwin Lankester, to negotiate the concession of an additional plate, partially paid for by reducing the color of another. Following the letter he wrote directly to Lankester "to know whether there could be any objection to my having (if I find it request) a 10th additional Plate at my entire cost [...]."[50] Darwin's willingness to pay for a tenth plate, as well as his attention to the technique used for illustration and their quality, vividly shows his great commitment to this aspect of his publications. Such commitment is entirely warranted, given the diminutive size of the specimens and the critical importance of their microscopic structures for identification and taxonomic classification.

Negotiations to increase the number of illustrations in his book continued throughout the second half of 1851. In July 1851, Darwin requested *The Palaeontographical Society*, through Bowerbank, to borrow one of the engravings used in *Fossil Cirripedia* (1851); again, the purpose of the loan was to reduce costs. Darwin wrote "I apologize for this trouble, but I thought it a pity that the Ray Soc.y shd be put to any useless expence, & I know that you are interested in the *Ray Society*."[51] Bowerbank, who had participated in the founding of both societies, was at the time of this letter the treasurer of *The Ray Society*; Darwin took advantage of his collaborator's relationships to enrich the illustrations of the *Living Cirripedia* (1851) with a copy of the woodprint shown in the Fig 4. Later in July, Darwin wrote again to *The Ray Society* to request four new xylographs and pressured Lankester to respond quickly, as there would be no "time to lose, as they come in my introduction. can you authorize me having them made?"[52] For the most part, Darwin was successful in these negotiations. *The Palaeontographical Society* lent the engraving for the publication, and two of the four woodprints were authorized by *The Ray Society*. The initial eight plates became ten, but there was no need for them to be colored.[53] In

[48] To E. Lankester, *Ray Society*, November 7, 1850, *Darwin Correspondence Project*, "Letter no. 1367," accessed,1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1367. Also published in *The Correspondence of Charles Darwin*, vol. 4.

[49] To E. Lankester, *Ray Society*, December 5, 1850, *Darwin Correspondence Project*, "Letter no. 1374," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1374. Also published in *The Correspondence of Charles Darwin*, vol. 4.

[50] To E. Lankester, *Ray Society*, March 4, 1851, *Darwin Correspondence Project*, "Letter no. 1395," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1395. Also published in *The Correspondence of Charles Darwin*, vol. 4.

[51] To J. S. Bowerbank, July 7, 1851, *Darwin Correspondence Project*, "Letter no. 1441," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1441. Also published in The Correspondence of Charles Darwin, vol. 5.

[52] To E. Lankester, *Ray Society*, July 19, 1851, Darwin Correspondence Project, "Letter no. 1443," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1443. Also published in The Correspondence of Charles Darwin, vol. 5.

[53] To E. Lankester, *Ray Society*, July 22, 1851, Darwin Correspondence Project, "Letter no. 1444," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1444. Also published in The Correspondence of Charles Darwin, vol. 1.

the following months, Darwin made corrections to his book with a view to it being printed, and in November he began preparations for sending copies to his collaborators, just as he had already done with *Fossil Cirripedia* (1851) and as he would do with the publications of 1854.[54]

The preparations for the 1854 publications closely mirrored those of 1851 and continued to receive support from the same sponsoring societies. The illustrations in both volumes were made by George B. Sowerby, Junior, and the printing was carried out by the same company, C. and J. Adlard. Thus, with the workflow already established, there was significantly less correspondence concerning the 1854 publications. The only surviving letter, dated March 19, 1853, and addressed to *The Ray Society*, records a conflict with Lankester regarding the publication deadlines: "it is impossible that I can be ready so soon as you seem to expect [...] the vast delay after my last volume was printed off, did not make me suppose that you were very particular as to exact time."[55] Darwin had planned to publish the second volume of *Living Cirripedia* at the end of 1852, but the delay due to his indisposition led to it being rushed by *The Ray Society*.[56] Following this letter, Darwin requested an extension of the deadline by five months and asked his sponsor to publish more color illustrations, offering to pay for six extra plates himself. This not only reveals the extent of the negotiations but also underscores his commitment to the quality and quantity of his illustrations.

By focusing on the preparations for the *Cirripedia Project* publications, intense negotiations concerning their material aspects were perceived. Among the surviving correspondence, there are 24 letters that pertain to the publication of *Fossil Cirripedia* (1851), with 19 of these addressed to the illustrator James de C. Sowerby.[57] In relation to *Living Cirripedia* (1851), there are 16 letters, 14 of which were exchanged with *The Ray Society*. Regarding the 1854 publications, today there is only one letter addressed to *The Ray Society*.[58] The contrast in the number of letters addressed to James by C. Sowerby compared to those addressed to George B. Sowerby Junior highlights the different relationships Darwin had with each of them. The volume of correspondence was largely due to errors in the production process and brings into relief the actual role played by assistants rendered invisible, or backgrounded in Darwin's project.

