the inequality in the inclination of the moon’s orbit, and in the motion of her nodes. He determined with new accuracy the astronomical refractions from an altitude of 45° down to the horizon, where he found it to be 30°, and he made a vast collection of observations on the planets, which formed the groundwork of Kepler’s discoveries, and the basis of the Rudolphine Tables.”

MINIATURE PHYSICAL GEOLOGY

There have appeared from time to time in the columns of Nature, interesting and instructive letters on the subject of Miniature Physical Geography. May I be allowed to add a new and important contribution by pointing out a few lessons which may be learnt during spare half-hours on Ramsgate Sands.

Not far to the east of the harbour, there bubbles up a little stream, which, when the tide is low, flows for a considerable distance over the sands before it reaches the sea. Small as it is, this offers an excellent miniature example of a large river, and from it several things may be learnt. In the first place the river, when carefully watched, is seen repeatedly, and with more or less rapidity, to cease to be a river. This is effected by the detection, from some cause or other, of the main course of the stream against one bank; the result of which is that the bank is forced to recede, and, as it does so, it ceases to be a shelving slope, and becomes a tiny cliff of greater or less relative height. This bank continues to be rapidly undermined by the action of the stream, and the upper portions, now and again, topple over, with a little splash, into the water. In a manner with which those who have travelled on the Mississippi are well acquainted. In this way a bold curve is formed, which increases in length downstream.

In the meanwhile, on the opposite shore of the river, sand is deposited, and, as the river cuts its way downwards, this portion lengthens and extends. But, very long, the deep water channel shifts—often rapidly, and without apparent cause—and the miniature river tends to resume a straight course; it recedes from its bank cliffs, and soon a tract of comparatively level dry land is formed, with a beautifully marked river terrace on either side, showing the length of swallow of the river on each occasion that it oscillates to and fro.

In the midst of the stream sand islands are from time to time formed, partly by the deepening of the main channel on one side or the other; but, no sooner has the sand of which they are composed become dry, than the trenched stream commences the destruction of which it had produced.

This is exactly what is continually taking place in the Delta branch of the Amazonas a large island (Parraquezet Island) has, within the last quarter of a century, completely disappeared. The Ilha Nova has arisen, and is now covered with a luxuriant vegetation.

But the repeated changes in the course of our miniature river, it is possible to watch the deposition of a layer of coarse sand on the partially-eroded surface of a bed of finer material, and it is interesting and instructive to observe how great a body of the coarse material is dragged along the bottom. Even in the most sluggish of my miniature streams the sand-grains might be seen rolling over and over each other as they travelled seawards.

In the more muddy flats of Pegwell Bay, I, on one occasion, had an opportunity of witnessing the formation of that which is known on the Mississippi as a “cut-off.” The miniature stream bent round in a great loop, and as the flow of the water caused the concave banks to recede, the loop was gradually converted into a circle of water, and, when the bend was wide enough, the main current flowing through the middle of it left a “horseshoe” lake, which was in time almost completely shut off from the miniature river.

Perhaps one of the most interesting of these spars intervals is missing in the watching of the formation of deltas. Numbers of these miniature rivers flow into the pools, which are miniature seas or lakes. I have often seen one of the streams in the course of an hour fill a considerable bay, and push its delta far out to sea. The grains of sand, when they come to rest in the pool, form a soft deposit of varying consistence, and, after some months, I have been able to find, by a number of measurements, I found to be 40° for coarse sand, and 34° for fine sand, the average angle being 36°. By watching the advance of the delta, the formation of false beds may be seen in actual progress. But these pools, or miniature seas, which lie in depressions in the chalk, offer a field for the study of marine denudation. One may see, for instance, the waves advancing over a newly-formed delta, planing off the upper portion, and forming tiny cliffs of delta material, but leaving the deeper part of the pool to be the new deposit.

Again, during gentle and steady breezes one may see the formation of drift-currents. I remember watching with interest such a current, which flowed between the chalk cliffs through the straits which separated two miniature seas; the most instructive point being that the finer grains of sand at the bottom of the straits, where the water was some 7 inches deep, were rolling over each other in such a manner as to prove the existence of an under-current setting in the opposite direction to that in which the surface-current was flowing.

There are many other lessons which may be learnt—such as the formation of fan-deposits (similar to those so plentiful in the Rhone valley and elsewhere in Switzerland), which are formed at the mouth of a river at the foot of mountains that stand out from the sand; and the stoppage of the sand ripples, or miniature sand dunes, by the tiniest stream, reminding us of the way in which the Nile has preserved Egypt from total obliteration by its material, but have already occupied enough of your space.

