

the mechanism by which it might be accomplished, is shown by "is invention of the "provisional hypothesis" of pangensis, has been justly pointed out by Sir William Thiselton-Dyer. In introducing this hypothesis Darwin wrote :—

"A multitude of newly acquired characters, whether injurious or beneficial, whether of the lowest or highest vital importance, are often faithfully transmitted . . . and we may on the whole conclude that inheritance is the rule, and non-inheritance the anomaly" ("Variation of Plants and Animals," popular edition, p. 454)

No mistake can be greater, as it appears to me, than one prevalent at the present day—namely, that by the newer developments of evolutionary theory in Weismannism, Mendelism, &c., Darwin's results are in any way superseded. On the contrary, I firmly believe that had Charles Darwin lived, no one would have more gladly welcomed these new developments than would he; for he would have rejoiced to follow the investigations of the particular *methods* by which variations are transmitted, the possible *limits* of individual variation, and the *laws* which govern their appearance.

Kew, February 1.

JOHN W. JUDD.

Glacial Erosion.

THE reviewer of "Geographical Essays," by Prof. W. M. Davis, writes in NATURE of January 19:—"Prof. Bonney's presidential address to the British Association has brought the controversy on glacial erosion to a head. It may be hoped that the authoritative and masterly statements on both sides will lead to an agreement as to the main facts, but no settlement can be expected until the arguments of those who limit the efficacy of glaciers as eroding agents have been directly answered."

I do not think that those who, like myself, hold that glaciers are powerful eroding agents would shrink for a moment from directly answering their opponents' criticisms. The most direct answer is that the deposits formed by glaciers are a direct measure of glacial erosion. I distrust all theoretical opinions based upon the study of ice as a "rock." In the early days of geological science it was difficult to convince the many that the "purling brook" and the "babbling river" had frequently excavated the deep valleys and gorges through which they run.

Do the opponents of glacial erosion really contend that the enormous deposits of boulder clay which cover such extensive portions of England, Scotland, and Ireland are not the results of glacial erosion? I say boulder clay advisedly; for there are immense deposits of laminated clay with or without boulders, sands, and gravels, which some may argue have no connection with glaciation. Here, however, I should again differ, for many years of careful study in the field have convinced me that nearly all these superficial or "drift" deposits are the result of glacial erosion.

Taking the "glacial" deposits themselves as a measure of glacial erosion, and concluding that we must look for marked effects in the areas from which the material was eroded, what do we find? We find surface lowland features, valley gradients, valley forms, and entire valleys and gorges, which are not such as are produced by the erosive action of water, rain, and frost.

The opponents of glacial erosion have been too much guided by glacial action, as now seen in such mountainous areas as Switzerland. The puny glaciers now found there cannot be compared, so far as the effects they produce are concerned, with the great confluent glaciers which once occupied the valleys.

It is a pity that in this country the conviction which so many hold concerning glacial erosion and climatal changes should have resulted in the stagnation of glacial geology as a science, for it cannot be denied that if glaciers have done very little as agents of change, there must be very little to study.

Glacialists of the active school cannot but feel grateful to such workers as Prof. James Geikie, Prof. W. M. Davies, Prof. R. S. Tarr and others, for keeping the lamp burning

R. M. DEELEY.

Inglewood, Longcroft Avenue, Harpenden,

January 18.

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HARDLY anyone disputes that the passage of ice over the British Uplands swept away all the loose rock materials and redeposited them in the Lowlands as glacial drifts. The controversy is not as to the removal of the loose debris, but of the excavation of basins in fresh hard rocks. As Mr. Deeley states, the opponents of glacial erosion have written extensively; but certain serious difficulties that have been advanced by Prof. Bonney, Prof. Garwood, and others, do not seem to me to have been directly answered. I share Mr. Deeley's gratitude to the three geologists whom he names for their important contributions to glacial geology.

J. W. G.

An Unconscious Forecast by Joule

THE following remarks by Joule in his paper on the changes in temperature produced by the rarefaction and condensation of air (*Phil. Mag.*, May, 1845) are worthy of notice:—

"The beautiful idea of Davy, that the heat of elastic fluids depends partly upon a motion of particles round their axes, has not, I think, hitherto received the attention it deserves. I believe that most phenomena may be explained by adapting it to the great electrochemical discovery of Faraday by which we know that each atomic element is associated with the same absolute quantity of electricity. Let us suppose that these atmospheres of electricity, endowed to a certain extent with the ordinary properties of matter, revolve with great velocity round their respective atoms. . . ."

"The phenomena described in this paper, as well as most of the facts of thermochemistry, agree with this theory; and in order to apply it to radiation we have only to admit that the revolving atmospheres of electricity possess, in a greater or less degree, according to circumstances, the power of exciting isochronal undulations in the ether which is supposed to pervade space."

In the idea of the "atmosphere of electricity" revolving round the atom, we have the substance of J. J. Thomson's corpuscular theory, while the electromagnetic mass of the revolving "atmospheres of electricity" would certainly cause them to be "endowed to a certain extent with the ordinary properties of matter." Again, the last phrase of the extract is simply the modern idea of electromagnetic waves in the æther.

The premature birth, in this short quotation, of three of the most startling advances of modern physics is not a little remarkable.

B. A. KEEN.

University College, London, January 25.

The Sailing-Flight of Birds.

IN a letter to NATURE in February, 1876, I suggested that the sailing-flight of birds and the flight of flying-fishes could be explained as tobogganing under almost perfect conditions, and in 1889 the late Duke of Argyll accepted this, in a letter to the *Spectator*, as a correct and sufficient explanation. My old friend the late Prof. H. N. Moseley, a member of the *Challenger* staff, held the view that a quivering, imperceptible to the eye, of the wings and fins was the true explanation. I do not know which explanation has been generally accepted, but I would suggest that a kinematographic picture of the flying-fish ought to settle the question finally, if it is not already settled.

I said in my letter:—"By means of a suitable mechanism for changing the inclination of the wing-planes every few seconds the sailing-flight of the albatross, I believe, might be simulated without much difficulty." Has not the aeroplane done this?

R. ABBAY.

Earl Soham Rectory, February 1.

A Morning Meteor.

A METEOR equal in brightness to the Pole Star, and of much the same colour, was seen by me to fall from the southern sky at 6.25 on the morning of Friday, February 3. Its path was one of ten degrees, extended along a line midway between α Coronæ Borealis and the planet Jupiter, which at that time was shining lustroously some thirty-four degrees south, and slightly east, of Arcturus. The meteor left a steel-blue train which remained visible for six seconds.

JOSEPH H. ELGIE.

72 Grange Avenue, Leeds.