

DANA AND DARWIN

Museum of Yale University, and in other great museums of natural history, may quicken the desire to hear the words of a wise interpreter.

Dana and Darwin

The relations of Dana's researches to Darwin's are thus indicated :

" Our cruise led us partly along the course followed by Mr. Charles Darwin during the years 1831 to 1836, in the voyage of the *Beagle*, under Captain Fitzroy; and, where it diverged from his route, it took us over scenes, similar to his, of coral and volcanic islands. Soon after reaching Sydney, Australia, in 1839, a brief statement of Mr. Darwin's theory with respect to the origin of the atoll and barrier forms of reefs was found in the papers. The paragraph threw a flood of light over the subject, and called forth feelings of peculiar satisfaction, and of gratefulness to Mr. Darwin, which still come up afresh whenever the subject of coral islands is mentioned. The Gambier Islands, in the Paumotu, which gave him the key to the theory, I had not seen; but on reaching the Feejees, six months later, in 1840, I found there similar facts on a still grander scale and of more diversified character, so that I was afterward enabled to speak of his theory as established with more positiveness than he himself, in his philosophic caution, had been ready to adopt. His work on *Coral Reefs* appeared in 1842, when my report on the subject was already in manuscript. It showed that the conclusions on other points, which we had independently reached, were for the most part the same. The principal points of difference relate to the reason for the absence of corals from some coasts, and the evidence therefrom as to changes of level, and the distribution of the oceanic regions of elevation and subsidence—topics which a wide range of travel over the Pacific brought directly and constantly to my attention."

Darwin's gratified reception of Dana's *Geology of the Expedition* is thus mentioned in his memoirs, under the date of December 4, 1849:

LIFE OF JAMES DWIGHT DANA

"Dana has sent me the *Geology of the United States Expedition*, and I have just read the Coral part. To begin with a modest speech, I am astonished by my own accuracy! If I were to rewrite now my Coral book, there is hardly a sentence I should have to alter, except that I ought to have attributed more effect to recent volcanic action in checking growth of coral. When I say all this, I ought to add the consequences of the theory on areas of subsidence are treated in a separate chapter to which I have not come, and in this, I suspect, we shall differ more. Dana talks of agreeing with my theory in most points; I can find out not one in which he differs. Considering how infinitely more he saw of coral reefs than I did, this is wonderfully satisfactory to me. He treats me most courteously. There now, my vanity is pretty well satisfied."

Popular Errors Corrected

The erroneous notions of the coral world, widely prevalent even among educated people, are thus referred to by Dana:

"A singular degree of obscurity has possessed the popular mind with regard to the growth of corals and coral reefs, in consequence of the readiness with which speculations have been supplied and accepted in place of facts; and to the present day the subject is seldom mentioned without the qualifying adjective *mysterious* expressed or understood. Some writers, rejecting the idea which science had reached, that reefs or rocks could be due in any way to 'animalcules,' have talked of electrical forces, the first and last appeal of ignorance. One author, not many years since, made the fishes of the sea the masons, and in his natural wisdom supposed that they worked with their teeth in building up the great reef. Many of those who have discoursed most poetically on zoöphytes have imagined that the polyps were mechanical workers, heaping up the piles of coral rock by their united labors; and science is hardly yet rid of such terms as polypary, polypidom, which imply that each coral is the constructed hive or house of a swarm of polyps, like the honeycomb of the bee, or the hillock of a colony of ants.

"Science, while it penetrates deeply the system of

PROLONGED ILL-HEALTH

CONTINUOUS ILL-HEALTH

Dana's intellectual activity, continued beyond the four-score limit, is the more remarkable when his continued ill-health is borne in mind.

