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A generalized historical trajectory for Charles Darwin's specimen collections, with a case study of his coral reef specimen list in the Natural History Museum, London.

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A generalised historical trajectory for Charles Darwin's specimen collections, with a case study of his coral reef specimen list in the Natural History Museum, London.

The passion for collecting, which leads a man to be a systematic naturalist, a virtuoso or a miser, was very strong in me, & was clearly innate, as none of my sisters or brother ever had this taste.

Charles Darwin (1876, CUL-DAR26.1-121, and Barlow (1958, p.23)

It is also evident that much remains to be discovered regarding where specimens are and how they arrived.

D.M. Porter (1985, p. 994) on Charles Darwin's specimen collections

1. *Aims and background*

How strange, even ironic, is the contrast in the two epigraph quotations above: the first by Charles Darwin himself, one of the most eminent scientists and naturalists in the history of biology and geology, confessing his own dedication to (not to say obsession with) making scientific collections. The second is by the Darwin historian and botanist, Duncan Porter, writing over a century later, reflecting how insufficient is our current knowledge of where exactly Darwin's collections now reside. We can speculate on Darwin's dismay were he to know now just how incomplete our knowledge still is about the whereabouts of all his specimen collections, while noting a second irony that Darwin felt he had little choice but to scatter them in

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the first place. This arose primarily from his frustrated search for able and willing specialists to work on his *Beagle* collections, and his complaints about the problem are well documented (e.g. Porter 1985).

Our paper arises from a task commissioned of one of us (BRR) by the Natural History Museum in London (NHM) to fill in some of the gaps in our knowledge about Darwin's collections by compiling those in its own care. While much has been completed of this compilation, work is still in progress (an interim summary is given in Appendix 1). However, to give this project further meaning, historical context was also needed about these collections, and this paper concentrates on context.

While the history of Darwin's collections is known, at least broadly, to most Darwin specialists, those who are seeking to study particular specimens and their history need to make detailed investigations, particularly into the different links between Darwin's writings, both published and unpublished, and his collections, especially at specimen level. Establishing these links proved quite complex. In the case of Darwin's *Beagle* collections in particular, the relevant information is scattered through diaries, notebooks, miscellaneous manuscripts, field books and numerous specimen compilations. Much of this legacy still remains available only as original manuscripts.

It also seemed that the very wealth of post-Darwin literature about his work and achievements, with its general emphasis on retrospective assessment and interpretation, has displaced or even obscured seemingly more mundane compilations of raw historical facts, especially about his specimens and collections. Although most of the relevant writings are probably well known to Darwin scholars and biographers, this legacy is actually scattered and disparate, and the connections between all the different relevant items not very clear, especially to those who are engaging with it for the first time. This is a major obstacle from the point of view of people like museum curators and those who do specimen-based research, who need to be able to compile relevant information about specimens in a consistent and methodical way. A guide therefore seemed to be needed to help to connect the writings with the specimens. Our paper is intended to be a step in this direction. Also, as unsuspected

'discoveries' and clarifications emerged when we started working with Darwin's specimen lists, we felt these merited publication in their own right.

This paper is therefore intended to help someone find information about any given specimen of Darwin's by reference to the records he left, starting with the moment when he collected it, through subsequent compilations and studies by others as well as himself, to eventual acquisition by a museum or other institution. However, a 'trail' like this for every specimen is potentially different and could only be tackled realistically with electronic tools like databases. So as a first step, one of us (BRR) has devised a generalised trail for working with Darwin's collections, referred to here as a 'generalised historical trajectory' for his *Beagle* collections in particular.

This should be of value not just to those who wish to study Darwin's specimens in their historical context, but also those like taxonomists who have their own specialist research interests in the specimens. Those with wider historical and biographical interests in Darwin may also find such a trajectory useful. Thus, although specimens were the starting point for this project, others whose studies start with Darwin's writings, or writings about him, might also find that a trajectory would help them track back from writings to specimens.

There are potential applied interests too, since there has been an upsurge in interest in using older collections in museums to derive information about ecological and environmental changes during historical time (Johnson *et al.*, 2010), e.g. Hua *et al.*. (2004) used one of Darwin's corals from Cocos (Keeling) (see Section 4) to calibrate marine reservoir age of ^{14}C. This kind of project usually requires specimens which are accompanied by good locality information and other relevant documentation. In many museums, this is missing or inadequate in older specimens (not just in Darwin's case) – or only seemingly so. The principle of a generalised historical trajectory for collections should actually help to recover or improve information about historical specimens, not only in the case of Darwin's collections, but also those of others too.

In many respects, our paper builds on Porter's (1985) account of Darwin's

Beagle collections. Undoubtedly too, our aim was made much easier to achieve than it would have been in the past, because of the availability of most of the relevant writings of Darwin in published or web-based facsimiles and transcripts, notably *Darwin Online*. Our particular aims and results here are:

1. To present a generalized historical trajectory for Darwin's specimen collections, based mostly on his *Beagle* collections, though potentially expandable to his other collections.
2. To provide a schematic synthesis of Darwin's own specimen lists.
3. To provide a case study of one particular specimen list (so-called "list of Darwin's corals"), which has not previously been published as images or transcript, and whose history and purpose has not previously been understood.

2. Broader context

2.1. Current status of studies of Darwin's specimens

Obviously, there is an almost universal interest in Darwin as a key figure in the history of science, and with the ensuing impact of his ideas on society and history generally. There is clearly also a wider fascination with Darwin as an individual case history of human creativity in general and scientific creativity in particular. In consequence, Darwin scholars have long been diligent, even exhaustive, in mining his original writings (both published and manuscript), and the relevant resources for this are now impressive (e.g. *Darwin Online*). It is a realistic prediction that in the conceivable future, there will be very little of Darwin's manuscript material which will not have been published or made available on-line, e.g. *Darwin Correspondence Project*).

Most people are therefore aware that Charles Darwin was a prolific researcher and writer who left a huge legacy of famous ground-breaking published work as well as numerous letters and unpublished manuscripts. For the general public at least, it is probably less well-known that Darwin was also equally a prolific collector of geological and biological material

- not just Galápagos birds and not only while he was on HMS *Beagle*. And yet, with some notable exceptions referred to below, the 'Darwin industry' has been almost continuously evaluating, reassessing and celebrating his huge contribution, more through his written work and ideas, than through his specimens. In contrast to Darwin's written legacy, a comprehensive historical treatment of all his specimens and their accompanying documentation, is still a distant prospect, not least because there is no single, readily available 'one-stop' compilation of all the specimens themselves.

It could also be argued that Darwin's work has by now received so much historical, scientific and scholarly attention, especially during these recent years around his bicentenary (2009), that even if his specimens have been neglected, study of them would surely now add very little to what we already know about the man and his work. Admittedly, this might well apply to some of Darwin's most well-known specimens (e.g. *Beagle* birds), but for his collections in their entirety, this is only really an *a priori* assumption. In fact, many of Darwin's specimens have not been re-studied in a historical context at all, including much of his geological and marine invertebrate material – rather ironically, given that early during his *Beagle* time, he wrote to Henslow on May 18th 1832 (Barlow 1967, p.54) that "Geology & the invertebrate animals will be my chief subject of pursuit through the whole voyage" (and this is matched by his own records and collecting). Nevertheless, it is not an aim of the present paper to offer historical evaluations of Darwin's specimens, but rather to provide information and a framework which might facilitate that.

Normally, studies of specimens are the province of those with specialist expertise relating to the specimens as samples. In the case of Darwin's specimens, these would include taxonomists, palaeontologists or petrologists. The specialists are generally studying specimens for their intrinsic scientific characteristics and working within their own contemporary scientific context. They are not necessarily interested in the historical significance of the specimens. This is different from, though not mutually exclusive to, studies of specimens retrospectively, i.e. in their historical and biographical context, and as heritage objects. We refer to this retrospective approach as 'historical studies of specimens'. The focus of these studies is

therefore on the collector (in this case, Darwin), on the context provided by the relevant work of that collector, and perhaps also extends to the work of that collector's contemporaries and those who have previously worked retrospectively on the specimens. Nevertheless, we recognize that the historical significance of a given specimen is often also treated in the course of a scientific study (especially in revisionary taxonomy). Conversely, good historical understanding of a specimen should in theory at least, benefit from a technical understanding of the specimen too.

As noted at the outset however, there is no single source of information either at specimen or collection level, about where all, or even most of, Darwin's specimens are now located, though a valuable start at collection level was made by Porter (1985). Study of Darwin's specimens, in whatever context, has also been very lop-sided (compare his *Beagle* birds with his marine invertebrates (Table 2)).

2.2. Why do historical studies of Darwin's specimens matter?

The importance of specimens is widely accepted and taken for granted by those, like museum curators and researchers, whose work is specimen-based. On the other hand, non-specialists and those approaching Darwin's work from his writings may be less imbued with the workings of museum-based science and wonder why his specimens matter beyond their sheer value as heritage objects. In the wider socio-economic sphere, those with a responsibility for care and study of collections also find themselves ever sometimes having to justify their work, and the facilities needed for keeping collections. It is therefore useful to reiterate here the importance of specimens, in this case, in the context of Darwin.

Going back long before Darwin's time, there had already been a long tradition of collecting specimens, not just for their possible monetary value, aesthetics, projected symbolism, and as curios, but as an integral part of the sciences related to them. Specimens are appositional to many scientific observations and ideas, in their role as raw data and evidence. Cognitive feedbacks (explicit or implicit) between a scientists' use of specimens, and their observations and ideas, are often critical for the scientist concerned as well for those interested in that person's work. All this is particularly

true in the subjects which interested Darwin, like geology, taxonomy and natural history, because they draw strongly on the concrete evidence which specimens provide, most obviously, for example, in the use of fossils to determine the relative age of geological strata.

Moreover, as long as specimens are deposited, documented and conserved in well-maintained collections, they provide enduring evidence which can continue to be accessed, both by the original observer and collector during their lifetime, as well as by contemporary and later scholars and scientists. Specimens can be studied and re-studied indefinitely without necessarily having to revisit the often distant and difficult localities which yielded them. Their substantive and objective value stands, regardless of what differing interpretations are placed on them by the original collector or by anyone else.

It follows that evaluations of Darwin's work should, ideally, also try to encompass his specimens, wherever relevant. Given Darwin's eminence, his specimens also have (or should have) particular retrospective interest. This applies regardless of whether subsequent study of them confirms or conflicts with how he interpreted them, or even if a specimen proves in retrospect to be simply too poor or trivial to have much significance at all. But all such possibilities are potentially significant in their own historical right. Darwin's own notes on his collecting and specimens often demonstrate their close relationship to his thinking, as is well illustrated his *Zoological Diary* (Keynes 2000). Porter (1985) has given a very useful overview of Darwin's collecting and collections, in particular relation to the *Beagle* voyage. For his geological work, Herbert (2005, Chapter 3) gives an excellent account of Darwin as a collector and of the role and significance of his geological specimens. The essay by Richmond (2007) expresses well the value of understanding specimens in relation to ideas, in the particular and important case of Darwin's barnacle studies, which, incidentally leads us to suggest that a historical study of Darwin's barnacle specimens is well overdue.

Without specimens, a scientific collector (and those that follow) would have to depend entirely on the collector's own recorded observations alone. Darwin's observations are famously careful and astute in many

instances, but as with any field scientist, and as he expressed it himself in advising other collectors, "Let the collector's motto be, 'Trust nothing to the memory ….' ") (Darwin 1839, pp. 598-9). Memories are subject to chance circumstances and distractions, perceptual biases, and personal factors including quality of expression in recording information. Fortunately, since specimens are a vital part of the subjects which interested Darwin, we have the opportunity to pass behind these possible hazards of memory and Darwin's own written records and interpretations, into the concrete world of his specimen legacy.

2.3. Impediments to historical studies of Darwin's specimens

Anyone with a serious intention to address the need expressed here for continued historical studies of Darwin's specimens, immediately encounters some practical, albeit sometimes mundane, difficulties which can make the task a logistic, scientific and scholarly obstacle course. Uncertainties can also accumulate along the way, whether one works forwards from his original observations and documentation, or backwards from his specimens as stored in a museum collection. Indeed this may be part of the reason why historical studies of his specimens seem to have lagged behind those of his writings.

Godfray (2002) has discussed the procedural and bibliographic problems which beset the taxonomic sciences, obliging taxonomists to delve into all the previous relevant, but often arcane, literature going back if necessary through two and half centuries or so of relevant taxonomic publications, to those of Linnaeus (1707-1778) himself. The task can be painstaking, time-consuming and potentially frustrating. The problem is also exacerbated by the parallel task of locating all the relevant specimens, often in small and not well-known museums. Many of the same problems also apply to historical studies of specimens and the relevant literature in their own right.

In spite of (or perhaps even because of) the large amount of information which is already available about Darwin's work, his substantial legacy of diaries, notes and notebooks can be quite confusing for specimen-based specialists like curators and taxonomists. Although Darwin was very

methodical, the relevant information is complicated. In particular, his primary source of specimen information is spread over two different sets of inventories, each numbered in parallel from '1' to over '3000' respectively. This means that in theory at least, two different specimens might carry the same actual number. So when any given number is encountered on a specimen, or in a document or publication, it may not be clear which of the two numbering sequences it belonged to, 'wet' or 'dry', though geological specimens in particular can generally be assumed to be 'dry' (this is further explained in Section 3.3). Also, for any given specimen, the relevant information in diaries, notes and lists might also be different though complementary, and not necessarily identical to what is found on its label(s). While initially this may all be a source of frustration, the net total information, when eventually extracted from all possible sources, potentially enriches what is known about a specimen.