Darwin's relationship with James de C. Sowerby, the illustrator of *Fossil Cirripedia* (1851) was peppered with friction and had more than a bit of tension, resulting

[54] To T. H. Huxley, November 22, 1851, Darwin Correspondence Project, "Letter no. 1462," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1462. Also published in The Correspondence of Charles Darwin, vol. 5.

[55] To E. Lankester, *Ray Society*, March 19, 1853, Darwin Correspondence Project, "Letter no. 1507," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1507. Also published in The Correspondence of Charles Darwin, vol. 5.

[56] To E. Lankester, *Ray Society*, July 30, 1851, Darwin Correspondence Project, "Letter no. 1447," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-1447. Also published in The Correspondence of Charles Darwin, vol. 5.

[57] The rest were sent to James S. Bowerbank.

[58] The other two were sent to James S. Bowerbank, as a representative of the *Palaeontographical Society*, and to Edwin Lankester regarding the publication of *Living Cirripedia* (1854).

from the many errors, inaccuracies and delays in the publication of the volume. Sowerby's slowness, however, does not appear to be associated with a lack of diligence but rather to his being overwhelmed with work. As highlighted above, between 1850 and 1851, in addition to taking care of the cirripedes illustrations, he was also active in *The Royal Botanic Society* and was involved, as co-author, in the completion of Frederick Dixon's book. Thus, his constant delays may be the result of a strategy to coordinate his multiple tasks, and not his negligence. It is plausible that he relegated the illustrations into a secondary position to prioritize those projects that would bring him more prestige or were more urgently needed.

The relationship with George B. Sowerby Junior, however, appears to have been more productive. Besides illustrating the other volumes of the *Cirripedia Project*, Sowerby Junior also illustrated Darwin's book on orchids and a pamphlet against animal cruelty produced by Emma and Charles.[59] The contrast in treatment between the two illustrators is further evident in the prefaces of the first volumes they contributed to, and both are cited alongside 54 other individuals and institutions. Sowerby was remembered for the "valuable aid rendered to me by the loan of the original specimens figured in the 'Mineral Conchology' and for the pains exhibited in the drawings here published (Darwin 1851a, p. v)." The tone of the thanks to George B. Sowerby Junior was more laudatory; Darwin wrote, "I am under obligations for the great care he has taken in making preparatory drawings, and in subsequently engraving them. I believe naturalists will find that the ten plates given here are faithful delineations of nature" (Darwin 1851b, p. viii). Unlike his uncle, Sowerby Junior was not criticized for the *Cirripedia Project* to Darwin's collaborators. This disparity in acknowledgment underscores the varying levels of recognition and appreciation extended to each illustrator for their respective contributions to Darwin's work. (Fig 5)

Despite all this, there are more mentions of James de C. Sowerby than of George B. Sowerby Junior in the documents analyzed. This discrepancy suggests that Darwin's relationship with his illustrators fits with Steven Shapin's analysis, that the normally transparent work of assistants, becomes apparent when error occurs (Shapin 1989). The most problematic, tense, and most error-prone relationship is also where the assistant's role ceases to be invisible. The same can be said about the preparations for the 1854 publications, for which the experiences of the 1851 publications seem to have contributed to the ease of the work, with fewer problems and letters exchanged. The smooth functioning of all the background work leading to publishing the second volumes was also responsible for the greater transparency involved in producing the work, and drawing attention to the actors involved in the project.

These mistakes or errors enable us to look inside the black box of the *Cirripedia Project*. This enables us to glimpse the complexity of issues that involve the materialization of the work, and to understand the role that deadlines, sponsorships, costs, and techniques that are usually rendered invisible but are crucial in the production,

[59] G. B. Sowerby Junior to Emma Darwin, July 22, 1863, *Darwin Correspondence Project*, "Letter no. 4251," accessed 1 February 2019, http://www.darwinproject.ac.uk/DCP-LETT-4251. Also published in The Correspondence of Charles Darwin, vol. 11.

Fig 5 *Balanus tintinnabulum.*Chalcographies produced by George Brettingham Sowerby Junior for the second volume of *Living Cirripedia*; the illustrator's name appears in the lower right corner, almost invisible (Darwin 1854b, plate II)

and to understand complex negotiations between all these. Although James de C. Sowerby's problems with the 1851 preparations may be seen as detrimental to Darwin's work, they enable us to see all the background work, and the hidden but important elements behind the development of Darwin's famous *Cirripedia Project*.