In the early autumn of 1859 (as was stated in the ninth chapter), he broke down and went abroad in order to recruit his health. Here is his own note of his first breaking down:

"Editorial duties connected with the *Journal of Science*, and college duties during the spring and summer of 1859, in addition to the writing of mineralogical and three other articles for the *Journal of Science*, and some essay-writing for the *New Englander*, and also the preparation of a *Manual of Geology*, besides work on the scientific department of *Webster's Dictionary*, led to a breakdown in July of that year, the difficulty being an overworked and tired head. Unable to work, or even to engage in conversation without unnatural fatigue of head, in October I left for Europe with my wife. I visited France, Italy, and Switzerland, and in August, 1860, returned, having gained but little, and that little mainly among the glaciers of the Alps. The rest of 1860, and all of 1861, was spent doing nothing—hopeful and cheerful, as I had ever been, and seeing some small progress towards health with the passing months."

He was absent ten months and came back somewhat improved.

A few years later, in December, 1862, he wrote to Darwin: "I have worked to great disadvantage, from one to three hours a day, and often not at all. I am now resuming my duties in the University, but an hour's intercourse with the students in the lecture-room is a day's work for me." Some years afterwards, in 1869, he broke down again, and Professor Marsh read his lectures to the senior class. Then followed a severe fever, from which he slowly recovered. In 1874, he was again

LIFE OF JAMES DWIGHT DANA

called into requisition in the case, in a manner so parallel that there is no drawing any but a purely arbitrary distinction between the one and the other.

"I conceive one as effective as the other as regards the leading on and fixing variation. When I say now again that the expression 'fitted by its regional development to the region' conveys no clear meaning to me, I am only telling you, as I did before, my way of looking at things, not finding fault with yours.

"By the way: 'variation (inherent) in particular directions' is your idea and mine, but is very anti-Darwin."

ASA GRAY TO DANA

"CAMBRIDGE, May 20, 1886.

"I find little time to read anything now out of my regular trodden course. But having to lie by a few hours, I took up your memoir of dear Guyot, and have read it with much gratification. You have very much in common with Guyot in thought and ways of viewing, and so you are just the person to pay this well-deserved tribute. For myself, I begin at length to be old—to find that I cannot do much except just when in the best physical condition. Just then I forget my age. But this expelling of nature (the inevitable) with a fork, does not keep it off for long." *

II

CORRESPONDENCE WITH CHARLES DARWIN

The names of Darwin and Dana will always be associated,—partly because they had like opportunities in the exploration of the Pacific, partly because their studies included the broad aspects of geology and zoölogy, and perhaps still more because they were independent investigators of the origin and growth of coral islands. Each fitted himself for generalizations by careful and prolonged studies, the one of the barnacles, and the other of the crustacea and zoöphytes.

* Dr. Gray died January 30, 1888.

They never met, but their correspondence, which was opened by Darwin in 1849, continued until 1872, and possibly longer. Not all their letters have been preserved, but those which have been recovered are of so much interest to naturalists, because of the eminence of the writers, that long citations will be given.

The voyage of the *Beagle* gave Darwin his opportunity. It was begun, under Fitzroy, in December, 1831, for the purpose of surveying the shores of Chili and Peru and of some islands in the Pacific, and to carry a chain of chronometrical measures around the world. Fitzroy offered part of his own cabin to any young man who would volunteer to go, without pay, as naturalist. Darwin was eager to go, but his father objected to the son's acceptance, and Fitzroy's offer was refused. An uncle advised the young man to go, and finally the father consented.

In October, 1836, the *Beagle* returned to Falmouth. In the following May, Darwin gave to the Geological Society his views respecting the formation of the three great classes of coral reefs, atolls, barrier and fringing reefs, and these views were afterwards developed in a separate volume on the *Structure and Distribution of Coral Reefs*, published in 1842. Dana's knowledge of Darwin's study was accidental, as will be apparent from the story as it is told by the friend of both, Professor Judd, in a recent edition of Darwin's *Coral Reefs*.

As a key to many of the allusions in this correspondence, two extracts from the *Life and Letters of Charles Darwin* are here inserted.

