

to conceive how a recoiling atom of mass 14 or 16 can produce an ionisation track of 4 cm. length in a mixture of helium and water vapour, after suffering a collision with an α -particle from polonium. The distance at which the collision took place was about 3 cm. from the source. Probably the phenomena observed can best be explained on the assumption that here we have the case of the breaking up of a nitrogen nucleus by an α -particle with the expulsion of a hydrogen nucleus, which produces the long ionisation path. The cause of the large initial curvature of the path remains to be explained. It is not due to the superposition of a number of large-angled single scatterings.

Further experiments are in progress.

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Porto Santo in Pleistocene Times.

THE Geological Society of America has recently published an extremely interesting review and summary of the recent work and opinions of specialists on the Pleistocene, by Dr. H. F. Osborn and Dr. C. A. Reeds. The chronology and changes of level are fully discussed, and we are invited to consider the evidence in favour of changes in sea-level depending upon the amount of water withdrawn as ice. It is improbable that the views of Depéret, in particular, will be accepted as they stand; but it must be admitted that the glacial periods produced some world-wide changes of level, and the question how great these were becomes an extremely interesting one.

The statement of these views is an invitation to geologists all over the world to search their coasts anew, and try to detect evidence of the postulated phenomena. In the course of this search I believe few places will better repay study than Porto Santo, in the Madeira group. I have on more than one occasion directed attention to the small I. de Cima, separated from the main island by a narrow and shallow channel (Boqueirao de Cima), yet possessing a very distinct species of snail in great abundance, found nowhere else. The postulated fall of the sea in glacial times would, I think, certainly unite Cima with the main island, yet the snail has not passed. That the snail has evolved in post-glacial times seems improbable. Between Cima and the main island are some rocks, and on one of these (Sircada) Miss Nancy Paterson collected for me some fossil snails, *Ochthephila obtecta* and others. I thought at first that we had evidence of a submerged island or neck of land between Porto Santo and Cima, once supporting a snail-fauna, but now washed by the waves. Further investigation, however, convinced me that the Sircada Rock was nothing more than a large piece of the adjacent high cliff of the main island, which had fallen into the sea, carrying the fossils with it. Objection may be made that in postulating long constancy of level for the islets Cima and Baixo I do not take into account denudation, which would have worn them down had they not risen (or the sea fallen). These islets are essentially flat on the top, and wear away extremely slowly above, but rapidly along the sides, so that we have what may be called *lateral denudation*. This can be seen going on at the present time.

Continuing the investigation, we naturally ask for marine pleistocene beds. These are to be found at the Campo do Baixo, west of the Villa Baleira on the main island. A wide well has been dug at this place, and it is possible to go down and explore it fully. At

a depth of about 30 feet is a layer of marine pleistocene rock, full of shells firmly cemented together. This rests on dense, dark, volcanic rock, but there is no evidence of volcanic activity in the material above. Far above the marine bed, near the surface, is dense sandy rock containing snail shells, *Plebecula bowditchiana* (Fér.), *Ochthephila lectiformis* (Sby.), etc. *P. bowditchiana* is an extinct species, but it is not certain that it lived so much later than the marine beds, for it might have been carried in sifting sand though it is a heavy shell to travel in that manner. Another species of snail, *Ochthephila coronata* (Desh.) was found in the marine layer itself. A fine slab of the marine deposit, carrying many shells, has been presented to the British Museum. I broke up a quantity of the material, and submitted a series of the shells to Mr. J. R. le B. Tomlin, who has very kindly determined them as follows: *Erato prayensis* Rochebrune, *Mitra fusca* Swainson, *Cerithium vulgatum* Brug., *Bittium latreillei* Payr. (abundant), *Alectrion incrassata* Müll., *Trivia pulex* Sol., *Rissoa costulata* Ald., *Alvania testæ* Ar. and Magg., *A. punctura* Mont. (?), *Mangilia striolata* Sc., *Natica* sp. (? *macilenta* Phil., or perhaps *sanche-helenæ* Smith), *Anadema cælatum* A. Ad. (?), *Calliostoma exasperatum* Penn., *Cardium papillosum* Poli, *C. tuberculatum* L., *Ervilia castanea* Mont., *Macrocallista chione* L. To these I may add the common *Columbella rustica* L., which was not submitted to Mr. Tomlin. A peculiar Naticoid and some others were not determined.

This is a modern fauna, many of the species still abundant in the sea near by. The place is not far from the sea, a short distance behind the line of sand hills, which are planted with tamarisk. The level of the deposit is little if at all below that of the shore, and we are not obliged to postulate anything more than a deeper bay, now largely filled up with sand.

This brief discussion merely opens up the subject, and it is to be hoped that some student will pursue the matter further, combining a charming holiday with profitable research.

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The Hermit-Crab and the Anemone.

IN NATURE of December 2 and 30, 1922, vol. 110 (pp. 735 and 877), there are two very interesting letters from Dr. J. H. Orton on the relationship between these animals and the advantages of the partnership. Many years ago (September 1901) I took the opportunity, after a short visit to Millport, to watch the habits of the species *Eupagurus prideauxii* and *Adamsia palliata*, which seem always to live together, the association presumably being needful for their mutual welfare. Possibly my observations of these may be helpful in understanding the ways of other Paguridae.

On the occasion referred to, I brought with me to Sheffield a specimen of the hermit-crab and *Adamsia* living together. To ensure their being undisturbed during my experiments, they were settled by themselves in a small aquarium and regularly fed with oysters and cockles. I thus managed to keep them alive and healthy for nearly six weeks. The *Adamsia*, as is usual, had attached itself head downwards on the underside of the shell occupied by the hermit-crab, and the two sides of its base had grown upwards and round the shell, so as to meet in the centre above the back of the crab, forming a tube or sack for its accommodation, the crab having far outgrown the small *Natica*-shell, which, later, was found at the bottom of the sack.