In the course of being studied, Darwin's specimens passed along many different routes and through the hands of many individuals and institutions, including museums which now no longer exist (Section 3.6). Reflecting this history, Darwin's collections are now relatively scattered, albeit still mostly within the British Isles (Porter 1985), e.g. NHM, Royal Botanic Gardens Kew, Universities of Cambridge and Oxford, Trinity College Dublin, British Geological Survey and Darwin's own former adult home at Down House on the outskirts of London. No single simple estimate or record exists of which institutions hold which of Darwin's collections according to their basic scientific categories (e.g. rocks, minerals, fossils, plants, animals) let alone in more detailed systematic categories, nor in relation to Darwin's specimen lists (Sections 3.4, 3.5, Tables 1, 2). In contrast with Darwin's publication and manuscript legacy, there is no comprehensive, widely available, basic compilation of all of Darwin's specimens and their locations, and only a few institutions to date have made publicly accessible compilations of what they have, e.g. his collections (mostly zoological) at the Oxford University Museum (Chancellor *et al*., 1988), and his rocks at BGS (*British Geological Survey Rock Collections*).

So having established by one means or another, that a particular Darwin collection is kept in a particular institution, the next problem is

to locate the actual specimens. Non-specialists, and perhaps those more familiar with art collections, are sometimes surprised to discover that one can only rarely go to a museum and ask to see all or most of the material relating to a single person, or expect a museum to provide quickly a list of the person's material which they hold, and where it is stored. This is because most scientific museums organize their collections under different scientific and practical categories and only rarely by collector, however famous or important that collector may be. In any case, a person's fame and importance may have emerged some time after their collection has been acquired and split into its categories. The task of retrieving or locating it in entirely is therefore likely to be slow, often requiring specialist curatorial knowledge.

If a museum does keep a collector's material together at all, it is usually because it, or a subset of it, falls neatly into one of the scientific or geographical categories which that museum uses for organizing its collections generally. There are therefore a few subsets of Darwin's collections which can still be found all in one place, in various museums including the NHM, like his coral reef specimens (Section 4) and his fossil woods (item 2.18 in Table 2). Nevertheless, searching out Darwin's specimens is also complicated by the fact that institutions which now house (or which previously housed) his collections have usually also given his specimens their own numbers (as with other collectors). There are understandable reasons for this, but it is now also best museum practice to retain all previous labels, numbers and documentation for specimens. This has not always happened in the past. Unless there is unambiguous indication on original labels or other accompanying documentation, uncertainties can therefore arise about what material is actually Darwin's. Also while Darwin numbered most of his specimens in a methodical way, his numbering system, and the way in which he documented his specimens, needs to be properly understood too (Section 3.3).

Although the ultimate aim is to see and study the specimens themselves, another common approach to finding a particular collection is to start with the accession registers rather than the specimens. Museums generally register (accession) their material, and entries are usually made

firstly by the museum's own accession number and date of registration (not by date of collection or acquisition). The collector is generally recorded only as a subsidiary part of the registration routine. However, registers in larger museums contain tens of thousands of entries, so it can be an arduous matter to search them for a particular person's material, without prior clues like date of acquisition or registration. Ideally these events should more or less match in time, but this should not be assumed, since date of entry may lag considerably behind acquisition, or the relevant numbers may appear earlier in the register's date sequence if they have been allocated to specimens prior to formal accession.

Also, for various reasons, some material escapes the registration process altogether, while other material arrives by a such a circuitous route that the original information and collector may be incomplete or lost on the way. It is sometimes recoverable hrough research, and in Darwin's case, the present trajectory (Section 3) might help with this. For these reasons, use of registers can be of limited practical use in searching for a particular person's collections. Fortunately, in many cases, curators have over many years, often made secondary indexes to material of wider thematic interest, such as Darwin's collections. Also the entire registration process has been changing in recent years as searchable electronic media are being increasingly adopted as the standard method of museum registration, recording of specimen information, and for retrospective transcription of older registers. This will transform and greatly facilitate the task of searching the collections themselves for particular collectors' specimens.

A third approach to locating and compiling someone's specimens is to start with publications about a collector's material, since in taxonomic works at least, it is usual to cite particular specimen numbers and collectors. In this case, one first has to establish if the cited numbers are an author's original ones, or are the numbers given by individuals or institutions who subsequently acquired them, perhaps several times round, and there are the additional aspects of Darwin's numbering system (above) to deal with too. In any case, aside from the five-volume work, *Zoology of the Beagle*, treating amphibians and reptiles (Bell 1842-1843), fish (Jenyns 1840-1842), birds (Gould 1838-1841) and mammals (Owen 1838-1840, Waterhouse

1838-1839), and Darwin's monographs on living (Darwin 1852, 1854) and fossil barnacles (Darwin 1851, 1855), his collections have been treated in a widely scattered literature, and in some cases, not at all.

Separately from the foregoing curatorial and historical impediments there is also the practical issue that historical study of scientific specimens like Darwin's ideally requires detailed relevant expertise in the class of things to which they belong — usually in Darwin's case, scientific subjects like petrology, structural geology, tectonics and the taxonomy of various groups of plants and animals. However, the knowledge and backgrounds of many of those who have evaluated Darwin's work over the years has been in the humanities, especially history and biography. In this respect, a whole dimension of understanding how Darwin worked would seem so far to have been somewhat one-sided. In any case, unless someone has combined expertise, detailed historical study of scientific specimens is probably best done as a multidisciplinary collaboration (e.g. Chancellor *et al.* 1988, Herbert *et al.* 2009).

3. Towards a generalized historical trajectory of Darwin's collections

3.1. Summary of trajectory phases

To locate any given specimen of Darwin's, and to determine its historical status, it is necessary to explore a series of actual or probable historical connections which might lead to information about (1) the location and circumstances of its collection point, such as field observations, labels, specimen lists and accession records, (2) the one or more successive locations where it has been kept or deposited between the time when it was collected and its final (current) place of deposition, and (3) any relevant writings or records by Darwin or other authors which refer to it. These connections do not necessarily have to explored in this sequence. Moreover the logic of the connections is not necessarily strictly chronological, but crosses both time and space. Museum curators and researchers would most likely start with Darwin's specimens themselves (as we did), while others might start with those of his writings which refer to his specimens. It is for these reasons that we have referred to these kinds of connections

as a 'trajectory' rather than a 'history' or 'chronology'.

The general aim of such a trajectory, such as the one we present here for Darwin's collections (Section 3), is to use it, in effect, as a check-list of things to do, in order to make as complete as possible a compilation of all the available information about the same (or, one hopes, the same – it is not always possible to be certain) given specimen or collection. Such an approach would not of course be unique to Darwin's specimens. It would be useful in studying specimens of many other collectors, and not necessarily those of the distant past, or for purely historical studies of their specimens.

Porter's (1985) account of Darwin's *Beagle* collecting and collections, provided us with an initial narrative for our present 'generalized historical trajectory', especially Porter's sequence of headings which lead from Darwin's collecting and listing of specimens to their eventual deposition in various museums and other institutions. Further relevant information for the concept of a trajectory was derived from the work of Porter (1987), Smith (1987), Keynes (2000) and Herbert (2005). In this paper, we have therefore mostly not repeated the same details found in these publications, apart from what we felt necessary for completeness' sake in setting out the trajectory.

Our trajectory is given below in as a set of phases (i.e. not necessarily chronological, in a strict sense) representing the history and documentation of Darwin's collections, especially those he assembled during his *Beagle* voyage.

1. DIARIES AND NOTEBOOKS. Darwin made his immediate observations in various diaries and field notebooks.
2. SPECIMEN COLLECTIONS AND NUMBERS. Darwin and contemporary associates, especially during the *Beagle* voyage, and especially with his assistant, Syms Covington, assembled a numbered collection of geological and natural history specimens which Darwin cited by number in various diaries and notebooks.
3. *PRIMARY SPECIMEN LISTS*. Towards the end of the *Beagle* voyage, Darwin and Covington extracted from Darwin's diaries and notebooks,

two sets of primary lists, one for dry material including geological specimens and one for wet material ("In spirits of wine").

4. *SECONDARY SPECIMEN LISTS*. Still on the *Beagle*, and shortly after, Darwin and Covington extracted further specialist lists (i.e. secondary lists) from the *Primary Specimen Lists*. Most of these were intended for use by possible specialists for whom Darwin envisaged a likely research interest.
5. DISTRIBUTION TO OTHER SPECIALISTS. Darwin distributed (or tried to distribute) many of his specimens to specialists with relevant research interests, aiming to get them studied and published.
6. POST-*BEAGLE* ADDITIONS. Darwin acquired further post-*Beagle* specimens, many from other specialists or people interested in helping him with his own studies (e.g. barnacles, beetles, domestic birds).
7. PUBLICATIONS. Darwin and many others published scientific studies of many of his collections.
8. MUSEUM DEPOSITION. In many cases, further authors and institutions acquired different parts of Darwin's collections, directly or indirectly, both during his lifetime and also posthumously, often applying their own numbering system to them in the process of cataloguing them.
9. RETROSPECTIVE STUDIES. Later authors made (and are still making, as here) retrospective studies of Darwin's collecting and collections, e.g. edited transcriptions of Darwin's original specimen lists and notes, sometimes combining this with detailed re-examination of the specimens themselves, historical accounts of the collections, and historical and scientific evaluations.

In addition, Darwin had long had a collecting interest since childhood, before he had embarked on the *Beagle*, and this might be added to the above phases in the future. It is also important to note that the trajectory is centred on Darwin himself, but of course, historical work usually also draws on the record of contemporaries especially those who accompanied or collaborated with a collector (e.g. in Darwin's case, Syms Covington, Captain FitzRoy, Adam Sedgwick), and of course commentators, and cor-

respondence between third parties. Use of such sources is too ramified and open-ended to capture in a simple trajectory.

Although the trajectory is broadly chronological, the phases are based on kinds of activity which followed each other logistically and logically, rather than in strict historical sequence. And of course the phases do not all apply routinely to every one of Darwin's specimens or collections. Further details of some of these phases follow below. Fuller treatment, especially covering the work of other authors who have researched Phases 5 onward, and the work of those who have studied Darwin's material, is beyond present scope.

3.2. Phase 1: Diaries and field notebooks

Darwin recorded his initial ongoing observations in his *Beagle Diary* (Darwin 1831-1836 in Keynes 1988). This is primarily a record of Darwin's journey, with only indirect or occasional reference to scientific specimens, and Darwin does not actually cite specimen numbers in it. From the point of view of specimens, the main importance of this diary is the wider context it provides. Much more importantly for specimens in particular, Darwin also kept zoological and geological diaries, these being where he first cites his specimen numbers against particular observations. The zoological one, *Diary of observations on zoology of the places visited during the voyage* [of the *Beagle*] (1832-1836) (in Keynes 2000), is often referred to in short as his *Zoological Diary*). Note that Keynes refers to the *Zoological Diary* as Darwin's *Zoology Notes*, but '*Diary*' is preferred here.) Although not indicated in the title, the *Zoological Diary* also includes Darwin's botanical observations, which amount to roughly a fifth of the content (Porter 1985).

For geology, Darwin kept *A diary of observations on the geology of the places visited during the voyage* [of the *Beagle*] (1832-1834) (CUL DAR32-33), and this is often referred to in short as Darwin's *Geological Diary*. It does not cover the later part of the voyage, for which Darwin kept supplementary *Geology Notes* (CUL DAR34-38). The combined length of his geological records famously far exceeds the length of his biological records. Porter (1985, p.984) estimates that the annual ratio of his

Beagle records for geology and biology respectively was between 2 and 11.5, respectively, apart from 1832. Darwin's greater devotion to geology often surprises those who regard him first and foremost as a biologist. Nevertheless, no complete published reproduction or transcription of these geological records seems to exist yet. In addition, Darwin kept 15 *Field Notebooks* for his on-shore field observations (Chancellor *et al*. 2009). These are distinct from his three diaries above, and although the observations are very specific to both organisms and rocks, they only rarely contain citations of specimen numbers. Note that although Darwin cited his specimens by number when he mentions them, the above records are not inventories as such. Fortunately, Darwin evidently also felt the need to generate true inventories (as below).

Not included as a separate phase here, mention should also be made of Darwin's prolific letter writing, in this case during his *Beagle* time. His letters often include observations which can be related to actual specimens, albeit by inference from relevant records and inventories where he cites their specimen numbers.

3.3. Phase 2: Specimen collections and numbers

During the *Beagle* voyage in particular, Darwin collected many of his specimens in conjunction with other people, or was directly assisted by others, especially Syms Covington, Darwin's assistant and servant. Porter (1985) says that Covington actually collected the bulk of Darwin's vertebrates. Porter and Pearn (2009) also cite the contributions of many others on the *Beagle*, including Captain FitzRoy himself. FitzRoy also famously upbraided Darwin for his meagre acknowledgement of the help and contribution of his *Beagl*e colleagues. Darwin was also given substantial amounts of material by other people during his post-*Beagle* lifetime, especially beetles and barnacles. This means that there is often a fuzzy boundary between what was literally collected by Darwin himself, and other material associated with him, or collected for him, all of which have usually been referred to as 'Darwin's specimens' if only as curatorial shorthand. In any case, the primary origin of some possible or probable Darwin specimens in museums is not always clear especially where original labels have been lost or

where it has been difficult to establish retrospectively a direct relationship between specimens and Darwin's notes and diaries. Taking these points together, it is therefore convenient for present purposes to refer to all such material collectively as 'Darwin-related' collections.