He says of himself:

"In October, 1846, I began to work on *Cirripedia*. When on the coast of Chili, I found a most curious form, which burrowed into the shell of concholepas, and which differed so much from all other cirripedes that I had to

LIFE OF JAMES DWIGHT DANA

form a new suborder for its sole reception. Lately an allied burrowing genus has been found on the shores of Portugal. To understand the structure of my new cirripede I had to examine and dissect many of the common forms, and this gradually led me on to take up the whole group. I worked steadily on this subject for the next eight years, and ultimately published two thick volumes, describing all the known living species. I do not doubt but that Sir E. Lytton Bulwer had me in his mind when he introduced in one of his novels a Professor Long, who had written two huge volumes on limpets.

"Although I was employed during eight years on this work, yet I record in my diary that about two years out of this time was lost by illness."

In September, 1854, his *Cirripedia* work was practically finished, and he wrote to Sir J. Hooker:

"I have been frittering away my time for the last several weeks in a wearisome manner, partly idleness, and odds and ends, and sending ten thousand barnacles out of the house all over the world. But I shall now in a day or two begin to look over my old notes on species. What a deal I shall have to discuss with you! I shall have to look sharp that I do not 'progress' into one of the greatest bores in life, to the few, like you, with lots of knowledge." *

DARWIN TO DANA

Opening the Correspondence

"DOWN, FARNBOROUGH, KENT, Aug. 12, 1849.

"I hope that you will forgive the liberty I take in addressing you, but having been in correspondence with Dr. A. Gould, he has advised me to write to you on my present occupation, in order to beg, if it lies in your power, assistance. I have been for many months, and shall for a year or two longer (for my poor health allows me to work but an hour or two daily) be employed on an anatomical and systematic monograph on the *Cirripedia*.

* *Life and Letters of Charles Darwin*, vol. i., p. 395.

CORRESPONDENCE WITH CHARLES DARWIN

I have the use of Mr. Cuming's, Mr. Strickland's, Mr. Sowerby's, British Museum, and Jardin des Plantes collections, all placed at my disposal, and many other private collections.

"It is my earnest wish to make my monograph as perfect as I can. Can you lend me any species collected during your great expedition? They would be most valuable to me whether named or not, for I describe the animal of every species and disarticulate the shells. If you would pay me so great a compliment as to entrust any specimens to my care, I would pledge myself to return them carefully to you. Even well-known species are very interesting to me, if localities are given accurately. I am bound to state that I require to separate the valves of one specimen of every species, but I preserve them pasted on board. Characters, I find, drawn solely from the outside are quite valueless, and the systematic condition of the *Cirripedia* is one of chaos. I find that by soaking I can examine the animal pretty well in dried specimens. I believe it is generally admitted that the *Cirripedia* have been much neglected, and I hope that my work may be of some small service. If you can and are willing to assist me, I shall feel truly grateful. I trust that our common pursuits and attachment to the good cause of natural history will excuse my thus writing to you."

DARWIN TO DANA

On the Cirripedia

"DOWN, FARNBOROUGH, KENT, Oct. 8, 1849.

"I am sincerely obliged to you for your very kind letter and the information sent. I am sure from what you say that had it been in your power you would have assisted me with specimens. I was not aware that you had attended to the *Cirripedia*, otherwise I would have had greater scruple in applying to you. Yours was indeed a grand voyage, and your range of research a wide one. I have always felt much interested in regard to your classification, etc., of the corals. I dissected enough to see what a generous field there was open. Indeed, I had intended working on the subject, but my miserable health

LIFE OF JAMES DWIGHT DANA

for the last ten years (which has lost me much more than half my time) has interrupted all my former hopes and designs. You cannot imagine how much gratified I have been that you have to a certain extent agreed with my coral island notions. To return to the *Cirripedia*. I am allowed to work only two hours daily (after five months' doing nothing), so that it will be long before I publish. The *Cirripedia* are, moreover, very troublesome from their great variability, and the necessity of examining the whole animal and [the] inside and outside of shell. Possibly you may publish your specimens before my monograph. In that case would it be possible for me to see any duplicates, or in no case must [they] be sent out of the country? Your spirillus sounds very curious. I would really like to know whether it is absolutely loose and unattached amongst the seaweed.