Conclusion

The *Cirripedia Project* is located between the voyage of the Beagle (1831–1836) and the publication of *Origin of Species* (1859), two major milestones in Charles Darwin's life that have drawn the attention of generations of historians of science. Richmond (1988), for example, shows us that the *Cirripedia Project*, in many ways, interconnects these two milestones, notably because it began with a specimen collected during the trip whose close study subsequently enabled Darwin to develop his theory of evolution. Though it has been studied by scholars, the background preparations leading to its publications have received scant attention; indeed, Darwin's own role and involvement as well as interventions in its production, and his use of assistants has not been highlighted. This paper, that has drawn on Actor-Network Theory, has focused on many of the unseen elements leading to the publication of Darwin's work on the cirripedes. In particular, it has tried to render visible the many other people, from illustrators, to engravers, to sponsors, and assistants, indeed, the complicated networks and social processes that were at play, as well as the many technical elements that led to the production of the publication. What have we now learned from an examination of this correspondence, and what conclusions can we draw?

For one thing, we see that Darwin understood the importance of illustrations in his work, and indeed their centrality to the scientific success of the *Cirripedia Project* and for the scientific questions and goal that Darwin proposed to address: developing the most complete description and classification possible of the cirripedes, as a taxonomic unit of crustaceans. With publications in 1851 and 1854, Darwin sought to bring order to *Cirripedia*, through the standardization of the nomenclature of specimens and their parts. Accurate and detailed illustrations, thus became powerful aids in this endeavor, hence the attention given by Darwin to the quantity and quality of their production.

We also see that Darwin had the critical skills and knowledge about the processes involved in their preparation that went beyond his expertise in natural history, and that in his letters and correspondence, we see that he actively sought collaborators from different parts of the world, and from many diverse class backgrounds. Indeed, a close examination of the correspondence shows us that Darwin was in fact a skillful project manager, one able to gauge the abilities (and disabilities) of collaborators, and then able to mobilize them for his ends, exercising control over the publication process even over long-distances. Darwin's elite social position, no doubt helped in this, but so too did the fact that he was an important naturalist whose career was on the rise, and one who had the capabilities and skill-set to make sure the end product was as good as he could make it.

Finally, one of the questions we originally sought is perhaps the most difficult to answer: is it possible to grasp the interests of these collaborators in their relationship with Darwin? Is it possible to infer what they had to gain from this relationship and how their interests were imposed on, or affected Darwin? The difficulty in addressing this point lies largely in the fact that we have access to the voices of these collaborators, mainly from the testimony of the letters written to Darwin. Regardless of this, we see that Lankester demonstrated a clear commitment to managing the deadlines for *The Ray Society's* publications. We also see that Bowerbank, a beverage businessman who also pursued natural history, appeared eager to strengthen his newfound position through collaboration with Darwin, while also addressing concerns about publication costs and the financial well-being of the two societies he co-founded. The harmonious relationship with George B. Sowerby Junior led to a long-lasting partnership as translator and illustrator of Darwin's *Cirripedia Project* and, in the years that followed, a continued collaboration with Darwin. The more harmonious relationship between Darwin and George B. Sowerby Junior resulted in a smaller quantity of letters, but also a more unseen role in the project. On the other hand, Darwin's tense relationship with James de C. Sowerby resulted in much more correspondence, most of which shows us the illustrator under pressure to conform to the deadlines and techniques requested by Darwin; in return, Sowerby imposed on him his own work rhythm, while prioritizing his personal projects as a naturalist and at *The Royal Botanic Society.*

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Declarations

Conflict of interests The authors have no conflicts of interest to declare.

References

Alvarez, Fernando Gómez. 2017. *Gravura*. Vitória: UFES. http://acervo.sead.ufes.br/arquivos/gravura.pdf. Accessed 30 April 2024.

Anderson, Lyall I., and Mathew Lowe, 2010. Charles W. Peach and Darwin's barnacles. *Journal of the History of Collections* 22: 257–270. https://doi.org/10.1093/jhc/fhq006.

Anonymous. 1877. Obituary. James Scott Bowerbank, F.R.S., F.L.S., and F.G.S. 1877. *Geological Magazine* 4: 191–192. https://doi.org/10.1017/S0016756800149106.

Anonymous, 2020a. About the Society. https://www.palaeosoc.org//the-society. Accessed 30 April 2024.

