

continuity established from cell to cell, but that *the phenomenon is of much wider, if not of universal occurrence.*"

Kew, September 7

W. T. THISELTON DYER

A Plea for the Experimental Investigation of some Geological Problems

THE subject of terrestrial physics involves the study of such a large number of phenomena that it is quite comprehensible that any one investigator must devote himself to only one or two branches of it at the most. The consequence of this is that from time to time some section of this extensive field of research is for a period neglected. Such is really the present state of experimental geology, and especially that branch relating to movements of the earth's surface.

Disturbances perceptible at the terrestrial surface may be looked upon as made up of three very distinct groups: first we have actual upheaval or depression of comparatively large tracts of land. Secondly, we have true earthquakes, which probably are dependent upon a variety of circumstances, as, for instance, the snapping of a rock stratum brought to the limit of its flexibility in consequence of the first group of movements; or the formation and injection of fissures by igneous matter. Lastly, there exists a series of small disturbances imperceptible to our senses and even to ordinary instruments of earthquake measurement, and only discoverable by special delicately constructed apparatus. They seem to be dependent upon a variety of causes, amongst which are those of the two former groups, together with changes dependent upon or in relation with barometric pressure, tidal action, temperature of the air, rainfall, &c.

The upheaval or depression of our earth's surface is the very basis of geological science, for it is in consequence of this that rocks have been brought within the reach of investigation, and that our globe has some dry ground upon which we can live, instead of one continuous expanse of ocean. The changes of level were supported by the cataclysmic school of geologists to occur suddenly, bringing about entirely new distributions of land and water in a short period of time. Lyell, as the leader of the uniformists, laboured all his life to prove that these upheavals were in the main a slow and gradual process, extending over long periods of time. One of this author's examples which he brought forward in the argument with as much skill and force as an accomplished counsel would have done in pleading a cause, was the renowned (so-called) temple of Serapis at Pozzuoli. This building was for half a century the subject of almost innumerable books and pamphlets, some of which show a vast amount of ingenuity. None perhaps were more elaborately worked out than the volume of researches on the phenomena of this building and the neighbouring coast from Gaeta, around the whole gulf of that name, together with the Gulf of Naples, to the Punta Campanella. The author there brings forward a large amount of genuine evidence to show that during the last 2000 years the whole coast has been in a state of oscillation, so that the relative change of level of the land and sea has been as much as 12 m. So far as Niccolini's investigations were capable of being carried out, abundant evidence showed that about the second or third century B.C. the coast line commenced to descend, and continued to do so gradually until the 10th or 11th centuries, when elevation took place for nearly 6 m., till in the sixteenth century, when depression again set in. This depression is now going on in a remarkably rapid manner. I have in my possession an engraving of the temple of Serapis, in which the base of the three columns stands on the upper antique pavement of the building, which is perfectly dry. This is dated 1810. In Niccolini's work is another drawing, made in 1845, in which water had commenced to collect, so that it was necessary to wade about. In 1879 a layer of earth of over a metre had been spread over the floor to make access convenient, the standing column being surrounded by brickwork cylinders, and standing in water of over a metre in depth. The ground was then dry, but from time to time when I visited the building I found puddles commenced to collect, which at last grew so large and deep that lately an additional layer of sea-sand has been added to further raise the level. Similar variations have been observed in other parts of both of the Mediterranean and Adriatic coasts of Italy, which all seem to indicate that this geologically speaking young peninsula has not yet stopped growing.

But if the coast-lines are altering, are we not justified in supposing that the axial ridges of the Apennines are not doing so also, even in all probability to a far greater extent, though from the

want of a fixed datum-line, such as the sea may afford, we are unable to appreciate the amount of disturbance? It is not likely that this change of levels exceeds 50 m. in historic times in Italy.

If we even accept the recent reports from Spain as gross exaggerations, we cannot well believe them to be pure inventions when changes of 400 m. are spoken of, which could hardly be asserted without some foundation of truth.

Now, are we not bound in some way to investigate these phenomena, which involve the very principles of geological science? It is strange, but true, that around the Gulfs of Naples and Gaeta no instrument exists for registering the relative level of the sea, nor do there exist any marks on rocks that are officially looked after. During the earthquake of Ischia of 1883 it is not known whether any disturbance of the sea took place, and we are perfectly ignorant of the rate and other characters in the change of the relative levels of the land and sea.

But putting aside this gradual elevation or subsidence, are we not permitting to slip by one of the most remarkable examples of quick elevation and depression which from the accounts that now reach us are taking place in Spain? Were the reports as to changes of three and four hundred metres true, we should be compelled, to a certain extent, to accept in part the teachings of the cataclysmists.