"I am particularly obliged to you for pointing out to me your notice on the metamorphosis of the *Cirripedia* in *Silliman's Journal*, for I should have overlooked it. You have to a certain extent forestalled me, though we do not take the same view in the homologies of the parts. I have, I think, worked out the anatomy of the larva in considerable detail, and I hope correctly. I have seen Dr. Leidy's eyes in several genera; indeed, I have seen and noted them as 'like eyes' before reading his paper; but I do not suppose that I should have followed out what I had seen had it not been for Dr. Leidy; for these organs are very minute and rudimentary."

DARWIN TO DANA

On Coral Reefs

"DOWN, FARNBOROUGH, KENT, Dec. 5, 1849.

"I have not for some years been so much pleased as I have just been by reading your most able discussion on coral reefs. I thank you most sincerely for the very honorable mention you make of me. . . . I have read about half through the descriptive part of the *Volcanic Geology* (last night I ascended the peaks of Tahiti with you, and what I saw in my short excursion was most vividly brought before me by your descriptions), and have

CORRESPONDENCE WITH CHARLES DARWIN

been most deeply interested by it. Your observations on the Sandwich craters strike me as the most important and original of any that I have read for a long time. Now that I have read yours, I believe I saw at the Galapagos, at a distance, instances of those most curious fissures of eruption. There are many points of resemblance between the Galapagos and Sandwich Islands (even to the shape of the mound-like hills), viz.: in the liquidity of the lavas, absence of scorix, and tuff-craters. Many of your scattered remarks on denudation have particularly interested me; but I see that you attribute less to sea and more to running water than I have been accustomed to do. After your remarks in your last kind letter, I could not help skipping on to the Australian valleys, on which your remarks strike me as exceedingly ingenious and novel, but they have not converted me. I cannot conceive how the great lateral bays could have been scooped out and their sides rendered precipitous by running water. I shall go on and read every word of your excellent volume.

"What an unfortunately short time you were permitted to stay in many places, yet how much you managed to see!"

DARWIN TO DANA

The Cirripedia Again: Blind Fauna of the Kentucky Caves

"DOWN, FARNBOROUGH, KENT, May 8, 1852.

"Your letter has given me much pleasure, more than you would anticipate, and more, perhaps, than it ought to do, though I put down part of what you say to the kindness of disposition which I have observed in your memoirs and in your letters to me. I have had a short letter from Müller of Berlin, expressing interest in my book, and now, with what you have said, I feel highly satisfied, and can go on with my work with a good heart. You will perhaps be surprised at all this, but I think every one wants sympathy in their pursuits, and I live a very retired life in the country, and for months together see no one out of my own large family. With respect to

what you say on the homologies of the larva in the first stage, I confess to have gone through more doubt than on any other part. For some time I thought the three pairs of legs corresponded with the mandibles, the inner and outer maxillæ, for I must still believe in there being (potentially) two pairs of antennæ in the earliest stage; but the description of the larva in the second stage by ——— (whose paper, by the way, is dreadfully incorrect), and the somewhat varying position of the mouth in the first stage, lead me to the view I have taken. I hope that whenever you have an opportunity you will attend to the adhesion of the *Lerneida*. The method of attachment which I have described is certainly the great character of the class of *Cirripedia*. I thank you very much for your wish for me to have the *Cirripedia* of the expedition, but I know well how impossible it is. Your information on the corals has been most useful. . . .

"I am most vexed at the little wooden pill-box with the crustacean being lost. I put it in the parcel myself. I suppose the parcel must have been opened at your Custom-House, and so the little box lost. I have got Ballière to write to New York to inquire. I had hoped that this would have turned out of some interest to you. I have lately been reading the volumes for the last dozen years of *Silliman's Journal* with great interest. What a curious account is that, by Mr. Silliman, on the blind fauna of the caves! * I feel extremely interested in the subject, having for many years collected facts on variation, etc. Would it be possible to procure one of the rats for the British Museum? I should so like my friend Mr. Waterhouse, to examine the teeth and see whether it is an old- or new-world form. If you could oblige the naturalists on this side of the water by getting so interesting a specimen, would you send it to me to give to Waterhouse? for (privately, between ourselves) it would be of little use to real science if once in the hands of Mr. —; but very likely I am asking for an impossibility; the rats may be very rare. It is not stated whether the optic nerve was dissected out, which would be a curious point. I read over again in the *Journal* several of your papers. If I [had] had space I should like to have fought a

* See the *American Journal of Science*, Second Series, vol. xi., p. 332; B. Silliman, Jr., to A. Guyot.

