

tion of even those who feel no interest regarding the causes which have modelled the surface of the land. The origin," adds Mr. Darwin, "of the terraces of Coquimbo is precisely the same, according to my view, with that of the plains of Patagonia; the only difference is, that the plains are rather broader than the terraces, and that they front the Atlantic Ocean instead of a valley,—which valley, however, was formerly occupied by an arm of the sea, but now by a fresh-water river. In every case it must be remembered that the successive cliffs do not mark so many distinct elevations, but, on the contrary, periods of comparative repose, during the gradual, and perhaps scarcely sensible, rise of the land. In the valley of Guasco we have the record of seven such nights of rest, in the action of the subterranean powers*."

As the whole history of these singular phenomena has been lately fully investigated by Mr. Darwin, and as I feel that my description given above is not only meagre, but probably inaccurate, from the inevitable haste in which the observations were made, I felt it due to the subject, as well as to all the parties who have treated of it, to request Mr. Darwin to give me his frank opinion upon my statement, to state the analogy existing between the phenomena at Coquimbo, and those of Patagonia, and also to point out the parts of his recent paper on the Parallel Roads of Glen Roy in Scotland, which bear most directly on this curious question. The following is the answer with which Mr. Darwin favoured me:—

"12, Upper Gower Street, 15th March, 1840.

"MY DEAR SIR,

"I much regret that, from the state of my health, I am incapable of answering your question at the length which I should much wish to do. I forget what I said to Mr. Lyell, but I remember that, from your description, I had expected a much larger valley. If the valley be considered as bounded by the mountains of granitic rock, its width is between three and four miles. But the width of the valley, in which the river flows, is only about a mile. I think, too, you have considerably overstated the distance up the valley to which the terraces extend, at least as far as I could discover. There are five terraces, of which three, as you observe, are best characterised. The height of the edge of the upper plain, close behind the town of Coquimbo, is 364 feet. This upper plain slopes down, but insensibly to the eye, towards Herradura Bay, where it is chiefly formed of calcareous rock, in the place of gravel, and its height is only 252 feet. This calcareous rock, contains recent marine shells. On the lower terraces, I also found existing shells. The upper plain, (whose edge is 364 feet close behind Coquimbo,) rises (but insensibly to the eye), in its course up the true valley of Coquimbo, and at two miles up the valley is 420 feet above the sea,—that is, 55 feet higher behind the town of Coquimbo.

"The sketch I have given in my Journal of Researches, of the theory of their origin, is I

* Darwin's Journal, in the Voyage of the Beagle, p. 423.

believe accurate. You will understand it better, if you will be so good as to read what I have written about the plains of Patagonia, at pp. 200 to 208. When I wrote p. 423 of my Journal, I had not visited Glen Roy. I now consider the cases as somewhat different. The appearances at Glen Roy are almost entirely due to the cumulative power of the sea, on steep slopes during a period of rest. The terraces of Coquimbo and Patagonia, are due to the abrading action of the sea, on gently inclined surfaces, during such periods. The parallelism of the terraces are, consequently, far less exact than those of the "Roads" of Glen Roy. If you think it worth the trouble to read my Glen Roy paper, in the Philosophical Transactions, you will perceive that the formation of terraces, by the abrasion of the matter accumulated in a gentle slope in the valleys during the rising, is a somewhat complex action. The upper terrace, or plain of Coquimbo, is, I believe, strictly analogous to the *fringe* of stratified alluvium in Glen Roy, described at p. 50 in my paper; its origin is explained in the hypothesis given at p. 59. The successive terraces at Coquimbo, I believe, are analogous to some appearances in the mouth of the Spean, which I have just alluded to at p. 67.

"Glen Roy and Coquimbo, or Guasco, offer two grand instances of slight modifications of the action of the sea on land, during periods of rest in its gradual elevation.

"I much fear this note will be scarcely intelligible; I should have much enjoyed conversing with you on this subject, but I am not at present capable of such exertion. If the subject is worth your attention, I am sure you will fully comprehend all I know, by comparing what I have written on Glen Roy and Patagonia at pp. 200 to 208. I should feel extreme interest in hearing your judgment on the theory I have proposed to account for the whole class of appearances under question. I think you will be pleased to hear, that traces of parallel roads have been discovered in other parts of Scotland, since I published my paper in the Philosophical Transactions for 1839.—Believe me, my dear sir,

"Yours very truly,

"CHARLES DARWIN."

I have only to add that, after having examined the parallel roads of Glen Roy, and carefully perused Mr. Darwin's paper on that wonderful series of shelves, as well as what he says of the gigantic terraces of Patagonia, and having witnessed in various other parts of the world many analogous phenomena, I feel compelled (cheerfully, I grant,) to surrender my judgment on this point into his hands, and to abandon many of my former notions on the subject. I consider Mr. Darwin's generalisations on this point as not more distinguished by boldness of speculation, than by the most careful, minute, and progressive induction—qualities by which geological theories are not always characterised.