Anonymous, 2020b. *The Ray Society–its history and aims*. 2020. https://www.raysociety.org.uk/history. Accessed 30 April 2024.

Antunes, Anderson P. 2019. *Um naturalista e seus colaboradores na Amazônia: a expedição de Henry Walter Bates ao Brasil (1848-1859).* https://www.arca.fiocruz.br/handle/icict/50379. Accessed 30 April 2024.

Antunes, Anderson P. 2015. *A rede dos invisíveis*: *uma análise dos auxiliares na expedição de Louis Agassiz ao Brasil (1865-1866).* https://www.arca.fiocruz.br/handle/icict/20457. Accessed 30 April 2024.

Bardin, Laurence. 2000. *Análise de conteúdo*. Lisbon: Edições 70.

Barlow, Nora, ed. 1933. *Charles Darwin's diary of the voyage of H.M.S. Beagle*. Cambridge: Cambridge University Press.

Browne, Janet. 2011. *Charles Darwin: viajando*. São Paulo: Universidade Estadual Paulista.

Buchanan, Roderick D. 2017. Darwin's 'Mr. Arthrobalanus:' Sexual differentiation, evolutionary destiny and the expert eye of the beholder. *Journal of the History of Biology* 50: 315–355. https://doi.org/10.1007/s10739-016-9444-9.

Chansigaud, Valérie. 2016. Scientific illustrators. In *A companion to the history of science*, ed. B. Lightman, 84-96. Chichester: John Wiley & Sons, Ltd. https://doi.org/10.1002/9781118620762.ch8.

Checa, Antonio G., Carmen Salas, Alejandro B. Rodríguez-Navarro, Christian Grenier, and Nelson A. Lagos. 2019. Articulation and growth of skeletal elements in balanid barnacles (*Balanidae, Balanomorpha, Cirripedia*). *Royal Society Open Science* 6: 190458. https://doi.org/10.1098/rsos.190458

Darwin, Charles R. 1851a. *A monograph on the fossil Lepadidæ, or pedunculated Cirripedia of Great Britain.* Vol. 1. London: The Palæontographical Society. http://darwin-online.org.uk/content/frameset?itemID=F342.1&viewtype=text&pageseq=1.Accessed 30 April 2024.

Darwin, Charles R. 1851b. *A monograph on the sub-class Cirripedia, with figures of all the species.* Vol. 1. London: The Ray Society. https://darwin-online.org.uk/content/frameset?itemID=F339.1&viewtype=text&pageseq=1. Accessed 30 April 2024.

Darwin, Charles R. 1854a. *A monograph on the fossil Balanidæ and Verrucidæ of Great Britain.* Vol. 2. London: The Palæontographical Society. https://darwin-online.org.uk/content/frameset?itemID=F342.2&viewtype=text&pageseq=1. Accessed 30 April 2024.

Darwin, Charles R. 1854b. *A monograph on the sub-class Cirripedia, with figures of all the species.* Vol. 2. London: The Ray Society. https://darwin-online.org.uk/content/frameset?itemID=F339.2&viewtype=text&pageseq=1. Accessed 30 April 2024.

Desmond, Adrian, and James Moore. 1995. *Darwin: a vida de um evolucionista atormentado*, 1st ed. São Paulo: Geração Editorial.

Deutsch, Jean. 2010. Darwin and barnacles. *Comptes Rendus. Biologies* 333: 99–106.

Dixon, Frederick, Thomas Bell, Edward Forbes, William Lonsdale, Richard Owen, and James C. Sowerby. 1850. *The geology and fossils of the Tertiary and Cretaceous formations of Sussex*. London: Longman, Brown, Green and Longmans. https://www.biodiversitylibrary.org/item/51324. Accessed 30 April 2024.

Duarte, Regina H. 2013. Between the national and the universal: Natural history networks in Latin America in the nineteenth and twentieth centuries. *Isis* 104: 777–787.

Gingras, Yves. 2010. Mapping the structure of the intellectual field using citation and co-citation analysis of correspondences. *History of European Ideas* 36: 330–339.

Horta, Márcio R. 2003. O impacto do manuscrito de Wallace de 1858. *Scientiae Studia* 1: 217–229. https://doi.org/10.1590/S1678-31662003000200007.

Jardine, Boris. 2009. Between the Beagle and the barnacle: Darwin's microscopy, 1837–1854. *Studies in History and Philosophy of Science* 40: 382–395. https://doi.org/10.1016/j.shpsa.2009.10.007.

Johnson, Kristin. 2016. The natural historian. In *A companion to the history of science*, ed. Bernard Lightman, 84–96. Chichester: John Wiley & Sons, Ltd. https://doi.org/10.1002/9781118620762.ch6.