At least one reason why the sequence of specimen numbers which Darwin used in all his diaries, notes and notebooks does not correspond strictly to the chronology of his observations, is that he used pre-prepared numbers and attached them to his specimens as he went along. So it was probably fortuitous which particular number he gave to a particular specimen. But in any case, he used two parallel sets of numbers for 'dry' and 'wet' material respectively, both starting from '1', And in the case of the 'dry' material, he sometimes omitted the digit representing the thousands (the 'thousand-prefix') because this was already indicated by his colour coding system. Darwin's numbering system has been explained by many previous authors but for completeness' sake, it is summarized again here. It is essential to understand it properly if mistakes and unnecessary problems are to be avoided, e.g. Porter (2010) in reference to Thomas (2009).

Darwin used one of his sets of numbers for material (always biological) which he preserved in 'spirits of wine', i.e. wet material. He used his other set of numbers for all his other (i.e. dry) specimens, whether geological or biological. Within the dry material, he did not use any kind of partitioning scheme for differentiating numbers of his biological specimens from those of his geological ones, even though he mostly kept his observations of the two subjects apart. In this respect, allocation of dry numbers to geological or biological specimens was evidently arbitrary.

As is well known (e.g. Herbert 2005, Porter 1987, Smith 1987), the dry numbers were preprinted on four different coloured tags where the colours represent the thousand-prefix:

white (0---, i.e. [000]1-[0]999)

red (1---, i.e. 1000-1999)

green (2---, i.e. 2000-2999)

yellow (3---- i.e. 3000-3999)

As explained by the above authors, Darwin set out this system at the start of various specimen lists, though in setting it out in his shell list (2.05 in Table 2), Darwin made a mistake with his explanatory example, writing, "For instance the number 242 printed on yellow paper has the value of 2000 + 242 = 2242". He should have written "3000 + 242 = 3242" (pers.comm. Phil Stone, British Geological Survey). The dry number tags are generally easily recognizable by their style, being rectangular and almost completely occupied by the number itself, printed in a font not unlike 'Modern No. 20' (e.g. **3242**) in bold, and clearly not hand-written. These labels have not often been illustrated, but see the inset in Fig. 19 in Smith (1987).

In the case of 3000-3999, Darwin evidently did not use up the whole batch. In neither his wet nor dry list did Darwin seem to use numbers beyond 3999, so assuming he used all or most of the available intervening numbers for both lists, and that he did not have a significantly large number of specimens which were not covered by these lists, a working total for numbered *Beagle* specimens would is less than 8000. However, this takes no account of when he used a single specimen number for a batch of specimens, so the real total would be much higher. The NHM alone holds at least 14,000 actual items (Appendix 1) though many of these consist of post-*Beagle* insects and barnacles.

It follows from his use of his bipartite parallel numbering scheme that there is possible ambiguity in how one reads any particular specimen number of Darwin's. One needs to check if Darwin and, where applicable, Covington (see below) are referring to wet or dry material. Also, when they cite any specimen number less than 1000, the reader also needs to check whether this can be taken at face value (i.e. in the range 1-999), or whether they simply omitted the thousand-prefix. In the latter case, the correct prefix may have been indicated in some other way, e.g. in Darwin's *List of Fossil Woods* (2.18, Table 2; van Wyhe 2010, Porter 2010), he omitted the thousand-prefix from his specimen numbers, but indicated the relevant colour within the list itself. Fortunately, for any specimen where there is a possible 'wet/dry' ambiguity in a secondary list, it is usually relatively easy to eliminate one of the possibilities by checking in both Darwin's wet and dry *Primary Specimen Lists* (see below and Table 1), for a complementary entry.

3.4. Phase 3: Primary Specimen Lists

According to Porter (1985), towards the end of the *Beagle* voyage, Darwin and Covington extracted from Darwin's diaries and field notebooks, two sets of inventories in numerical order, one for the dry specimens, and one for those in spirits. There are ten in all. There appears to be no

Table 1*: Darwin's* Primary Specimen Lists *(PS Lists) (see text for explanation), based on Porter (1985), Keynes (2000) and* Darwin Online.

ATTRIBUTED NUMBERING OF LISTS (THIS PAPER)	TITLE OR STANDARD REFERENCE	LOCATION / REFERENCE	NOTES	SPECIMEN NUMBER SERIES
1.01 - 1.04	*Geological Specimen Notebooks*	CUL DAR 236		Dry
1.05 - 1.07	*Catalogue for Specimens in Spirits of Wine (Specimen Notebooks* 1-3*)*	Down House Notebooks 63.1, 63.2, 63.3 (Specimens in Spirits of Wine)	c. 80% zoological 20% botanical specimens	Wet
1.08 -1.10	*Printed Numbers (Specimen Notebooks 4-6)*	Down House Notebooks 63.4, 63.5, 63.6 (Specimens not in Spirits)	Dried biological collections (c. 80% zoological, 20% botanical)	Dry

Darwin used the same run of specimen numbers for his 'dry series' of biological specimens (items 1.08-1.10) as for his geological specimens (items 1.01-1.04). Items 1.01-1.04 not yet published or on line. For images and transcripts of items 1.05 - 1.07, see *Darwin Online* and Keynes (2000, pp. 321-369), and for 1.08-1.10 see same and Keynes (2000, pp. 370-421)

First column: Grouping of items is based on self-evident functional distinctions between the lists. Individual lists within the groups notionally correspond respectively to an individual list cited in the third column, e.g. item 1.06 corresponds to 63.2.

Second column: titles or attributed titles of lists, as in above references.

Third column: Numbering of Down House notebooks is after Keynes (2000). CUL DAR – Cambridge University Library reference to Darwin MSS.

Fourth column: Wet – "in spirits of wine" (i.e. alcohol). Wet/Dry categories based on titles of lists and related information.

generally accepted, convenient, collective name for these, so we designate them here as Darwin's *Primary Specimen Lists* (*PS Lists*) and have itemized them as 1.01-1.10 in Table 1. The first digit in this numbering system indicates their primary status. The present numbering of these lists is for the convenience of the present paper and has no further significance. The specimen numbers in the dry specimen lists always seem to include the thousand-prefix.

The combined dry *PS Lists* consist of four geological ones (1.01 - 1.04) together with the second trio of the six biological ones (1.08 - 1.10), seven in all. The wet *PS Lists* consist of the first trio of the biological ones (1.05 - 1.07). Of the total ten *PS Lists*, we have not yet seen Darwin's geological ones, but we have inferred that they included Darwin's fossils and that he did not make a separate inventory for them. Also, about a fifth of the content of the biological *PS Lists* actually concerns botanical specimens (Porter 1985, p.984). In retrospect, the methodical nature of this whole exercise by Darwin and Covington does not necessarily exclude the possibility of a few small 'stray' primary lists, i.e. additional lists of material not included in the above main set of ten, e.g. in Table 2: items 2.12 (further discussed in Section 4.5) and 2.20). However, these examples need to be checked against the contents of Darwin's *Geological Specimen Notebooks* to confirm whether or not he had first listed their respective specimens there.

3.5. Phase 4: Secondary Specimen Lists

As Porter (1985) and others have explained, Darwin and Covington extracted a further set of lists from the *PS Lists*, each one of which was usually dedicated to a particular category, generally a higher level phyletic group like birds, insects, etc. As with the *PS Lists* above, they kept dry and wet material apart in different lists. Darwin and Covington also continued compiling these secondary lists after their return from the *Beagle* voyage. Also, as with the *PS Lists*, there appears to be no generally accepted, convenient, collective name for these, so we designate them here as Darwin's *Secondary Specimen Lists* (*SS Lists*) and have itemized them as 2.01-2.27 in Table 2. The first digit indicates their secondary status. Our numbering is

Table 2

ATTRIBUTED NUMBERING OF LISTS (THIS PAPER)	TITLE OR ATTRIBUTED TITLE	LOCATION / REFERENCE	NOTES ON THE LISTS	SPECIMEN NUMBER SERIES
2.01 (R)	*Beagle animal notes*	CULDAR29.1.A1-A48 (6)	Actually only mammals if DAR29.1.A49 excluded (6)	Dry
2.02 (R)	*Fish in Spirits of wine* […. etc.]	CULDAR29.1.B1a & CUL DAR29.1. B1b-B20	Pauly (2004)	Wet
2.03 (R)	*Shells in Spirits of wine*	CUL-DAR29.1.D1-D8	Mostly numerous invertebrate groups (1)	Wet
2.04 (R)	*Ornithological notes*	CUL DAR 29.2	Sulloway (1982) Steinheimer (2004)	Dry
2.05 (R)	*Shells* [&] *List of Mr Darwin's Shells*	CULDAR29.3.1 & CULDAR29.3.3	Mostly bivalves and gastropods (2)	Dry
2.06 (R)	*Insects in Spirits of Wine* [… etc.]	CUL-DAR29.3.44	Includes mites (acari) Smith (1987,1996)	Wet
2.07 (R)	*Mammalia in Spirits of Wine* [...etc.]	CUL-DAR29.3.76-77		Wet
2.08 (R)	*Birds &c &c in Spirits of Wine*	CUL DAR 29.3 [in part: (3)]	Sulloway (1982) Steinheimer (2004) (3)	Wet
2.09 (R)	*Plants* [OR] *Plant Notes*	CU Herbarium	Porter (1987)	Dry
2.10 (R)	*Reptiles in spirits of wine* (4)	NHM(Z) MSS DAR itemid 178530	Includes amphibians. Donoso-Barros (1975)	Wet
2.11 (R)	*Insect Notes* [OR] *Copy of Darwin's notes in reference to Insects collected by him*	NHM(E) itemid 341187-1001	Smith (1987, 1996)	Dry

ATTRIBUTED NUMBERING OF LISTS (THIS PAPER)	TITLE OR ATTRIBUTED TITLE	LOCATION / REFERENCE	NOTES ON THE LISTS	SPECIMEN NUMBER SERIES
2.12 (M)	*Coral Reef Specimen List* [OR previously] "*list of Darwin's corals*"	NHM(Z) MSS DAR A	Includes algae, corals and rocks. (5)	? (5)
2.13 (R)	*Diodon - Bahia*	CUL-DAR29.1.A49	Fish. (6)	Wet
2.14 (R)	*Insecta. June*	CUL-DAR29.1.C1	Smith (1987, 1996) (7)	Wet
2.15 (R)	*Pediculus. Chiloe. July*	CUL-DAR29.1.C2	Insect. Smith (1987) (8)	Wet
2.16 (R)	*Plants in Spirits of Wine*		List not yet found (Porter 1985, p.988, 1987). (9)	Wet
2.17 (R)	*Crustaceans in Spirits of Wine*		List not yet found (Porter 1985, pp.988, 1009).	Wet
2.18 (R)	*List of Fossil Woods ….*	NHM(PSL) NHM-408865-1001	Thomas (2009), van Wyhe (2010). (10)	Dry
2.19 (R)	*Coralline Algae Notes*	TCDH	List within letter, Darwin to Harvey (Porter 1987 pp.186 ff)	Dry
2.20 (?R/?M)	*List of Cape de Verd shells*	CUL-DAR29.3.2	Bivalves and gastropods (11)	?Dry (11)
2.21 (?R/?M)	*Shells [enumeration and description of specimens collected]*	CUL-DAR29.3.4-8	(12)	Dry
2.22 (M)	*Shells listed alphabetically* […. etc.]	CUL-DAR29.3.10-22	Actually a diary index (13)	N/A (13)

ATTRIBUTED NUMBERING OF LISTS (THIS PAPER)	TITLE OR ATTRIBUTED TITLE	LOCATION / REFERENCE	NOTES ON THE LISTS	SPECIMEN NUMBER SERIES
2.23 (M)	*[list of birds with some description and referenced ...]*	CUL DAR.3.31-33	Actually molluscs and insects (14)	Wet, Dry (14)
2.24 (?)	*part of descriptive inventory of shells* […. etc.]	CUL-DAR29.3.37-38	Actually insects (15)	N/A (15)
2.25 (M)	*list of contents of specimen boxes/ packets 1-8*	CUL-DAR29.3.41-42	Mostly algae and invertebrates (16)	Dry
2.26 (M)	*Box 1 Specimens originally in spirits*	CUL-DAR29.3.43	Algae and invertebrates (17)	Dry
2.27 (M)	*Catalogue of the appendages and other parts of Cirripedes, mounted as microscopical slides. (1854-5)*	UMZC-Histories3.454	(18)	(18)

Darwin's *Secondary Specimen Lists (SS Lists)* (see text for explanation). Most lists are not in Darwin's hand: compare 2.25 (which is) with 2.01 (which is not). Those not in Darwin's hand have been attributed by numerous authors to Syms Covington (see text). Numbers in parentheses in the table refer to the notes below.
First column: Lists categorized here as *SSR Lists* (i.e. for Darwin's research purposes) are based on criteria used by Porter (1985) (see text) and distinguished by an R-suffix, and those made for miscellaneous other purposes (*SSM Lists*) by an M-suffix. These categories are only suggestive, subject to further research. M- and R-suffixes are symbols, not an integral part of the numbering scheme. Sequence of items is not intended to be historically or scientifically significant, only as convenient identifiers. However sequence is as mentioned by Porter (1985, pp.987-988), then by Porter (1987), followed by additional lists not treated by Porter but as sequence used in the *Manuscripts* section of *Darwin Online*. Further information based on Keynes (2000).
Second column: titles or attributed titles of lists, mostly as used by *Darwin Online* or else by other sources above. Some titles shortened for convenience ("[…. etc.]")
Third column: Library references CU – Cambridge University. CUL DAR – Cambridge