My object in drawing attention to such matters of ordinary observation is to induce students of physical geography to go out and observe these things for themselves. If, after a morning’s study of Lovell’s “Principles,” the young geologist will devote an hour’s careful observation to miniature physical geography, with sketch and note-book in hand, he will find that his conceptions have a reality and a solidity which could not have been evolved in the study at home, while at the same time he will find it more easy to follow, when he shall have the opportunity, the workings of nature on a grander scale.

C. LLOYD MORJAN

TESTIMONIAL TO MR. DARWIN—EVOLUTION IN THE NETHERLANDS

We have great pleasure in printing the following correspondence:

To the Editor of Nature.

Utrecht, February 20, 1877.

On the sixty-ninth birthday of your great countryman, Mr. Charles Darwin, an album with 217 photographs of his admirers in the Netherlands, among whom are eighty-one Doctors and twenty-one University Professors, was presented to him. To the album was joined a letter, of which you will find a copy here inclosed, with the answer of Mr. Darwin.
I suppose you will like to give to both letters a place in your very estimable journal, and therefore I have the honour to forward them to you.

P. HARTING.
Professor, University, Utrecht.

Letter 1, 6th February, 1877

Sir,—In the early part of the present century there resided in Groningen, Dr. J. E. Doornik, who, in 1816, took his degree for the first time. He was the founder of zoology in the Netherlands. His name, though little known elsewhere, is well deserving to be held in highest estimation among the pioneers of the theory of development. Among his numerous publications on natural philosophy, with a view to this, are worthy of mention his "Wijzegeer-natuurkundig oorsprong van de samenstelling der stemmen van de ezels gesticht" ("Philosophical Researches concerning the Original Man and the Origin of his Species"), and his treatise "Over de bezieling van levenswaarde uit een geologisch oogpunt beschouwd" ("On the Bevordering of Vitality considered from a Geological Point of View"). The first already appeared in 1825; the latter, though written about the same time, was published in 1817, together with other papers, more or less similar in tendency, under the title of "Wijzegeer-natuurkundige verhandelingen" ("Treatises on the Natural History of Man"). In these publications we recognize Doornik as a decided advocate of the conclusions in "Regenbogen-falen", in which life was revealed in consecutive times originated each from the other. He already occupies the point of vantage on which, shortly after, Lamark, with reference to the animal kingdom, and in his wake, Prevost and Lyell, with reference to the geologic history of our globe, have taken their stand.

Yet the seeds scattered by Dr. Doornik did not take root in his own country; but they were cultivated by a Groningen professor, G. Hakker, who, in a great measure, shared his arguments regarding the origin of man; it attracted but little public attention, and they were passed into oblivion.

A generation later, and away the era the theory of evolution began to attract more attention in the Netherlands. The impetus was given by the appearance of the well-known work, "Oudelings der Natuurlijke Historie der Kweekingen" ("A History of Natural History of Creation"), of which a Dutch translation was published in 1829 by the Rev. H. van de Bredel, Professor of Chemistry at the Military Medical College in Utrecht, with an introductory preface by the celebrated chemist, Prof. G. T. Mulder, as well known in England as elsewhere. This work excited a great deal of comment, and its opponents argued that the theory of evolution was not supported by any refutation of it; whether this latter argument or the professor's influence over his students could withstand the current, especially when, after his death, the German zoologist, Mr. Dechow, appointed by the Government of Zoology at Erlangen, was appointed at Leyden. A decided advocate of his theory, he weakened the younger zoologists a lively enthusiasm, and founded a school in which the conviction grew that the theory of development is the key to the explanation of the History of Creation.

In Utrecht, Prof. Harting, with convictions more moderate and more clear-sighted, was busy in the same direction; and Scheldt's successor, Prof. C. C. Hoffmann, entirely contrary, in Leyden, Prof. C. K. Hoffmann, entirely contrary, in Leyden, Prof. C. K. Hoffmann, entirely contrary, held much more unorthodox views; other names, among which are Groningen and Amsterdam professors, might here be cited. The translation of your "Descent of Man, and Selection in Relation to Sex" and "The Expression of the Emotions in Man and Animals," with copious explanatory notes and by various original papers and translations treating on your theory, Dr. Harrogh Heys van Zoutvaneen has also largely contributed to the more general spread of your system in the Netherlands.

To testify how generally they are held in esteem among the younger zoologists and botanists, and more and more obtain among professors of analogous branches in this country, we might refer to a multitude of less important papers and articles in the periodicals.

This, however, we deem superfluous, since by offering for your consumption an album containing the portraits of a number of professional and amateur naturalists in the Netherlands, we offer a convincing proof of our estimation of your indefatigable endeavors in the promotion of science and our admiration of you, Sir, for the uprightness in this untrodden path. We recognize it as a pleasure Dr. Harrogh Heys van Zoutvaneen as the primary mover of such a demonstration of our homage. The execution, however, devolved upon the directors of the "Netherlands Zoological Society," who recommended the publication of the portraits, and the design is the largest and most complete of our time. It shows that, although some ideas in that direction had already been suggested here, yet to you alone revert the honour of having formed out your writings a series of splendid and convenient pamphlets of the theory of evolution.