Latour, Bruno. 2000. *Ciência em ação: como seguir cientistas e engenheiros sociedade afora*. São Paulo: Editora Universidade Estadual Paulista.

Latour, Bruno. 2012. *Reagregando o social: uma introdução à teoria do Ator-Rede*. Salvador: Editora da Universidade Federal da Bahia; Bauru: Editora da Universidade Sagrado Coração.

Law, John. 1984. On the methods of long-distance control: Vessels, navigation and the Portuguese route to India. *The Sociological Review* 32: 234–263. https://doi.org/10.1111/j.1467-954X.1984.tb00114.x.

Mackay, David. 1985. *In the wake of Cook: Science and empire, 1780–1801*. New York: St. Martin's.

Montgomery, William. 1987. Editing the Darwin Correspondence - A quantitative perspective. *British Journal for the History of Science* 20: 13–27. https://doi.org/10.1017/S0007087400000467.

Passetti, Gabriel. 2014. O Brasil no relato de viagens do comandante Robert FitzRoy do *HMS Beagle*, 1828–1839. *História, Ciências, Saúde-Manguinhos* 21: 911–930.

Platts, Elizabeth. 1944. In the celebration of the Ray Society, established 1844, and its founder George Johnston (1797-1855). *The Ray Society 150th Anniversary* 163: 1-9.

Podgorny, Irina. 2013. Fossil dealers, the practices of comparative anatomy and British diplomacy in Latin America, 1820–1840. *British Journal for the History of Science* 46: 647–674.

Richmond, Marsha. 1988. Study of the Cirripedia. In *The Correspondence of Charles Darwin*, ed. Frederick Burkhardt, Sydney Smith, Janet Browne, Stephen Pocock, Marsha L. Richmond, and Anne Secord, Vol. 4, 388–409. Cambridge: Cambridge University Press.

Rodrigues, Deise S. 2016. *Ciências sem fronteiras:* comunicação epistolar, redes de correspondência e circulação das cartas de Agassiz no século das nações. http://hdl.handle.net/1843/BUBD-ACWERB. Accessed 30 April 2024.

Rudwick, Martin J.S. 1985. *The great Devonian controversy*. Chicago: The University of Chicago Press.

Saldaña, Johnny. 2013. *The coding manual for qualitative researchers*. 2nd edn. Los Angeles. https://us.sagepub.com/en-us/sam/the-coding-manual-for-qualitative-researchers/book273583. Accessed 30 April 2024.

Secord, Anne. 1994a. Science in the pub: Artisan botanists in early nineteenth-century Lancashire. *History of Science* 32: 269–315.

Secord, Anne. 1994b. Corresponding interests: Artisans and gentlemen in nineteenth-century natural history. *The British Journal for the History of Science* 27: 383–408.

Shapin, Steve. 1989. The invisible technician. *American Scientist* 77: 554-563. https://www.jstor.org/stable/27856006. Accessed 30 April 2024.

Sowerby, James, J. Farey, B. Meredith, C. E. Sowerby, J. C. Sowerby, R. Taylor, Arding, et al. 1812. *The mineral conchology of Great Britain; or, coloured figures and descriptions of those remains of Testaceous animals or shells, which have been preserved at various times and depths in the Earth*. Vol. 1, London: B. https://www.biodiversitylibrary.org/item/210430#page/1/mode/1up. Accessed 30 April 2024.

Sowerby, James, J. Farey, J. B. Meredith, C. E. Sowerby, J. C. Sowerby, R. Taylor Arding et al. 1834. *The mineral conchology of Great Britain; or, coloured figures and descriptions of those remains of Testaceous animals or shells, which have been preserved at various times and depths in the Earth*. Vol. 7, London: B. Meredith [etc.]. https://www.biodiversitylibrary.org/item/212979#page/1/mode/1up. Accessed 30 April 2024.

Tomio, Daniela. 2012. *Circulando sentidos, pela escrita, nas aulas de ciências*. https://repositorio.ufsc.br/handle/123456789/103421. Accessed 30 April 2024.

van Wyhe, John. 2007. Mind the gap: did Darwin avoid publishing his theory for many years? *Notes and Records of the Royal Society* 61: 177–205. https://doi.org/10.1098/rsnr.2006.0171.

Veak, Tyler. 2003. Exploring Darwin's correspondence: Some important but lesser Correspondents and projects. *Faculty Publications and Presentations.* https://digitalcommons.liberty.edu/lib_fac_pubs/12/. Accessed 30 April 2024.