University Library references to their holdings of Darwin's MSS, some with additional suffixes used by *Darwin Online*. CUH – Cambridge University Herbarium archives. NHM(E) – Natural History Museum, London (formerly British Museum (Natural History), Department of Entomology. NHM(PSL) – same, Department of Palaeontology, Seward Library. NHM(Z) – same, Department of Zoology. TCDH = Trinity College Dublin Herbarium archives. UMZC – University Museum of Zoology, Cambridge University. However, most lists with further information are now on *Darwin Online*, as transcriptions and/or images, with further possible additions in progress.
Fourth column: Includes selected key references which specifically treat a respective list, and summary of items in each list where not clear from the list title.
Fifth column: Wet – "in spirits of wine" (i.e. alcohol). Wet/Dry categories based on titles of lists, or otherwise by checking specimens against *PS Lists* 1.05-1.10 (Table 1).
Abbreviation: N/A – not applicable.
(1) Includes annelids, ascidians, bivalves, brachiopods, bryozoans, corals, crustacea including barnacles, echinoderms, fish, gastropods, sea anemones and tunicates.
(2) Seems to be what Porter (1985 p.987) referred to as "DAR 29.3 8pp", i.e. presumably the 2 pp. of introductory matter (CUL-DAR 29.3.1) which are separated from the 7 pp. of the list proper (CUL-DAR 29.3.3) by the 4 pp. of item 2.20 (DAR 29.3.2)). CUL-DAR 29.3.3 has heading statement in Darwin's hand: "N.B. The shells which I want out are marked with a cross || about 100 ||". See also item 2.21, for an additional shell (etc.) list, but note that items 2.22 and 2.24 though listed in *Darwin Online* as shell lists, are a diary index (note 13) and an insect list (note 15) respectively.
(3) This list was mentioned by Porter (1985, p.987) and though not separately itemized in *Darwin Online*, can be located therein as images 152-153 within CUL DAR 29.3.
(4) Full NHM Library entry: *Manuscript lists and notes by C.R. Darwin, J.E. Gray, T. Bell and Syms Covington relating to the Reptilia and Amphibia obtained by C.R. Darwin during the voyage of the Beagle*, and also "other title": *Reptiles in spirits of wine*.
(5) Both titles are attributed, as explained in the text etc. (Section 6, Figs 1-2, Appendix A2) where the title, contents, unusual nature of this list and its history, and reasons for categorizing it provisionally as a *SSM List*, are also discussed. All known relevant specimens are in NHM and now dry, but it is not yet clear whether any of the specimens were originally listed in Darwin's dry or wet *PS Lists*.
(6) Porter (1985, p.988) says this list (2.13) "is part of the Animal Notes" (i.e. 2.01), which is a dry specimen list, and *Darwin Online* similarly includes this as the final page (A49) of the *Beagle animal notes* (CUL-DAR29.1.A1-A49). But *Diodon* is a fish, and Darwin marked "F" (for fish) against the relevant specimen in his wet specimen *PS List* 1.05 (Table 1) (Keynes 2000, p.324). Therefore present list (2.13) seems more logically to belong with *Fish in Spirits of Wine* (i.e. 2.02).
(7) "June" in the title is only really the month of collection (in 1833), not title as such. Not really a list, but a description of a single wet sample (No. 328), text for which corresponds verbatim to an entry in Darwin's *Zoology Diary*, p.191 (Keynes 2000, pp.168, 331). Porter says: "part of the Insects in Spirits of Wine Notes" (i.e. 2.06 (CUL-DAR29.3.44)). Lawrence in Smith (1987 p.43) confirmed this is a true insect, i.e. a springtail or 'gunpowder mite', not a true mite.
(8) Title line actually also includes the month "July" (in 1834) (cf. "June" in 2.14). Not really

a list, but a description of a single sample of lice (inferred as wet specimen No. 1185), text for which corresponds almost verbatim to entry in Darwin's *Zoological Diary*, p.314 (Keynes 2000, p.283). See also Keynes (2000, p. 358), Smith (1987 pp. 43-44). Porter (1985, p.988) says this list is part of "DAR 29.3", whereas *Darwin Online* refers to it as part of 29.1 (see CUL-DAR 29.1.C2).

(9) Enigmatically, Porter (1985, p.988) says that this list is "probably" at Trinity College Dublin, but on p.1016 says it "perhaps would not *[sic]* have been sent to Harvey [Curator of the Herbarium, there, in Darwin's time] with these [algal] specimens."

(10) Thomas (2009) has recently drawn attention to the list. The full title is attributive and handwritten by W.N. Edwards (former curator of fossil plants NHM) on the folder containing these notes: *MS List of Fossil Woods Collected on the Voyage of the Beagle, 1832-6*. Edwards' accompanying note says "These woods are now in the Geol. Dept. [NHM]. They were transferred from the Bot. Dept. in 1898, & now registered under various numbers. No.1473 is missing. WNE." Specimens now in the Department of Palaeontology, NHM. See also text Section 3.

(11) List numbers (1-29) do not match either with those in Darwin's dry or his wet series of biological or geological material. List may refer to fossil molluscs from St.Jago. G.B. Sowerby (1844) identified Darwin's fossil molluscs from Cape Verde Islands, but although Darwin acknowledges Sowerby at the end of the present list, there is very little taxonomic overlap between this list and the names in Sowerby's Appendix.

(12) Includes annelids, barnacles, bivalves, corals and gastropods. List seems to be additional to the other list of dry *Shells* cited by Porter (1985, p.987) as "DAR 29.3 8pp." (see item 2.05 and note 2) but there is some overlap in the specimens between both lists.

(13) Full attributed title in Darwin Online appears unfinished: *(Shells listed alphabetically and indexed by their numbers in list of* [*sic*]. It is also not factually correct since list itself contains not only shells (molluscs etc.) but a large range of plants and other animals. Moreover, numbers and names do not correspond at all to those in Darwin's *PS Lists* etc. However numbers do match the page numbers in Darwin's *Zoological Diary* where the respective names are mentioned. So this is evidently an index to the *Diary* (not necessarily complete). Relevant specimen numbers can be inferred from the Diary (Keynes 2000).

(14) Of the four relevant images of this list in *Darwin Online*, images 1-2 is list of molluscs in spirits, including land slugs and snails, nudibranchs, and images 3-4 list insects not in spirits. So probably two separate lists respectively, but purpose and context not clear.

(15) Full attributed title in *Darwin Online*: *[part of descriptive inventory of shells collected by Darwin Charles Robert]*. Notwithstanding reference shells, list consists entirely of insects. No specimen numbers are included so it does not appear to be a true *SS List* at all.

(16) Appears to be a packing list for eight enumerated boxes (1-8). Specimens include annelids, bryozoans, coralline algae, corals, hydrozoans, insects (termites), octocorals, rat's head, and "shells". Specimens listed in this "Box 1" are different from those in "Box 1" in 2.26

(17) Appears to be a packing list which includes ascidians, bryozoans, codiacean algae (*Halimeda*), coralline algae, corals and echinoids. Specimens in this "Box 1" are different from those in "Box 1" in 2.25.

(18) Although strictly, this is a research-related list, we categorize this as a *SSM List* because it does not fulfill all of Porter's (1985) criteria (see text) as adopted here for designating *SSR Lists*. List is numbered in its own sequence, not matching those in Darwin's *PS Lists* (Table 1).

for convenience, but is based in part on previous listings, as explained in Table 2. Darwin and Covington transcribed or edited their entries in the *SS Lists* from the *PS* lists. Some entries are abbreviated, but others include relevant information from Darwin's various diaries, notes and notebooks. So entries in the *SS Lists* are not necessarily simple duplicates of those in the *PS Lists*. It is therefore useful when studying a given specimen (e.g. when starting from the generally small amount of information included on museum labels) to find and extract not only all the relevant entries in his *PS* and *SS* lists, but also any other relevant information in these and his other writings, published or unpublished, as covered in the present trajectory. In the first place, it is easiest of course to extract from those of Darwin's records where he cites the relevant specimen number. It may then also be possible to use that information to work through other records without cited specimen numbers, including Darwin's correspondence, to obtain further information.

Porter (1985, pp.987-988) and others have explained how and why some of these secondary lists were compiled. He infers, or knows, them to have been (1) extracted directly from the *PS Lists* above, (2) intended for various specialists whom Darwin knew or hoped would study the specimens in any given group, and also that they (3) "enumerate all specimens of its [phyletic] group collected on the [*Beagle*] voyage". However, as Porter acknowledges, Darwin made other kinds of secondary list which do not fit Porter's three criteria. In any case, it is not always obvious, without further research beyond present scope, to know the exact purpose of some of these secondary lists. In fact, Porter (1985) does not always explain why (or not) a given list fits with his own criteria. In order to be more explicit, we have therefore researched these lists further and divided them into *Secondary Specimen Lists for Research* (*SSR Lists*) and *Miscellaneous Secondary Specimen Lists* (*SSM Lists*) [i.e. other kinds of *Secondary Specimen List*]. *SSR Lists* correspond to those which Porter regarded as meeting his three criteria above.

All the secondary lists mentioned by Porter (1985) are shown in Table 2, keeping to his own sequence on his pp.987-988, but with some additional items mentioned in later works, or newly added here. We have also

made some amendments and reinterpretations. Our division into the two categories of *Research* and *Miscellaneous* is meant only provisionally, not categorically, since further research could lead to an alternative placing of a list. Also, the compilation in Table 2 is probably not exhaustive as there may be further lists not yet found or checked by us, and therefore not included here.

Porter (1985, p.987) stated that, "There appear to be thirteen such [*SSR*] lists in all". He actually goes on to discuss 17 examples. This needs to be explained. Of these 17, he says that three of them (2.13, 2.14 and 2.15, Table 2) "actually are parts" of two other lists, implying that they can be merged accordingly (see annotations to Table 2). These so-called lists actually consist only of one entry item each. We suggest an alternative merger for the list usually referred to as *Diodon - Bahia* (2.13 and see Note 6, Table 2). However, for clarity reasons, we have not actually merged any of these three 'lists' in our itemization scheme in Table 2.

Porter (1985, p.988) also says that there is a "one-page list of Darwin's corals [i.e. 2.12 in our Table 2], collected in the Cocos-Keeling Islands", and that, "Unlike the other lists, it does not enumerate all specimens of its group collected on the voyage so it is not counted [by him] as one of the thirteen." Accepting his own criteria above, we confirm this assessment, but the real nature and purpose of this list appears not to have been well understood until now. We have therefore made it the subject of our case history (see Section 4 and Table 2).

Porter's stated total of 13 "such lists" can therefore be arrived at by deducting these four apparently 'extra' items (2.12-2.15, Table 2) from the 17 he mentions in all. However of these 13, he also says that two are missing: *Plants in Spirits of Wine* (2.16) and *Crustaceans in Spirits of Wine* (2.17). There also appears to be no list of dry fishes, even though the NHM collection includes various dry specimens of Darwin's fishes (Pauly 2004, Appendix II). This does not necessarily mean that there ever was a dry list. More probably, Darwin's fishes were all originally preserved in spirits (2.02), but for some reason, a few were later removed and dried after they had been listed as wet specimens in 2.02 (pers. comm. Oliver

Crimmen, NHM). There are no fish listed in *Box 1 Specimens originally in spirits* (2.26).

On the other hand, it seems that Porter (1985) did not know about the *List of Fossil Woods* at the NHM (2.18), though he does now (Porter 2010). Although this list (and its respective specimens) has been known to NHM palaeobotanists for many years, they escaped published attention until very recently (Thomas 2009, van Wyhe 2010). This list was evidently intended for the botanist, Robert Brown, and for this reason we categorize it as a *SSR List*.

Porter (1987, pp. 186 ff.) did subsequently locate Darwin's *Coralline Algae Notes* (2.19) and reported on the respective specimens. Thus the minimum total for *SSR Lists*, based on Porter's criteria (above), currently stands at 18, prior to any possible mergers and including the two lists which Porter did not find, and still apparently missing. To these 18 lists, we have added a further nine, none of which appears to be a true *SSR List* (i.e. on Porter's criteria as adopted here). Eight of these (2.12, 2.20-2.26, Table 2) are included as a result of investigating their contents on the *Darwin Online* website. They mostly belong to the same set of manuscripts (CUL DAR 29.1 – 29.3) as the *SSR* lists above. We can therefore now offer some further clarifications and corrections, including a summary of their contents (subject to changes in usage of taxonomic names since Darwin's time). Finally we have added Darwin's own list of his cirripede (barnacle) slide collection (2.27), bringing the total number of secondary lists to 27. This is not necessarily a final figure, as further research may add more. Note for example that 2.23 looks as if it actually comprises two distinct lists, a 'wet' mollusc one and a 'dry' insect one.

*3.6. Phases 5 (distribution to other specialists), 6 (post-*Beagle *additions), 7 (publications) and 8 (museum deposition)*

Note that Phases 5-8 post-date Darwin's own documentation of his specimens, already discussed above. Although similar phases for other scientists might have followed each other in neat chronological order, this does not apply to Darwin's collections, taken as a whole. Together, these phases are historically long and interwoven and cannot be treated

fully here. Many of the complexities in the task of making a rigorous and comprehensive compilation of Darwin's specimens as represented in museum collections like those of the NHM have already been discussed. For general accounts of what is known in general about the nature and location of Darwin's collections, see Porter's (1985) valuable overview. For the University of Cambridge, the other main concentration of Darwin's collections, see Pearn (2009) in particular for a readable account intended for general interest. Both works include broader information relevant to the NHM collections too.

As already mentioned, Darwin's collections often passed through the hands of several different people or institutions before reaching their present place of deposition. In fact, in the case of the NHM (then the British Museum or BM), very few of Darwin's collections arrived directly from Darwin himself. Most of his dry collection of molluscs for example first went to his mentor Charles Lyell and reached the NHM only in 1976 via Lyell's descendants. Darwin's irritation with the lack of interest in his *Beagle* collections, especially by BM specialists at that time (Porter 1985) is well known. A notable ironic exception would seem to have been Richard Owen, who described Darwin's fossil mammals (Owen 1838-1840) but who later bitterly opposed some of Darwin's evolutionary ideas. However, Owen was actually at the Royal College of Surgeons at the time, and only later moved to the then BM in 1856, subsequently becoming the first Director of the new British Museum (Natural History) in 1881.