Among the names in the accompanying list you will observe several professors of Natural History, Anatomy, and Physiology at the three Dutch Universities, the "Athenaeum Illustris of Amsterdam, and the Polytechnische Academy of Delft, the Con
Hansen, the Amelina; and I myself; the others, the Crotacon, Tycognomusa, Polyonca, Hystroidea, Spopgia; together with the lowest organisms standing on the boundary line between the animal and vegetable kingdoms (Foraminifera, Radiolaria, and Diatomaceae), and that department of the researches which specially concerns coral-sand waters, is interesting. A net has been provided for a considerable time in working out each his own portion of the collected material. But as this has been extraordinarily arduous, it has not been found possible to submit to examination so that a detailed account of it can be given. As, besides, the more special results will be reserved for the collective work, which it is proposed to publish when the expeditions are concluded, it may be well to consider the whole as one of the most important results of the expedition. It may also be here mentioned that these researches, carried on far out in the open sea from a comparatively small vessel, and at depths approaching 3,000 fathoms, are, even under the most favorable circumstances, attended with extraordinary difficulties, and occupy a comparatively long time. That we, notwithstanding the exceedingly unfavorable state of the weather during the expedition, were able to obtain such an abundance of zoological material, is due to the skillful and intelligent way in which the work was carried out by Lieut. Petersen, to whom Capt. Wills's command was given over.

During our expedition we had in all employed the dredge from the vessel sixteen times, the trawl-net twelve times, both these together twice, and the swabs but once; there were thus no fewer than thirty-one separate casts, and of these only a few were unsuccessful, while the great majority yielded excellent results. A net was also employed for examining the marine animals occurring in the upper stratum. Boat dredgings were also undertaken in Sogne Fjord, at Hamo, at Thorsnes in Iceland, in the Faeroes, and in the Banka, and the work. Without entering on any detailed specification of the numerous animal forms thus brought from the depths of the sea, I will merely state that there are interesting species, new to science, of new and interesting classes, of which complete descriptions and drawings will be published.

The greatest depth reached during the expedition was about 7,000 fathoms, almost half-way between Norway and Iceland; there were several casts at depths of over 6,000 fathoms. The zoological researches were begun in Sogne Fjord, where the considerable depth of 650 fathoms was reached, the greatest depth which up to that time had been examined on our coasts. We found here the common deep-sea fauna known from earlier researches, viz., of Hadonger Fjord, and various rarities were collected; among others a well-preserved specimen of the remarkable family, Brisingidae, discovered by Capt. I. A. Veijer, corona, G. D. Sara, several specimens of the Phippiniopsis, lucidata, Danielsen, and great numbers of the beautiful bivalve Musita trimaculata, G. D. Sara, of which previously only very few specimens had been found.

Our researches, however, first attained their peculiar interest when we reached the extended barrier that lies along our coast on the west, the outermost limit of which forms the so-called Faeroen. Here below 500 fathoms we had to enter a cold area, with a bottom-temperature of from 0° to 1/6° C., and the fauna now, in correspondence with this temperature, exhibits a very peculiar character, totally different from that on our south and west coasts. Seventeen of our casts were in the cold area, and we have thus some idea of the peculiar physical and biological conditions prevailing there.

On the extensive depth which occupies the greater part of the expanse of sea between Norway on the one side, and the Faroe Islands and Iceland on the other, the bottom below 7,000 fathoms appears everywhere to consist of a very peculiar, brown, very adhesive, exceedingly light, nearly greyish white clay, which is very strongly calcareous, and, on being washed or passed through a sieve, appears to consist almost exclusively of shells of a little, low organism, belonging to the Foraminifera, Protobolina. The Protobolina clay of the cold areas is the oldest clay which we have been able to examine, and it is worthy of notice that it is as old as the Tertiary era, for which reason it is of great importance. The Protobolina is an alga, which is not only of great importance to science, but also to geology, and is valuable as a means of determining the time of the Glaciation of the Atlantic Ocean, and which is called, after a very different Foraminifer, Globigerina. The Globigerina is also the commonest of the Protobolina, and is associated with the Protobolina clay in the warm region, and the Globigerina clay of the Atlantic Ocean, and which is called, after a very different Foraminifer, Globigerina. The Globigerina is also the commonest of the Protobolina, and is associated with the Protobolina clay in the warm region, and the Protobolina clay of the Atlantic Ocean, and which is called, after a very different Foraminifer, Globigerina.