CORRESPONDENCE WITH CHARLES DARWIN

friendly battle with you on the Australian valleys. I see I have not stated my side versus fresh water in nearly enough detail. Did you not observe the great high plains forming peninsulas running laterally into the valleys (and I expect almost truly insulated masses)? These seem to me to be very improbable on the running-water theory. Again, as far as I saw, and as appears on maps, the line of drainage never seems to be at foot of precipices on either side, and it appears to me that this might be expected to occur here and there if the valleys were still in process of excavation. But I had no intention to discuss this subject when I began, or to trouble you with so very long a letter."

DARWIN TO DANA

Volcanoes

"DOWN, FARNBOROUGH, KENT, Sept. 9, 1852.

"I make most snail-like progress in whatever I do. I should think more thought passed through your head, and words from your pen, in one day, than in ten through mine. My weak health is partly my excuse. In the spring I saw Abich, who has just returned from the Caucasus, where he has been studying, *inter alia*, the extinct volcanoes; and he told Sir C. Lyell that there were many points he was never able to understand until reading your admirable chapters on the Sandwich Islands. I sincerely hope that you are well, and that your multifarious and valuable labors are all prospering successfully."

DARWIN TO DANA

Dana's "Crustacea"

"DOWN, FARNBOROUGH, KENT, Nov. 25, 1852.

"I shall read with interest your geographical discussion in Mr. Lubbock's copy when he can purchase it. You ask whether I shall ever come to the United States. I can assure you that no tour whatever could be half so interesting to me, but with my large family I do not suppose that I shall ever leave home. It would be a real pleasure to me to make your personal acquaintance."

LIFE OF JAMES DWIGHT DANA

DARWIN TO DANA

"DOWN, BROMLEY, KENT, Sept. 27, 1853.

"Pray forgive me troubling you, but my neighbor, Mr. J. Lubbock, has got your work on *Crustacea* (as yet without the plates), and has lent it to me for a fortnight to look over, and I have experienced such great interest in many parts, and have found it so suggestive towards my *Cirripedia* work, that I cannot resist expressing my thanks and admiration. The geographical discussion struck me as eminently good. The size of the work, and the necessary labor bestowed on it, are really surprising. Why, if you had done nothing else whatever, it would have been a *magnum opus* for life. Forgive my presuming to estimate your labors, but when I think that this work has followed your *Corals* and your *Geology*, I am really lost in astonishment at what you have done in mental labor. And then, besides the labor, so much originality in all your works! I only hope that your health has withstood such labor. It frightens me to think of it. You will have seen my friend and neighbor, Mr. Lubbock, has been working a little on the lower crustacea. He is a remarkably nice young man, only a little above eighteen years old. If you can ever give him a little encouragement it would really be a good service, for he has great zeal, and for one so young, I should hope, has done well; and if he can resist his future career of great wealth, business, and rank, may do good work in natural history. I hope myself to go to press in a month's time with my last volume on the *Cirripedia*. I have got thirty plates engraved, and shall be very glad to have finished it."

DARWIN TO DANA

Caution against Overwork

"DOWN, FARNBOROUGH, KENT, June 15, 1857.

"I thank you much for your note of the 13th of May, and the tracings of the curious *Bopyrid*.

"Considering how overwhelmed you are with work, I am quite sorry that you should have had this trouble. I have always been utterly astonished at the amount of

CORRESPONDENCE WITH CHARLES DARWIN

work which you have done, and allow me to add that I have been frightened at it. I do not believe any head can long withstand such work; reflect sometimes how much you will do if you can keep ten years of good health. I know to my cost what ill-health is,—may you never have my experience."