Most of the specialists to whom Darwin sent his material, did not work at the BM. However some of the other institutions (e.g. the Zoological Society of London and Geological Society of London) who acquired his specimens, later relinquished their collections altogether, and their material eventually passed in entirety to the BM/ BM(NH)/NHM, to other places, or to some combination of both. Sometimes, a single category of material (e.g. coralline algae) became split between two or more institutions, though in some cases, these collections consist of duplicates (e.g. Porter 1987 on coralline algae). There are a few collections whose whereabouts are not currently known, e.g. Permian fossil bryozoans from Tasmania ("Van Diemen's Land") originally described by Lonsdale (1844) as "corals".

3.7. Phase 9: retrospective studies

It is not possible here to cover all the retrospective works relating to Darwin's specimens and specimen lists, but some key examples will be mentioned. Useful retrospective lists and indexes have been made by many museum workers, though in most cases, these are only internally available in their respective museums. The manuscript catalogues of material held in the University of Cambridge by Harker (c.1907) and by Harmer (1901) are available in *Darwin Online*. Darwin's volcanic specimens from Ascension and elsewhere are also on-line in database form (*British Geological Survey Rock Collections*. In addition to works cited in Tables 1-2,

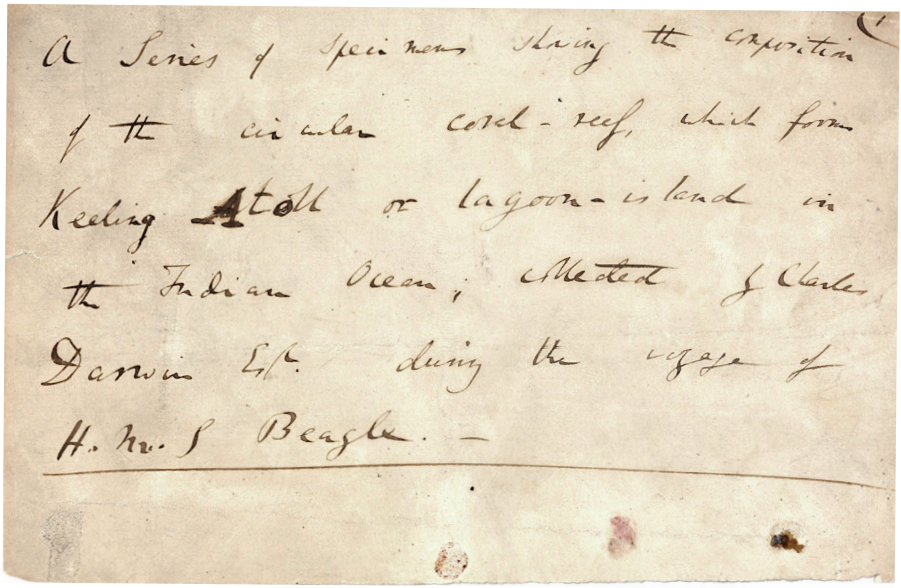
A Series of Specimens shewing the Composition of the circular coral-reef, which forms Keeling Atoll or lagoon-island in the Indian Ocean; collected by Charles Darwin Esq. during the voyage of H. M. S Beagle. —

Fig. 1.1, Fig. 1.2, Fig. 1.3: *Images of Darwin's* Coral Reef Specimen List *in the NHM Zoology Library. The list consists of two sheets, both now backed, the second of which (Figs. 1.2, 1.3) appears to consist of two former sheets now pasted together. As explained in the text, this list is a set of captions accompanying a little exhibit. The second sheet is reproduced here in two consecutive image.* **Fig. 1.1.** *First sheet: introductory statement. © Natural History Museum, London.*

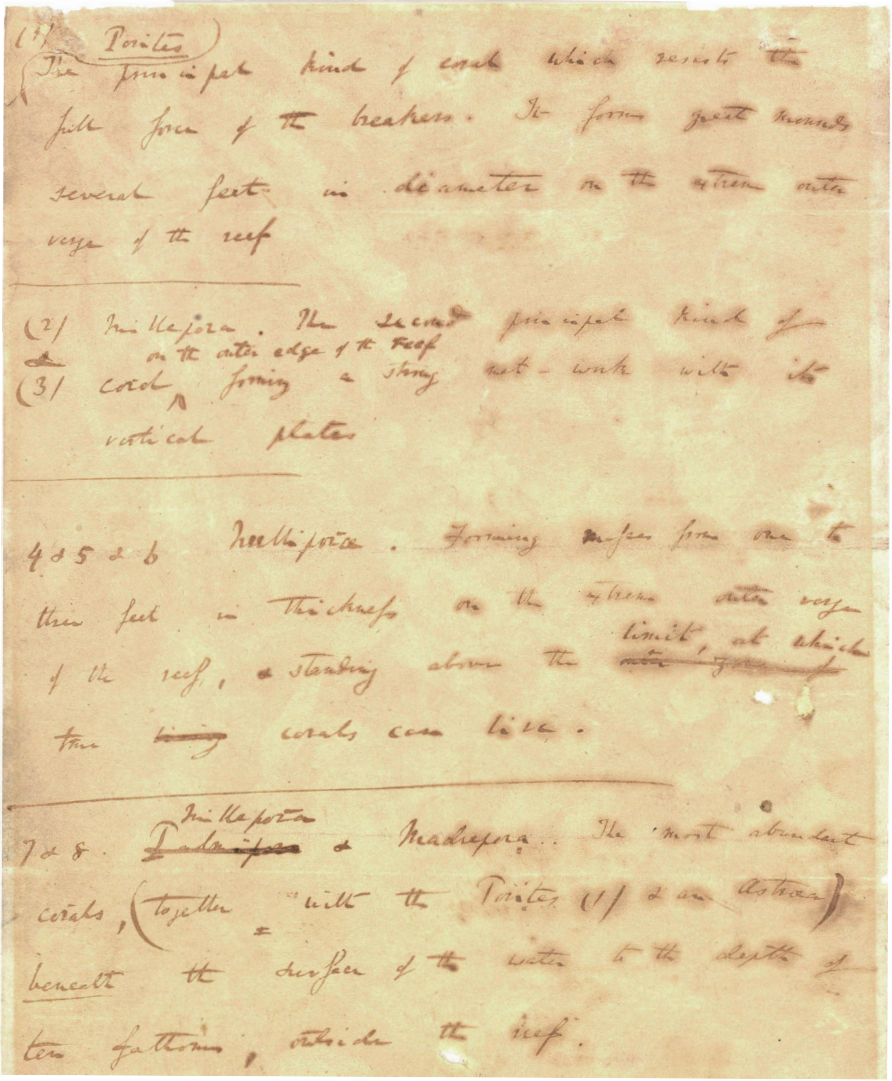

Fig 1.2. *Second sheet: upper part showing caption items 1-8. © Natural History Museum, London.*

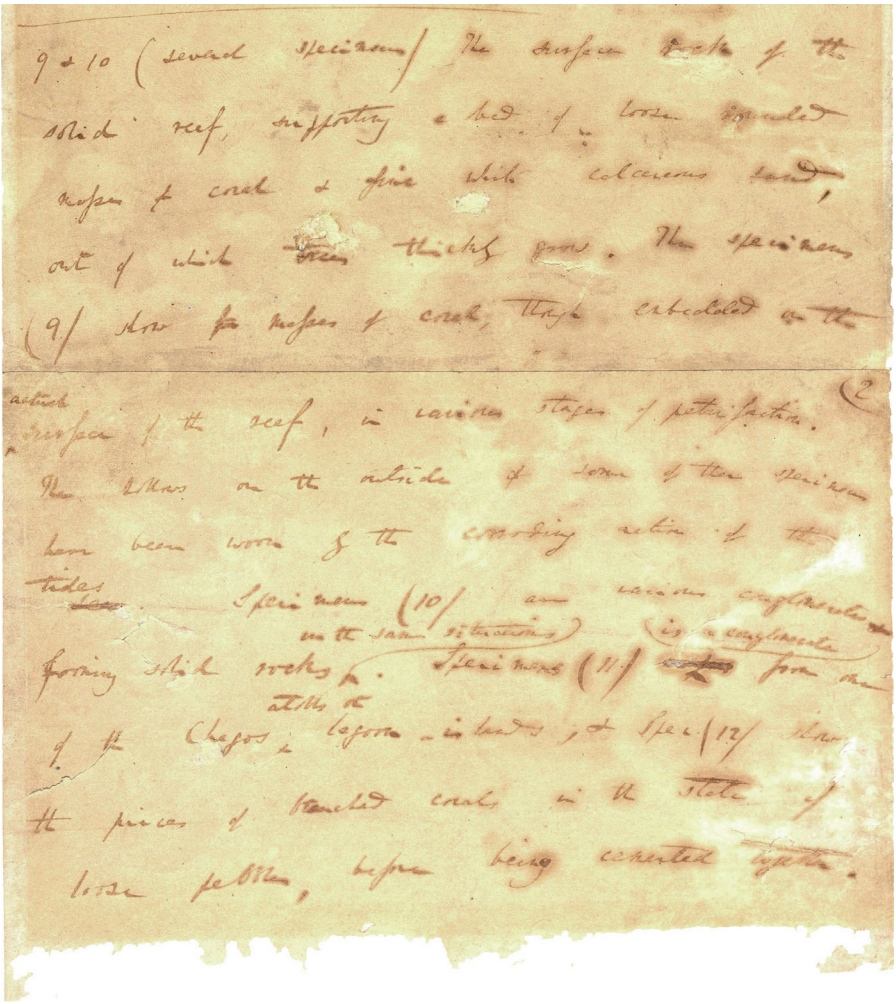

Fig. 1.3. *Second sheet: lower part showing caption items 9-12. Note that below the fifth line in this image, there is a faint straight horizontal line which marks a join between two former sheets. Immediately below this line Darwin wrote "(2" in the right hand margin. For transcript, see Appendix 2.1. Four of the exhibited specimens are shown in Fig.2.*

other important published lists include that by Chancellor *et al.* (1988) for Darwin specimens in the Oxford University Museum, Griffin & Nielsen (2008) for Darwin's South American Cenozoic molluscs, Pauly (2004) for fish, and Thomas (2009) for fossil woods.

At the collection level, Porter's (1985) valuable overview has already been mentioned, as has Pearn's (2009) book. It is rare however for a retrospective study to focus on a particular *SS List* in its own right, with or without reference to the relevant specimens. This is understandable since the people concerned have usually concentrated on collections in a particular institution, or from a particular place or region, or on a particular group of organisms, and in all three cases, the relevant specimen information is often in more than one list. It is partly to help with such studies that we have compiled Darwin's lists in Tables 1-2.

At a deeper level of investigation, are studies based on information and specimens collected by revisiting Darwin's localities, but this seems to have been done relatively rarely (e.g. Herbert *et al.* 2009). Admittedly, this is not always practical or possible. It is generally easier to attempt this for geological localities and specimens, including fossils, and for living vegetative organisms because there is a higher probability that they can still be found in the same place, than for vagile organisms.

Darwin Online is one of the most valuable retrospective (and still ongoing) efforts, as implied by our frequent reference here to this website. It covers not only Darwin's specimen lists, diaries and other records relating to his collections, but also most of the rest of his entire output, and the relevant work of other authors too. Most of the foregoing papers and manuscripts we have cited can be found there. Some of Darwin's lists however are still available for study only in the library concerned. This applies most importantly, to Darwin's entire *Geological Specimen Notebooks* (*PS Lists* 1.01-1.04, Table 1).

The extra labour of on-line transcriptions, rather than on-line image capture of the original papers and manuscripts (interesting and valuable though these are in their own right), has the advantage that they can be searched electronically. When complete, searchable versions of all Darwin's specimen lists (Tables 1, 2) and related records, together with relevant

papers published by later authors, will make it much easier to extract all the available information about any given specimen. A database can then be envisaged, for every specimen with all its attendant information from the different sources by Darwin and later authors. Museums holding relevant specimens would then be able to extract the information for their own specimen databases, eventually making it possible to generate a global Darwin specimen index giving Darwin's information, subsequent studies and current locations.

4. *Case study: the so-called "list of Darwin's corals" (i.e. Coral reef specimen list) in the NHM, and its accompanying specimens*

4.1. The list itself

Amongst the specimen lists discussed by Porter (1985), he mentions (p. 988) "a one-page list of Darwin's corals collected in the Cocos-Keeling Islands" in Darwin's handwriting. Cocos (Keeling) Islands (Lat. 12.14°S Long. 96.88° E), as they are now known officially, consist of an isolated coral atoll and satellite island in the Indian Ocean, lying south-west of Sumatra. The *Beagle* stopped there between April 1st and 11th 1836, and from the second day onward, Darwin surveyed and sampled the atoll proper, which he called 'Keeling Atoll' in his coral reef book (Darwin 1842). The atoll itself is also known as 'South Keeling Island' and 'Southern Cocos Atoll' (Armstrong 1991). His observations there played an important part in his formulation and publication of his subsidence theory of coral reefs (Darwin 1837, 1842 and subsequent editions of the latter). We have included this list as item 2.12 in Table 2 where we have provisionally categorised it as a *Secondary Specimen List (Miscellaneous)*. We discuss its category below.