It seems regrettable that England, which is the mother country of geology, should allow such an opportunity as the Spanish peninsula now presents for the investigation of important terrestrial disturbances to slip by. Even if the earthquakes themselves are not studied, little expense of time or money would be necessary to chronicle at least the principal phenomena now in progress, which the Royal or some other Society might well take up.

H. J. JOHNSTON-LAVIS

Iridescent Clouds

THE letters of Prof. Piazz Smyth and Mr. J. Edmund Clark (vol. xxxi. p. 148) on iridescent clouds, while interesting, do not, if I mistake not, record any new phenomena. The descriptions given agree very well with that of a phenomenon which I have observed here several times, and which is described in Herschel's "Meteorology," p. 225. Here the phenomenon is usually seen before the approach of the monsoon, and is looked upon as a sign of its being near at hand. Under these circumstances it can hardly be admitted that they have any connection with the cloud glows of which so much have been written, and which, as observed from the top of Dodabetta (8600 feet), are as brilliant as ever when the atmosphere is sufficiently dry.

It may perhaps still be of interest to some to know that observations made on the spectrum of the sun when seen through mists from the same hill-top, showed that the spectrum of the "green sun" can be completely reproduced by superposing the spectra of sunlight passing through a mist and through a thick layer of moist air; and it is probable that all cases in which the sun has been seen green can be thus explained.

C. MICHIE SMITH

The Christian College, Madras, January 1

Science Teaching in Schools

IN the discussion as to the teaching of science I have failed to find any distinct expression of an element in the subject which has for years seemed to me of the highest importance, and to which I should like with your permission to call attention. In those of our schools where science is taught it is almost always taken up late in the boy's career, often when he is passing from the lower to the upper school. This I feel sure is a mistake. Think for a moment of the process of evolution of that phenomenon—the English schoolboy. In too many cases he passes through the first, second, and third forms of a school, learning little more than the habit of diligent plodding, and developing little more than the art of storing away an unheard-of quantity of dry facts. He learns, for instance, page after page of grammar rules; he learns rules for making numerical transformations; he even learns in the same fashion answers to questions that examiners are known to set for the purpose of finding out whether the pupil has been *intelligently* taught! The habits so acquired are valuable, but they are acquired at the risk of sacrificing the boy's freshness, and with the subjugation of his habit of independent reasoning. After several years of such training the herald of science comes forward with such a

scheme as Prof. Armstrong very properly suggests. The would-be disciple of science is thunderstruck (as probably not a few teachers of science were when they first saw the scheme), but the novelty of the situation, the sight of new appliances and strange results, enable him to pull himself together, and his interest for a time keeps up. Presently he is asked to conduct for himself some simple steps of deductive reasoning; he fails, the whole business is a new world to him, and in the misery of his wishfulness to do something, he beseechingly asks for more dry facts to devour. What is the ultimate result? If science is to be taught effectually *it must begin with the earliest years of the educational career*, and there is surely no subject that lends itself more appropriately to the youthful mind. Children delight to talk of flowers, of insects, of the wonders of nature; they are ever asking suggestive questions; they are indefatigable collectors of objects of beauty; the Kindergarten system has acknowledged that the child is an orderly being delighting in symmetry and colour. Yet we increase his vocabulary by the word "star" and fail to tell him anything of the wonders of stardom. Why, our very fairy tales are based on just such fabric! To effect this early introduction of science the very best and most considerate teaching is required, as indeed it is a much more difficult task to guide the young student's thoughts than to guide the veteran student's reading. We want, further, a well thought-out progressive scheme of simple general science which shall be suggestive to the teacher of the course to be pursued. To draw up such a scheme is, I am quite aware, not a matter of moments: it would require the association of many minds and many sympathies.

Something in this direction has been done in France, and good text-books are to be found in the English science primers and in Paul Bert's Book of General Science for the Young; text-books, however, are not an immediate want—for the matter of that, the pupil may make his own—we do, however, want that which will help the conscientious teacher to see how he may make the teaching of science interesting, intelligent, and above all progressive. We cannot afford to wait for unintelligent teaching to die a natural death, remembering that there is in England no criterion that the teacher in the middle-class school can teach, that teaching does not pay in examinations, that the dry-bones method lends itself most readily to school discipline, and finally, that the subjects chiefly taught are of such a nature as almost to preclude any other method with the young. Under the present régime science is not a growth, it is a graft, and a graft, it is to be feared, of a most unfortunate nature; the sooner it develops roots of its own the better. It is, under the circumstances, no cause for wonder that the more advanced student flounders over common general principles. I have confined my remarks, for the sake of definiteness, to middle-class schools, but they are, I believe, with unessential variation, applicable to the general question of the teaching of science. G. H. BAILEY