DANA TO DARWIN

On the Origin of Species

"NEW HAVEN, Dec. 4, 1862.

"A year and a half ago I partially completed a letter to you in reply to your kind words which greeted me soon after my arrival in the country. I have been delaying ever since then, against my inclination, with the hope of being able soon to report that I was in a condition to read your work. Many long months, and now even years, have passed by, and still your book, the *Origin*, remains unopened. You see that I have been gaining and doing some work in the *Geological Manual*, which I trust will have reached you before you have the reading of this note. But I have worked to great disadvantage, one to three hours a day, and often none at all, and thus have gradually pushed through the labor to the end. I am now resuming my duties in the University. But one hour's intercourse with the students in the lecture-room is a day's work for me. Thus you will yet pardon my seeming neglect of your work. In my *Geology* I had a chapter partly prepared on the question whether the organization of species was a subject within the range of dynamical geology,—taking sides, I confess, against you; but I omitted it entirely because I could not study up the subject to the extent that was necessary to do it justice. I have, however, expressed an opinion on this point in the *Geology*; and this you will excuse, for my persuasions are so strong that I could not say less. You will perhaps be the more interested in the work because of its American character.

"I have thus far had nothing to do, since the summer of 1859, with the editing of the *Journal of Science*, although wholly charged with it before then. I hope soon to take hold again.

LIFE OF JAMES DWIGHT DANA

"I shall take great pleasure in hearing from you, and if a photograph of yourself could be added to your letter it would enhance greatly the pleasure. Although so long silent, there is no failing of esteem and admiration on the part of your friend."

DARWIN TO DANA

"DOWN, BROMLEY, KENT, Jan. 7, 1863.

"I was most truly rejoiced to hear by your letter of December 4th that your health is considerably re-established and that you are at work on Science again. From one to three hours a day must be a great change to you; but for me during many years three hours has been a most unusually hard day's work. I hope to God that your health will steadily, though slowly must be expected, improve. I have received the printed *Corrigenda*, but am sorry to say that your *Manual* has not arrived. I wrote to the Geological Society, and it has not there arrived for the Society, as I heard this morning. I enclose a photograph as you request. It was made by my eldest son, and is the only one which I have. One, almost too large for post, has been made in London.

"My health of late has been very indifferent, and I have not seen one man of science for months; so I really have no news. Man is our great subject at present, and Lyell has been working very hard, and I cannot conceive why his book has not appeared. Murray on day of sale disposed of four thousand copies! The fossil bird with the long tail and fingers to its wings (I hear from Falconer that Owen has not done the work well) is by far the greatest prodigy of recent times. This is a great case for me, as no group was so isolated as birds; and it shows how little we knew what lived during former times.

"Oh, how I wish a skeleton could be found in your so-called red sandstone footstep beds! I am not at all surprised that you had not read the *Origin*. All my friends say it takes much thought (which really surprises me), and most have had to read it two or three times. I am at present at work on dry parts and dry bones, preparing a work to be entitled *Variation under Domestication*."

CORRESPONDENCE WITH CHARLES DARWIN

DANA TO DARWIN

" NEW HAVEN, February 5, 1863.

" The arrival of your photograph has given me great pleasure, and I thank you warmly for it. I value it all the more that it was made by your son. He must be a proficient in the photographic art, for I have never seen a finer black tint on such a picture.

" I hope that ere this you have the copy of the *Geology* (and without any charge of expense, as was my intention). I have still to report your book [*The Origin of Species*] unread; for my head has all it can now do in my college duties.

" I have thought that I ought to state to you the ground for my assertion, on page 602, that geology has not afforded facts that sustain the view that the system of life has been evolved through a method of development from species to species. There are three difficulties that weigh on my mind, and I will mention them:

" 1. The absence, in the great majority of cases, of those transitions by small differences required by such a theory. As the life of America and Europe has been with few exceptions independent, one of the other, it is right to look for the transitions on each continent separately. The reply to this difficulty is that the science of geology is comparatively new and facts are daily multiplying. But this admits the proposition that geology does not yet afford the facts required.