We have had first hand familiarity with this list, and its respective specimens, since the 1970s, through our positions at the NHM. The list is now held in the NHM Library and the specimens held in the Department of Zoology. The few previous published mentions of this list (Section 4.3) do not give clear indications of its nature and purpose, and we are also unaware of any pre-existing complete transcriptions or reproductions of it. We therefore reproduce it here (Fig. 1) for the first time, together with

an annotated transcript (Appendix 2.1).

As far as we have been able to establish, the set of specimens to which it refers is complete or almost so. We are therefore able to shed substantial light for the first time, on both the list and the specimens. Here we concentrate mostly on the list itself, with some mention of the specimens. We intend to treat the specimens and the wider context of both the list and specimens in a separate paper. The present account concentrates on our inferred history of the list. Treatment of Darwin's work on coral reefs, and its importance, is beyond scope here, but some key references are mentioned below.

The list is clearly in Darwin's own handwriting, but is undated. We give constraints on its date below.

It is not clear however whether Porter's (1985, pp. 988, 1006-7) comments are really based on his first hand inspection of the NHM list, since the list, as currently kept in the NHM Library, actually consists not of "one sheet" but two (Fig.1). Moreover, as explained in Appendix 2.1, the present second sheet (Figs. 1.1-1.2) seems to have once been two sheets now joined together, making three original sheets in all. The first sheet (Fig. 1.1, Appendix 2.1), which is evidently an introductory statement or long heading, used also for the NHM Library catalogue entry, makes no direct reference to corals: *A series of specimens showing the composition of the circular coral-reef which forms Keeling Atoll or Lagoon-island in the Indian Ocean*. The specimens itemized on the second sheet, clearly include both corals, non-corals like "nullipores" (i.e. coralline algae) and also rock samples. So it this is not just a "list of corals" alone (Porter 1985). And in spite of Darwin's own title, the list includes one specimen from the Chagos Archipelago (Lat. 6.57º S Long. 72.42º E) which the *Beagle* did not actually call at (see Appendix 2.1). For these and other reasons which will become clear, we therefore propose for convenience to refer to this list instead by our own attributed short title of Darwin's *Coral Reef Specimen List*, as in item 2.12 of Table 2.

Porter (1985, p.988) suggested that this list "may have been made for [Darwin's] own use" rather than for the benefit of possible future researchers so in this respect it is different from the *SSR Lists* in Table 2, and we provide evidence to support his suggestion, below. Later in

the same paper though (pp. 1006-7), Porter suggested the list might have been made for P. Martin Duncan (a well-known contemporary British coral taxonomist) with a view to him studying the corals, but we have found no evidence so far for that.

4.2. The specimens

Although a full treatment of the specimens referred to in the *Coral Reef Specimen List* will have to reported on separately, we provide some initial details in order to support our offered interpretation of the nature and purpose of this list. For reasons to be explained, we know the specimens were once on public display in the NHM and that the list is actually a set of explanatory captions for them. The specimens became separated from the list when they were taken off display (see below), but we have been able to reconstruct the original exhibit with some confidence, e.g. see caption for Fig. 2.

The collection consists in total of 29 pieces, of which 13 are modern organisms, and 16 are geological specimens of fossils and rocks. Taking into account Darwin's own introduction to his list (above) and the rest of the text (Appendix 2.1), it is clear that although the collection is actually kept in the Department of Zoology NHM, it is a geological collection linked to his ideas about the processes of reef-rock formation. In referring to the individual specimens below, we use our own identifications.

The modern organisms in the collection, which were evidently collected when alive, consist of two scleractinian corals (*Porites* and *Acropora*), three hydrozoan corals (*Millepora*) and three of coralline algae. There are five further specimens of coral which were evidently heavily weathered, corroded and water-worn when Darwin collected them, though still identifiable to generic level: three of *Acropora* and one each of *Favia*, and *Porites*. Many of these specimens are encrusted by bryozoans and larger benthic foraminifera (*Homotrema rubrum* and *Carpentaria*), and bear borings and tubes of various endolithic organisms which we provisionally identify as vermetid gastropods, serpulid worms and boring sponges.

The 16 geological specimens consist of bioclastic limestones and 11 beach-worn pebbles. In a few of the rocks it is possible to see skeletal frag-

ments here identified as coral or coralline algae, but lithological alteration (diagenesis) has mostly progressed too far to permit more detailed identification. One specimen that Darwin described in his list as a "conglomerate" is the one from Chagos Atoll (see above). It actually consists of filled crypts of the boring bivalve *Lithophaga* held closely together in a compact mass of the coral. In Appendix 2.1, we suggest how Darwin might have obtained this specimen.

4.3. Previous published references to the list and related specimens

The *Coral Reef Specimen List*, and/or the accompanying specimens seem to have been referred to only in a small number of previous places, prior to Porter (1985), but mostly rather indirectly and incompletely. We gather these complementary fragments together, below, into a plausible history, starting with Darwin (1842, p.12) himself who seems to have referred to the same specimens when he says:

> *"… and I collected a very interesting series, beginning with fragments of unaltered coral, and ending with others, where it was impossible to discover with the naked eye any trace of organic structure. In some specimens I was unable, even with the aid of a lens, and by wetting them, to distinguish the boundaries of the altered coral and spathose limestone. Many even of the blocks of coral lying loose on the beach, had their central parts altered and infiltrated."*

This passage of text should be compared with the text of the Coral Reef Specimen List (Appendix 2.1). It is reasonable to assume that both are referring to one and the same series of specimens.

As the specimens were once on display in the NHM, we have tried to reconstruct the history of this exhibit, starting with a search through most, if not all, of the numerous NHM *Guides* to its collections and galleries, for reference to these specimens. These go back to when the collections were part of what is now the British Museum in Bloomsbury, before the present NHM building existed (1881). We found just two mentions, these being identical in wording, in the first two editions of the *Guide to the Coral Gallery* (British Museum (Natural History) 1902, 1907). On p.70 of both

editions, the text reads:

> *"… the fate of coral masses is well indicated in Case 6 B, where the specimens selected for the Museum by the late Mr. Darwin are shown."*

We take the reference to Darwin's specimens to imply that these correspond to some or all of those referred to his *Coral Reef Specimen List*, probably accompanied by the non-coral material in the same list. The phrase "fate of coral masses" is consistent with the corresponding text of Darwin's *Coral Reef Specimen List*, so the exhibit was presumbably accompanied by his handwritten text and/or a printed version of it. In any case, it seems unlikely that Darwin would have prepared several different lists and exhibits on this same subject for the Museum, at different times. We therefore put forward these *Coral Gallery guides* as the earliest published references by those other than Darwin himself to either the corals or in his list Coral Reef Specimen List, as well as possibly the list itself, known to us, to date.

The next mention appears just a little later, in the special gallery guide, *Memorials of Charles Darwin* (British Museum (Natural History), 1909, 1910, 1988) published as *Special Guide No.4* for the 50th anniversary of Darwin's *Origin of Species* and for his birth centenary. On pp. 22-23, reference is made to an "explanatory account … in Darwin's own handwriting" of "specimens of Corals, Millepores and Nullipores collected by Darwin in 1836 on Keeling Island". The full text of this passage in the guide is quoted in Appendix 2.2 and can be seen to paraphrase closely some of the text of the *Coral Reef Specimen List*. The Keeling specimens mentioned in the *Memorials* are also referred to in the handwritten list and match in kind those which are part of the related collection (above) which the Museum has inherited.

Clearly, Darwin (1809-1882) could not have prepared the list and exhibit for his own celebrations in 1909. We suggest that this anniversary exhibit probably consisted in part, or in whole, of the same specimens that are mentioned in the *Coral Reef Specimen List*, and that this list and its specimens were incorporated from their earlier display in the Coral Gallery (as above) into the *Memorial* exhibit. In fact, as the full text of the

Memorials guide (Appendix 2.2) explains, printed transcript labels were also made of Darwin's handwritten explanation, to help the public read his explanations more easily. These printed labels are now kept with the handwritten original in the NHM Library.

So far, we have found no further published reference to Darwin's *Coral Reef Specimen List* and specimens until Whitehead & Keates' (1981) illustration, explained further below. However, from the time when we took up our posts in the NHM (BRR: March 1972. JGD: July 1975), we have had first hand recollections and involvement with the *Coral Reef Specimen List* and its specimens. Also, as a visitor to the Museum before working there, one of us (BRR) can recall seeing the display perhaps as far back as the 1950s-1960s. The Museum seems to have kept them on display for some or all of this time, at least since the *Memorials* event, or perhaps even before then. However, around 1973 (Appendix 2.3), the entire little exhibit was removed to the coral collections in the Department of Zoology to make way for new exhibits. Unfortunately, no record was kept of which specimens corresponded to which numbered items in Darwin's explanation. Shortly after this, BRR also instigated removal of the list and printed labels to the NHM Library.

In addition to Porter's (1985) discussion of Darwin's specimen lists, already mentioned, he indirectly refers to the present list in his treatment of Darwin's plants (Porter 1987, p.206). He quotes Darwin as having given "a suite of specimens, exhibiting the formation of coral-reefs" to the Museum, which surely refers to the specimens described in the present list. Porter noted that "some of the corals were illustrated by Whitehead & Keates (1981)" but that although they must therefore be in the Museum, he "did not find the coralline algae there".

Whitehead & Keates' illustration is the lowermost one on their p.23 and is also reproduced here (Fig 2). Although the published caption (anonymously by BRR) does not say so, the upper right specimen is actually one of the coralline algae which Porter said he could not find. In fairness to Porter, we guess the reason he missed this, and the coralline algae specimens themselves, is that the resolution of the image was not sufficient to check if it were algal or coral. Perhaps also he concentrated his time in the Museum by working in the Department of Botany and

had searched for the algae only there. He and our botanical colleagues at that time, were probably unaware that the present authors (then in the Department of Palaeontology), and perhaps only a very small number of other colleagues in Zoology, knew that the specimens referred to in this particular list of Darwin's, including the coralline algae, were (and still are) kept together that Department as a single collection. Porter would have had no obvious reason to have asked any of us.

Also in the same illustration in Whitehead & Keates (and Fig. 2), can be seen an item in Darwin's handwriting, around which the four specimens have been arranged for the photograph. Although (strangely) this is not explained in the original caption in Whitehead & Keates (1981), this manuscript is actually the first sheet of Darwin's *Coral Reef Specimen List* (Fig.1.1) and the visible text is the first and introductory sentence (also used by the Museum's Library entry as the title for this list). The text of the second sheet, reproduced here in two images (Fig. 1.2., 1.3), was not included in the Whitehead & Keates' photograph. This enumerates and explains the specimens themselves.

We believe that there is sufficient self-evident information in all these fragmentary references to Darwin's coral and reef specimens, and his explanatory captions, to suggest that they all refer to the same things, i.e. the present *Coral Reef Specimen List* and accompanying specimens. If so, it follows that they were both on public display in the NHM from at least as far back in time as a point shortly before the first apparent mention of them in the *Coral Gallery Guide* of 1902, and onward to around 1973. Of course, they may well have been moved around the galleries or even taken off display during this time. Nevertheless, the combination of the published evidence above, and our personal recollections, point to public display at least through 1900-1910 approximately, and also 1960-1973 approximately. Since the list itself, and the Museum's acquisition of the specimens, go back much further than 1900 (see below), earlier public display of them cannot be ruled out.

4.4. Unpublished references to the list and related specimens

The wording of the short piece of text in the *Coral Gallery guides* (1902,

1907), already referred to (" … specimens selected for the Museum by … Mr. Darwin …..") could be read to mean that Darwin had prepared his exhibit and explanation of it, expressly for the Museum at around that time. Alternatively, Darwin had selected these particular specimens for donation to the museum, and not necessarily for display as such. However, in Darwin's time, there was no sharp line between most museums' acquisitions and what they selected for display. Museums generally tried to display as much as possible of whatever they had – something which most larger museums today find unfeasible. In any case, Darwin must have "selected" his coral reef specimens for the NHM during his lifetime and long before 1902, since he had died 20 years previously. Even given Darwin's fame, it is also highly unusual for the Museum to have displayed specimens with a personal hand-written set of captions prepared by someone outside the Museum. This has led us to consider (below) whether there is something more to the history of his *Coral Reef Specimen List* and specimens, than a donation to the NHM with interesting explanatory notes.

The entries for these specimens in the Museum's accession registers also include a transcript of the accompanying *Coral Reef Specimen List*. This means that Darwin had created the captions and the related selection of specimens, some time between his fieldwork on Cocos (Keeling), from April 2nd to 11th 1836, and the date when the Museum registered his specimens on December 14th 1842. (Since registration generally follows specimen acquisition, Darwin could have presented them somewhat earlier than their date of registration, but we have not yet found any records (e.g. letters) recording his donation.) Hence, although the first apparent mention of the list and specimens is in the *Coral Gallery Guide* of 1902, they could have been on display in the Museum at least from December 1842. Until we have further contemporary evidence of how Darwin came to give his list and specimens to the Museum, we do not know for sure whether he really prepared them expressly for the Museum or for some previous purpose. There is however interesting circumstantial evidence in support the latter possibility.