Heidelberg, February 3

Barrenness of the Pampas

I AM anxious to add a few further remarks on this interesting subject. It was during its investigation that I was so deeply impressed with the desperate struggle for existence which characterises the bordering fertile zones. I could there watch the contest on the very battle-field itself, and for that purpose I established myself for some months in the north of Uruguay, away from all other habitation, among the wooded banks and lagunes of the River Arapey. This river, though normally a quiet stream, is subject to tropical floods, during which the water rose often thirty feet in eight hours. The "monte," or fertile wooded belt on each side, is intersected with ravines and lagunes teeming with animal and vegetable life of singular interest. The alligator, carpincho, myopotamus, nutria and other and numberless snakes thrive in the marshy swamps, while in the woods we met with the puma, the jaguar, the great lizard, the Podinama, the *Nasua socialis*, and numerous other singular animals and birds described in my little book. But it was among the flora that the principle of natural selection was most prominently displayed. In such a district, overrun with rodents and escaped cattle, subject to floods that carried away whole islands of botany, and especially to droughts that dried up the lakes, and almost the river itself, no ordinary plant could live, even on this rich and watered alluvial *débris*. The only plants that escaped the cattle were such as were either poisonous, or thorny, or resinous, or indestructibly tough. Hence we had only a great development of solanums, talas, acacias, euphorbias,

and laurels. The buttercup is replaced by the little poisonous yellow oxalis with its viviparous buds, the passion-flowers, asclepiads, bignonias, convolvuluses, and climbing leguminous plants escape both floods and cattle by climbing the highest trees and towering over head in floods of bloom. The ground-plants are the portulacas, turneras, and cenotheras; bitter and ephemeral on the arid rock, and almost independent of any other moisture than the heavy dews. The pontederias, alismas, and plantago, with grasses and sedges, derive protection from the deep and brilliant pools; and though at first sight the "monte" doubtless impresses the traveller as a scene of the wildest confusion and ruin, yet, on closer examination, we found it far more remarkable as a manifestation of harmony and law and a striking example of the marvellous power which plants, like animals, possess of adapting themselves to the local peculiarities of their habitat, whether in the fertile shades of the luxurious "monte" or on the arid, parched-up plains of the treeless Pampas.

EDWIN CLARK

Great Marlow

Recent Earthquakes

WITH reference to the statement in NATURE, vol. xxxi. p. 262, that the earthquake of December 25, 1884, was registered by the magnetic variation instruments in London, permit me to inform you that an effect was also noticed on a curve of the magnetograph at the Imperial Marine Observatory, Wilhelmshaven. But while at London declination and bifilar were specially affected, here only the Lloyd's magnetic balance, the instrument for vertical intensity, was set in oscillation, first at 9h. 52m. p.m. local time. Full details will be published in the *Zeitschrift* of German Meteorology.

Dr. M. ESCHENHAGEN

Wilhelmshaven, February 6

MR. W. A. SANFORD, in NATURE of January 29, p. 289, says on the above subject:—"It would be interesting to know whether anything of the same kind [as described in his letter] had been observed elsewhere at the same time." I have been collecting observations on this subject for a continuation of my paper on earthquakes in Devon, published in the *Transactions* of the Devonshire Association. The Vicar of Bampton has very kindly given me his experience of the earthquake, as the wave appeared to have passed very near, if not directly under, his house. Bampton is seven miles north of Tiverton, and about a mile inside the junction of the Carboniferous and the Devonian systems, situate on a rather large patch of limestone. The time the earthquake occurred there was 8.42 p.m. In the drawing-room at the vicarage it appeared as if a heavy traction-engine was passing close to the window; the window faces eastward. In the kitchen the servants were greatly alarmed by a rumbling noise and a shaking under the floor. Some of the Vicar's neighbours say they heard a report, and houses with cellars under them and higher felt the shaking more; some persons who were up stairs, thinking that it was some explosion, rushed down stairs and out of doors. The effects were also felt at Shillingford, two miles distant, and also at Combehead, one and a half mile distant. The porters at the station describe it as like a heavily-laden mineral train passing. The only damage done at Bampton was a piece of wall was thrown down. This was undoubtedly the same shock or seismic wave as mentioned by Mr. Sanford as occurring on the night of Thursday, January 22, and would appear to have travelled from east to west.

EDWARD PARFITT

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Loligopsis ellipsoptera

COULD you allow me space to ask whether any of your readers can give me a clue to the present locality of the type-specimen of *Loligopsis ellipsoptera*, Adams and Reeve, obtained during the voyage of the *Samarang*; and also to state how grateful I should be to any one who can lend me specimens of that genus or of others allied to it?

WM. E. HOVLE

Challenger Expedition Office, 32, Queen Street, Edinburgh, February 9

L. WRAY, JUN.—Your supposed dragon-fly belongs to the family *Ascalaphidae*, allied to the ant-lions.