" 2. The fact of the commencement of types in some cases by their higher groups of species instead of the lower,—as fishes began with the selachians, or sharks, the highest order of fishes, and the ganoids, which are above the true level of the fish, between fishes and reptiles. In the introduction of land plants, there were acrogens and conifers and intermediate types, but not the lower grade of mosses, seemingly the natural stepping-stone from the seaweeds. The species, *Lepidodendra*, *sigillarids*, are examples of those intermediate or comprehensive types with which great groups often began, and seem to explain the true relations of such types; but they were not transitional forms in the system of life, but rather the commencing forms of a type. If I advocate your

LIFE OF JAMES DWIGHT DANA

theory, I think I should take the ground that there were certain original points of divergence from time to time introduced into the system, as indicated by the comprehensive types.

" 3. The fact that with the transitions in the strata and formations, the exterminations of species often cut the threads of genera, families, and tribes,—and sometimes, also, of the higher groups of orders, classes, and even subkingdoms; and yet the threads have been started again in new species. The transition, after the carboniferous age was one apparently of complete extermination both in America and Europe, when all threads were cut; and yet life was reinstated, and partly by renewing with species old genera in all the classes and subkingdoms, besides adding new types.

" You thus see that I have not spoken positively on page 602 without thinking I had some foundation for it. I speak merely of the geological facts that bear on the (or any) theory of development, not of facts from other sources.

" You say in your letter that according to Mr. Falconer, Professor Owen has not done his work well with the reptilian bird. I should be very glad to know what are Mr. Falconer's views. I should like also to have his present opinions with respect to the mesozoic mammals of England, or, at least, to be informed whether he sustains the conclusions he first published on the subject. I have quoted from Owen in my book because his publications were more recent, not that I have greater confidence in his opinions or knowledge."

DARWIN TO DANA

" DOWN, BROMLEY, KENT, February 20 [1863].

" I received a few days ago your book, and this morning your pamphlet on *Man* and your kind letter. I am heartily sorry that your head is not yet strong, and whatever you do, do not again overwork yourself. Your book [*Manual of Geology*] is a monument of labor, though I have as yet only just turned over the pages. It evidently contains a mass of valuable matter.

" With respect to the change of species, I fully admit your objections are perfectly valid. I have noticed them,

CORRESPONDENCE WITH CHARLES DARWIN

excepting one of separation of countries, on which perhaps we differ a little. I admit that if we really now know the beginning of life on this planet, it is absolutely fatal to my views. I admit the same if the geological record is not excessively imperfect; and I further admit that the *à priori* probability is that no being lived below our Cambrian era.

"Nevertheless I grow yearly more convinced of the general (with much incidental error) truth of my views. I believe in this from finding that my views embrace so many phenomena and explain them to a large extent. I am continually pleased by hearing of naturalists (within the last month I have heard of four) who have come round to a large extent to the belief of the modification of species. As my book has been lately somewhat attended to, perhaps it would have been better if, when you condemned all such views, you had stated that you had not been able yet to read it. But pray do not suppose that I think for one instant that, with your strong and slowly acquired convictions and immense knowledge, you could have been converted. The utmost that I could have hoped would have been that you might possibly have been here or there staggered. Indeed, I should not much value any sudden conversion, for I remember well how many years I fought against my present belief. . . ."

DANA TO DARWIN

"NEW HAVEN, May 23, 1872.

"I have addressed to you a copy of my book on *Coral and Coral Islands*, and have commissioned my son, Edward S. Dana, to present himself along with it, and also to assure you of my unflinching esteem, and my admiration for your labors in behalf of Science. My son, having graduated at our University, goes to Europe to continue his studies in Science next autumn in Germany. In the meantime he looks forward to excursions during the summer in the Alps, as one means of benefiting his health, now somewhat impaired.

"I was sorry that your sons did not visit New Haven when on this continent, and give me a chance to show my appreciation of their father."