A default possibility, for example, is that Darwin had prepared this

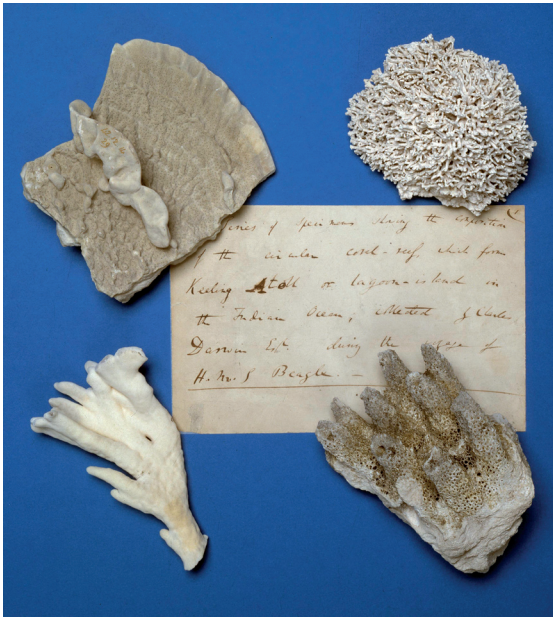

Fig. 2: *Four of the specimens mentioned in Darwin's* Coral Reef Specimen List *(Fig. 1), arranged around the first sheet of his list (see also Fig. 1.1 and appendix 2.1) (Pothograph by Colin Keates © Natural History Museum). This figure was first published as the lowermost image on p.23 of Whitehead & Keates (1981).*

When the specimens referred in the Coral Reef Specimen List *were taken off public display, no record was kept of which specimens Darwin's itemized captions referred to, but for these four specimens, we have inferred them as follows (clockwise from upper right) and have revised the names.*

Coralline algae (Rhodophyta) (BMNH Zoology 1842.12.14.32), probably Darwin's "6" described as "Nullipora" in his combined caption "4, 5 and 6" explaining that they are " forming masses from one to three feet in thickness on the extreme outer verge of the reef, and standing above the limit at which corals live".

Abraded scleractinian coral, Acropora *sp. (BMNH Zoology 1842.12.14.37), probably one of a group of Darwin's specimens described as "9" in his combined caption "9 and 10" , referring to "masses of coral, though embedded on the actual surface of the reef, in various stages of petrification".*

Hydrozoan coral Millepora tenera *Boschma, 1949 (BMNH Zoology 1842.12.14.33), probably Darwin's "7" in his combined caption "7 and 8" referring to "the most abundant corals, - together with the Porites (1) and an Astrea – beneath the surface of the water to the depth of ten fathoms [18.3 m] outside the reef."*

Hydrozoan coral Millepora platyphylla *Hemprich & Ehrenberg, 1834 (BMNH Zoology 1842.12.14.29), probably Darwin's "3" in his combined caption "2 and 3" referring to this coral as "the second principal kind of coral on the outer reef edge forming a strong network with its vertical plates".*

collection as a little exhibit of reef specimens for the general benefit of friends and scientific colleagues, shortly after he returned from the *Beagle*. It is well known that one of the things he was most preoccupied with at this time, was preparation of his subsidence theory of coral reefs for publication. More particularly, and as we have long believed without hard evidence, that the exhibit accompanied his reading of his coral reef paper to the Geological Society of London on May 31st 1837 (Darwin 1837).

The Society was then based at Somerset House. Thackray (2003) has explained the layout of the Society's lecture theatre during its early history, describing it as being "on a parliamentary plan" with Fellows presenting their papers at the head of a long table, and the audience arranged in Parliamentary (debating-house) fashion, on either side of the table, in actual or potential opposition to each other's views of the proceedings in hand. Thackray actually reproduced on his cover a sketch, possibly by Henry de la Beche, depicting just such a scene, with specimens on the table and a map on the wall at the far end. We can therefore readily imagine Darwin reading his coral reef paper in similar circumstances, with (*inter alia*) his coral reef specimens, perhaps accompanied by the same explanatory sheets which make up the present *Coral Reef Specimen List*, all on the table in front of him.

Up until recently, our own scenario had been purely fanciful, so we are indebted to Alistair Sponsel (Harvard University), to whom we had mentioned this idea in 2009. He kindly drew our attention in conversation to a hitherto little-known letter from Darwin's geological friend and mentor, Charles Lyell, and quoted in full by Sponsel (2009, p.181). The letter was written to the theologian and geologist John Pye-Smith and dated June 1st or 2nd 1837, i.e. just a day or so after Darwin had read his coral reef paper at the Geological Society (Darwin 1837). Lyell was arranging for John Pye-Smith to see Darwin's "sections of coral reefs & specimens" at the Geological Society. Sponsel cited the letter as evidence that Darwin had supported his paper with specimens and illustrations, but it also offers the best reasonable circumstantial evidence to date that Darwin had prepared his *Coral Reef Specimen List* as an explanation of some (or all) of the specimens he put on display at the Geological Society.

If so, it then seems that Darwin donated these specimens, as recorded in the Museum's registers for December 14th 1842, complete with the accompanying explanations that have also come down to us in the form of the *Coral Reef Specimen List*.

The present Museum specimens seem to be not only the same as those he probably showed at the Geological Society, but probably the same as the "very interesting series" of specimens which he said (as above) that he had collected on Cocos-Keeling (Darwin 1842, p.12). If so, he seems to have kept them together from that time onward. Might he also have written his explanations (i.e. the *Coral Reef Specimen List*) earlier than the days leading up to the Geological Society meeting in 1837, perhaps even during, or shortly after, his time at Cocos (Keeling)?

4.5. Towards a historical trajectory for Darwin's Coral Reef Specimen List *and accompanying specimens*

The specimen numbers in the *Coral Reef Specimen List* (1-11) are clearly in a sequence of their own without cross-reference to any specimen numbers in Darwin's *PS Lists* (Table 1) or elsewhere. Some have numbers referring to more than one specimen. The specimens themselves bear none of Darwin's own characteristic colour-coded number tags, and nor were any of his original numbers recorded in the Museum's accession registers at the time. In fact, as should now be clear, they are not specimen numbers, such as are found in Darwin's other specimen lists in Tables 1 and 2, and the list cannot be regarded as the same kind of inventory as most of the other specimen lists. It is really completely different (if not unique) in being a self-contained sequence of numbered captions for an exhibit of his own devising.

The unusual nature of the list and specimens makes it difficult to fit them easily into the generalized historical trajectory set out in Section 3. However, Phase 1 (diaries and notebooks) is well represented by Darwin's field observations at Cocos (Keeling), many of which are covered and quoted by Armstrong (1991). We already have in preparation an attempted reconstruction of how the specimens in the *Coral Reef Specimen List* correspond to Darwin's observations, reef sections and subsequent publications. But

while there are numerous plausible candidate specimens mentioned in the *Zoological Diary* and in the biological *PS Lists* (Keynes 2000), the absence of any of Darwin's original numbers on or with the present specimens, or recorded in the accession register apart from the caption numbers, makes it difficult to make confident matches between these exhibit specimens and any of those in his other field and specimen records. The same may apply to the rock specimens in Darwin's exhibit, but we have not yet been able to examine his geological records for these.

These problems of specimen identity carry forward as uncertainties about how Phases 2 (specimen collections and numbers), 3 (*PS Lists*) and 4 (*SS Lists*) apply to them. Thus the Coral Reef Specimen List would be an example of a SS List if it refers to specimens previously included in his PS Lists. If not, then the Coral Reef Specimen List represents an unusual little PS List in its own right, albeit numbered as captions rather than with true specimen numbers. Perhaps if Darwin had put together his exhibit during, or soon after his time on Cocos (Keeling) he did not then give them his usual specimen numbers. However, since there are plausible candidate specimens for this exhibit in the PS Lists, we think it more likely that he did catalogue all the present reef specimens in his PS Lists (both biological and geological, as applicable), and subsequently selected a few of them to make up his exhibit. He then listed them only by caption numbers for his Coral Reef Specimen List while (enigmatically, to us) omitting his original numbers. Or perhaps his original numbers have been lost or removed at some later date, not necessarily by Darwin. We have therefore provisionally categorized these captions as a SSM List in Table 2.

Phase 5 (distribution to other specialists) is clearly not applicable at all (see above). Phase 6 (post-*Beagle* acquisitions) applies only to the extra specimen of "conglomerate" mentioned in the *Coral Reef Specimen List* acquired by Darwin from the Chagos Archipelago possibly from Moresby or Powell (Appendix 2.1). Phase 7 (publications) is clearly applicable, and his coral reef publications cited above, like his unpublished field records, can be used to infer further information about the present specimens. Phase 8 (museum acquisitions) is seemingly straightforward NHM records show that as Darwin presented the specimens and list directly to the NHM, not

very long after the *Beagle* returned, and presumably not later than their recorded date of registration (December 14th 1842) . Phase 9 (retrospective studies) is self-evidently applicable, represented for example by our present paper, but also by other retrospective publications on Darwin's coral reef work, some of which are cited below, though none of those cited actually refer directly to the *Coral Reef Specimen List* and specimens.

4.6. The list in perspective

Other specimen lists and specimen sets of Darwin's have been more studied or more celebrated, and are more relevant to what he is best known for (evolutionary biology), but none of the lists covered here (Tables 1, 2) seems to have a comparable history or context as his *Coral Reef Specimen List.* As he left Cocos (Keeling) Is. on April 12th 1836, he reflected in his *Beagle Diary* (Keynes, 1988, p.418) that "I am glad we have visited these Islands; such formations surely rank high amongst the wonderful objects of this world." However, it must have been more than a purely aesthetic experience. His letter to his sister Caroline (Darwin 1836) shortly afterwards shows that he was equally glad to have had "our only opportunity of seeing one of those wonderful productions of the Coral polypi" – and relieved perhaps to have had that "only opportunity" to gather the ground-based evidence he knew he needed to support his subsidence theory of atoll origins. This is in spite of his having actually conceived much of his raw theory much earlier in the voyage – or even *because* he had done so. (For a full discussion of how Darwin developed his subsidence theory of reefs, see Sponsel (2009)). However, retrospective reassessment of the evidence which these specimens provided for Darwin's subsidence theory must await a detailed technical study of them.

In a wider context, it is important to keep in mind that Darwin saw himself as a geologist during this part of his life, and concentrated much more of his scientific energy on geology than biology (Herbert 2005 , Sponsel 2009). His evidence and arguments for his subsidence theory of coral reefs were one of his major preoccupations from the time he left Cocos-(Keeling) until it was fully published as his first scientific book (Darwin 1842).

Like the ideas in numerous of his other works, this theory became a huge influence on those engaged in the same subject ever since. It endures in modified form (notably by taking glacio-eustasy into consideration), even to this day (Rosen 1982). Further retrospective works about Darwin's coral reef theory and subsequent history include: Stoddart (1962), Purdy (1974), Rosen (1983), Scoffin & Dixon (1983), Menard (1986), Dobbs (2005), Herbert (2005), Chancellor (2008) and, most thoroughly from a historical perspective, Sponsel (2009).

Darwin's coral exhibit and list uniquely capture a moment in his thinking during his stay at Cocos (Keeling) when he was working hard in the field to make his only substantial first-hand observations of coral reef geology, and to collect specimen-based evidence for his subsidence theory – an idea which was by then, it might be argued, at a much more advanced stage for him than his ideas about transmutation of species.

Of course, at face value, Darwin's ideas about coral reefs would now understandably strike most people as much smaller in scope and of lesser importance than his evolutionary researches, being seemingly concerned only with explaining just one exotic example of the whole panoply of scenic features of the earth's surface. Although an understandable opinion, this takes no account of context. Darwin's subsidence theory (Darwin 1837, 1842) came at a time of ferment, if not revolution, in understanding the earth. Taken together with the other two volumes of his geological trilogy (Darwin 1842, 1844, 1846) and his other geological publications, they are a culmination of all that he had studied and come to understand about geology, starting from his youthful geological explorations in Shropshire and North Wales, onwards through his *Beagle* years, and up to the time of publication of these works. During this time he had become increasingly influenced by Charles Lyell's geological concepts (as Darwin acknowledged), though as Sponsel (2009) has shown, the influence was more mutual and more complex than has usually been recognized. Lyell, whose own "monstrous hypothesis" (Darwin 1836) of coral reef formation Darwin had made completely redundant, generously hailed Darwin's new theory,

much to the surprise of his contemporaries (Sponsel 2009). This was not merely for its persuasive elegance, but because it articulated Lyell's own 'principles of geology' (Lyell 1830-33) so effectively that it "out-Lyelled" Lyell himself (Rudwick 2008, p.492). it incorporated geological gradualism, long-term time-scale of envisaged geological processes, and conceptualization of apparently discrete land-forms as progressive (cf. 'evolutionary') stages in a dynamic process, all as part of a broader integrated model of earth processes (Sponsel 2009).

Earth scientists now largely take such things for granted, but even today, Darwin's subsidence theory can be thought of as an early step towards the topical concept of 'earth system' geology. Its wider implications can also be gauged by the huge controversy it generated later in his life (Rosen 1982, Sponsel 2009). Darwin's reef work rests on the edifice of geology as a whole, not only in a cognitive sense, but also in the literal geological sense that atolls grow on volcanic structures whose origin and subsidence history we now realize reflect the fundamental dynamic crustal differences between oceans and continents within the unifying earth model of plate tectonics. Just as the discovery of DNA vindicated pioneering evolutionary ideas by Darwin (*inter alia*), the discovery of sea-floor spreading, with its attendant gradual subsidence, effectively vindicates Darwin's geological vision (Rosen 1982).

In the field of coral reef studies and related subjects, Darwin is still a central figure. He is commemorated by the Darwin Medal, the main academic award of the International Society of Reef Studies. Other commemorations of his reef work include the Darwin Rise (Menard 1984), a vast elevated area of the Pacific Ocean floor corresponding to the world's greatest concentration of atolls, guyots and sea-mounts; also the Darwin Guyot (Lat. 22.07º N Long. 171.58º E) and the Darwin Point (Grigg 1982). If in the minds of the wider public, Darwin's geological work, including his coral reef contribution, is inevitably overshadowed by his pivotal contribution to evolutionary biology, the elegance, vision and historical context of his coral reef theory alone would nevertheless have assured him of a significant place in the history of science. In this respect, his *Coral Reef Specimen List*, and the little exhibit for which the

list provided captions, is an important snapshot of Darwin 'at work' on a scientifically significant theory of his own, and therefore a treasure in its own right.

7. Summary and conclusions

1. The age and historical complexity of older museum collections, including those of Darwin, and the frequently small amount of information on most specimen labels in such collections, often constrains their significance, scientific value and further study.
2. Recovery and enhancement of the available information about the origin and history of such collections is often possible, but a systematic approach to such work can greatly assist this task.
3. To this end, we put forward the concept of a *generalized historical trajectory*, as a framework for recovering and enhancing information about a given collection and as a prior step to working with individual specimens.
4. We provide a generalized historical trajectory for Darwin's specimen collections based on nine phases.
5. Darwin was very methodical with his collecting and specimens, but this also led to a complex legacy of his own records and lists. As part of the generalized historical trajectory of his collections, we therefore provide a new synthesis of his specimen lists.
6. Darwin's collections at the NHM amount to more than 14,000 specimens, almost entirely biological (including palaeontological), over two-thirds of which are insects and barnacles.
7. A case study using the historical trajectory approach is presented of the only known geological collection of Darwin's in the NHM, consisting of 29 coral reef specimens (held in Zoology), almost all from Cocos (Keeling) atoll, and an accompanying holographic *Coral Reef Specimen List* (held in the NHM Library).
8. We offer for the first time a likely explanation of the true origin and purpose of this list and its specimens. They are unusual, if not unique,

in being a little exhibit prepared by Darwin himself, some time before donating it to the NHM (registered in December 1842). The most likely occasion of the exhibit was his presentation of his famous subsidence theory of coral reefs (Darwin 1837) to the Geological Society of London on May 31st 1837.

Acknowledgements

A very large number of colleagues assisted us with the interim compilation of Darwin-related collections in the NHM (Appendix 1) and full acknowledgement will be made when the compilation is completed and prepared for publication in its own right. We thank Phil Stone (British Geological Survey) for various points of detail in our paper. For our work on Darwin's Coral Reef Specimen List and accompanying specimens, we particularly thank Alistair Sponsel (Harvard University) for his help during numerous discussions, for presenting us with a copy of his unpublished dissertation (Sponsel 2009), and for drawing our attention to the little-known letter from Lyell to Pye-Smith, mentioned in our text. We also thank the late Solene Morris who helped BRR with Darwin's coral reef specimens and list from the time when she was curator of coelenterates in the NHM (Zoology), 1972-73. Sadly, she is not now here to read this paper.

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Appendix 1

Interim compilation of Darwin-related collections at the NHM

This is work in progress (mostly by BRR); a full report will be prepared in due course. Data are given as far as possible for monophyletic clades, and these do not necessarily correspond directly to collection categories used in the NHM. Names of organisms not in bold are convenient groups not currently regarded as clades. Data in italics are approximations. Asterisks indicate NHM Darwin-related material for a particular group, located within the other collections listed. This is to avoid giving a misleading total by counting the same specimens more than once. In many cases, several specimens are stored under a single specimen number, but apart from the barnacle and insect collections, specimen totals here are based as far as possible on numbers of items, not by the inventory numbers used by Darwin or by NHM register numbers. Further information about the specimens in the *Coral Reef Specimen List* is given in the main text.

n/a - not applicable
† *- extinct groups of organisms*

Main categories	**Phyletic groups** (scientific names)	**Phyletic groups** (common names)	**Stratigraphical information**	**Collection size**
kingdom	**ANIMALIA**	**ANIMALS**	-----	-----
	class **Mammalia**	**mammals**	n/a	*200*
	class **Mammalia**	**mammals** [fossil]	Pleistocene	**31**
	order **Testudines**	**tortoises, turtles and terrapins**	n/a	**1**
	class **Aves**	**birds** [*Beagle*]	n/a	*200*

Main categories	Phyletic groups (scientific names)	Phyletic groups (common names)	Stratigraphical information	Collection size
	class **Aves**	**birds** [post-*Beagle*, domestic]	n/a	**156**
	order **Squamata**	**lizards and snakes**	n/a	**81**
	Amphibia	amphibians	n/a	**35**
	class **Actinopterygii**	**ray-finned fishes**	n/a	**78**
	phylum **Echinodermata**	**sea urchins, starfish, and relatives**	?Holocene	*
	class **Crinoidea [fossil]**	**sea lilies and feather stars** [fossil]	Devonian	*
	class **Insecta** [unspecified sub-groups (cf. 'unallocated']	**insects** [unspecified sub-groups (cf. 'unallocated')]	n/a	**5527**
	order **Odonata**	**dragonflies**	n/a	**1**
	order **Coleoptera**	**beetles**	n/a	*5000*
	order **Diptera**	**true flies**	n/a	**41**
	order **Hymenoptera**	**wasps, ants, bees and sawflies**	n/a	**11**
	order **Lepidoptera**	**moths and butterflies**	n/a	**31**
	order **Hemiptera**	**true bugs and relatives**	n/a	**47**
	order **Thysanoptera**	**thrips**	n/a	**1**
	order **Dermaptera**	**earwigs**	n/a	**3**
	order **Orthoptera**	**grasshoppers and relatives**	n/a	**8**
	superorder **Dictyoptera**	**cockroaches, termites and mantids**	n/a	**13**
	[Cirripedia] order **Sessilia** & order **Pedunculata**	**sessile and stalked barnacles**	n/a	*1500*
	[Cirripedia] order **Sessilia** & order **Pedunculata** [fossil]	**barnacles** [fossil]	Cretaceous, Cenozoic	*180*
	order **Aranae**	**spiders**	n/a	**155**
	Acari	**mites and ticks**	n/a	**1**

Main categories	Phyletic groups (scientific names)	Phyletic groups (common names)	Stratigraphical information	Collection size
	class **Clitellata [Oligochaeta]**	**earth worms and relatives**	n/a	**1**
	class **Trilobita †** [fossil]	**trilobites †** [fossil]		*
	class **Polychaeta**	**bristle worms etc.**	n/a	*
	phylum **Bryozoa**	**moss animals, bryozoans**	n/a	*200*
	class **Bivalvia**	**clams and mussels**	n/a	**171**
	class **Bivalvia** [fossil]	**clams and mussels** [fossil]	Devonian	*
	class **Bivalvia** [fossil]	**clams and mussels** [fossil]	Devonian, Mesozoic, Tertiary [*sic*]	**93**
	class **Gastropoda**	**snails**	n/a	**627**
	class **Gastropoda** [fossil]	**snails** [fossil]	Mesozoic, Tertiary [*sic*]	**108**
	class **Scaphopoda** [fossil]	**tusk shells** [fossil]	Tertiary [*sic*]	**3**
	Cephalopoda	**Octopus, squid, nautiloids, etc.**	n/a	**1**
	Cephalopoda [fossil]	**Octopus, squid, nautiloids, ammonites†, belemnites†** [fossil]	Cretaceous	**9**
	phylum **Brachiopoda**	**brachiopods** or **lamp shells**	n/a	**8**
	phylum **Brachiopoda** [fossil 1/2]	**brachiopods** or **lamp shells** [fossil (1/2)]	Lower Devonian	**47**
	phylum **Brachiopoda** [fossil 2/2]	**brachiopods** or **lamp shells** [fossil (2/2)]	Permian	**3**
	class **HYDROZOA**	**hydrozoans**		*
	order **SCLERACTINIA**	**stony corals**		*
kingdom	**FUNGI**	**FUNGI**	-----	-----
	[lichens]	**lichens**	n/a	**11**
kingdom	**PLANTAE**	**PLANTS**	-----	-----
	phylum **Bryophyta**	**mosses**	n/a	**7**

Main categories	**Phyletic groups** (scientific names)	**Phyletic groups** (common names)	**Stratigraphical information**	**Collection size**
	class **Spermatopsida** [etc.?] [fossil]	**seed plants (etc??)** [fossil woods]	Permo-Carboniferous, Triassic, Tertiary [*sic*], Quaternary	**28**
	family **Corallinaceae**	**corallines, coralline algae,**	n/a	**10**
kingdom	**PROTOZOA**	**PROTOZOANS**	-----	-----
	order **Foraminiferida**	**foraminifera, forams**	n/a	*
GEOLOGICAL COLLECTIONS	-----	-----	-----	-----
	n/a	**Coral Reef Specimen Collection**	Holocene including modern material.	**29**
TOTAL SPECIMENS				*14000*

Appendix 2

Written material relating to *Darwin's Coral Reef Specimen List*

A2.1. Transcript of *Darwin's Coral Reef Specimen List* in the NHM

Images of the Coral Reef Specimen List *are shown in Figs 1-2. Four of the specimens referred to in this list are shown in Fig.2 and the caption to that figure suggests which of Darwin's captions match those specimens.*

As explained in the main text, the numbers in the list, though used by Darwin to refer to particular specimens, are not really specimen numbers, but Darwin's numbered points (i.e. captions) in his explanation of the specimens as exhibited items. Note that the transcript below strictly follows Darwin's paragraphing, which initially separates the successive points, but from point 9 onward, they are all merged within a single paragraph.

As already noted in the main text, the specimen mentioned in caption 11 is from the Chagos Archipelago, not Cocos (Keeling) like the others. Darwin could not have collected this specimen himself as the Beagle *did not call at this Archipelago. At various places in the text and appendix of his coral reef book (Darwin 1842), Darwin acknowledges Captain [Sir Fairfax] Moresby and Lieut. Powell for first hand information about Chagos. It is therefore likely that one of these men donated this specimen to Darwin, in which case they must have done so between Darwin's return to England (October 2nd 1836) and the date (December 14th 1842) on which on which the entire little collection was registered in the NHM*

collections. For reasons also mentioned in the main text, perhaps he received the specimen prior to the date (May 31st 1837) when he read his coral reef paper (Darwin 1837) at the the Geological Society of London.

[Sheet 1]

A series of specimens showing the composition of the circular coral-reef, which forms Keeling Atoll or lagoon-island in the Indian Ocean, by Charles Darwin Esq. during the voyage of H. M. S. Beagle.

[Sheet 2]

1 Porites. The principal kind of coral which resists the full force of the breakers. It forms great mounds several feet in diameter on the extreme outer verge of the reef.

2 & 3 Millepora. The second principal kind of coral on the outer reef edge forming a strong network with its vertical plates.

4 & 5 & 6 Nullipora. Forming masses from one to three feet in thickness on the extreme outer verge of the reef, and standing above the limit at which corals live.

7 & 8. Millepora & Madrepora. The most abundant corals, (together with the Porites (1) and an Astrea) beneath the surface of the water to the depth of ten fathoms, outside the reef.

9 & 10 (several specimens). The surface rock of the solid reef supporting a bed of loose rounded masses of coral and fine white calcareous sand, out of which trees thickly grow. The specimens (9) show masses of coral, though embedded on the

[Faint horizontal line marks join between two formerly separate sheets]

(2

actual surface of the reef, in various stages of petrification. The hollows on the outside of some of the specimens have been worn by the corroding action of the tides. Specimens (10) are various conglomerates forming solid rocks in the same situations. Specimen (11) is a conglomerate from one of the Chagos Atolls or lagoon-islands, and Spec (12) shows

the pieces of branched corals in the state of loose pebbles, before being cemented together.

A2.2. Full text of the entry about Darwin's coral reef specimens and handwritten explanations, in *Memorials of Charles Darwin* (British Museum, 1909)

The description of this memorial exhibit corresponds closely to the text of Darwin's explanatory captions (i.e. his Coral Reef Specimen List*) in Appendix 2.1 and is taken to refer to this same manuscript . Note that "Batavia" is now known as Djakarta (Java), in Indonesia.*

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BARNACLES AND CORALS STUDIED BY DARWIN.

In Case **13**, a table-case standing in Bay IX (the second bay or recess on the Eastern side of the Hall counting from the Huxley statue):—

[… etc. …]

On the other side of the case are shown specimens of Corals,

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Millepores and Nullipores collected by Darwin in 1836 on Keeling Island, an atoll in the Indian Ocean, 800 miles S.W. of Batavia. The series shows corals in the fresh state and in various stages of conglomeration to form the body of the atoll; also some water-worn coral pebbles. The explanatory account of the specimens is in Darwin's own handwriting: the writing being in places difficult to decipher, a printed copy of it is also shown. Darwin's observations on coral reefs were published in 1842 as the "First Part of the Geology of the Voyage of the *Beagle*—The Structure and Distribution of Coral Reefs"; and a second edition was published in 1874.

A2.3. Transcript of information about Darwin's coral reef specimens on the manila cardboard storage box used for them after they were taken off display in the NHM.

The information (below) on the manila cardboard storage box is not completely accurate as the specimens were not "unregistered" but registered in 1842. Also, the specimens are not "unidentified", there being some supra-specific identifications in the NHM specimen register corresponding to those in Darwin's handwritten Coral Reef Specimen List*, and one of the specimens also bears a species identification. However, there were no visible registration numbers on the specimens at the time the specimens were taken off display. Present authors only recently discovered these registration details by exposing them to UV light. The handwritten and typescript label information are anonymous. After removal to the NHM Library, the labels were taken out of their frames. The specimens have now been removed from this manila cardboard box by one of us (JGD) and re-curated according to current good practice.*

[handwritten on box lid itself:]
Darwin Material

[printed label:]
PROPERTY OF: Department of Zoology
British Museum (Natural History), Cromwell Road, London, SW7 5BD

[Typescript on label:]
Darwin's Coral and Other Reef Material
Formerly on display until c. 1973
Framed handwritten notes & captions in General Library

[handwritten on label:]
Unidentified unregistered pieces of coral.