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CONTROVERSIAL GEOLOGY.

Collected Papers on some Controverted Questions of Geology. By Joseph Prestwich, D.C.L. (Oxon), F.R.S., F.G.S., Corr. Inst. France (Acad. Sci.); Acad. R. Lyncei, Rome; Imp. Geol. Inst., Vienna; Acad. Roy., Brussels; Amer. Phil. Soc., Philad.; &c. (London: Macmillan and Co., 1895.)

"WITH respect to the main facts of Geology, we geologists are in general of one opinion but with respect to the explanation of many of those facts, we hold very divergent opinions." In these opening words of his preface, the author explains and justifies the publication of this collection of essays. Prof. Prestwich's position, as the acknowledged *doyen* among British geologists, demands that these articles—the latest fruits of his ripe experience—should receive the most thoughtful consideration from his fellow geologists; but, quite apart from the position and authority of their author, all of the memoirs included in this volume are of the greatest value as contributions to science; and in reading them it is difficult to say whether we are more impressed by the wealth of knowledge or the literary grace which they display.

The key-note of the volume is struck in the first article, "The Position of Geology—a Chapter on Uniformitarianism," published in the *Nineteenth Century* of October 1893. In this short and admirably written essay, the author clearly defines his own attitude with respect to the doctrine of uniformity. He credits most English geologists with a belief in an absolute uniformity *both in kind and degree*, while he and many continental geologists, who fully accept uniformity *in kind*, altogether reject the notion that the actions going on at the present day can be accepted as *measures* of the rate of similar changes in the past. We cannot help thinking, however, in reading this essay, that the issue is not quite so simple as the author implies. The strictest uniformitarian would never maintain that no action that has taken place in past geological times could possibly have exceeded in violence, or in the effects produced by it, the phenomena which we may have happened to have witnessed during that century or two, in which systematic studies of terrestrial changes have been carried on. In 1783 a volcano in Iceland threw out lava having a volume equal to that of Mont Blanc; and in 1883, another volcano in the Sunda Straits projected materials to the height of sixteen miles into the atmosphere. Now no geologist would maintain that there could not possibly have occurred, in the long periods of the past, more violent eruptions than these. The uniformitarian only asks that in the explanation of the past we confine ourselves to operations of *the same order of magnitude*, as those now occurring upon the earth. We should be surely justified, for example, in asking for very definite evidence that in past times a single geological eruption had thrown out materials equal to the volume of the whole Alpine chain, or that another had projected materials to the height of 150 miles. If a gorge can be shown to have been cut by an existing river in 1000 years, it would hardly be legitimate to infer that a

similar gorge was cut in ten years by a river of 100 times the volume, unless at the same time it were shown that there were very strong reasons for believing that rivers of the proportions assumed actually existed in the past.

Prof. Prestwich puts what he conceives to be the position of the uniformitarians in the following simile:—"What if it were suggested that the brick-built pyramid of Hawāra had been laid brick by brick by a single workman? Given time, this would not be beyond the bounds of possibility. But nature, like the Pharaohs, had greater forces at her command to do the work better and more expeditiously than is admitted by the uniformitarians." We cannot accept the parallel as a just one. Large brick structures are not at the present day erected by a single bricklayer, and the historian—who is equally uniformitarian in his practice with the geologist—does not feel called upon to suggest any such improbable origin for a pyramid. But if, on the contrary, it were asserted that the pyramids are so vast that they must have been erected by a race of beings of larger stature and greater physical strength than the men of the present day, a position would be taken up similar to that of the opponents of a rational uniformitarianism. The historian justly asks that before such a view be accepted, it shall be shown that the work of pyramid-building could not be performed by ordinary men working in sufficient numbers for a long period of time. Nor would the historian be very greatly concerned if it were argued that by ordinary men such a task of pyramid building might extend over several reigns, or would even require centuries for its accomplishment. Every historian, in fact, takes up the same attitude as the uniformitarian geologist when he refuses to credit the men of bygone ages with gigantic stature, prodigious strength, abnormal wisdom, or extraordinary longevity.

While, however, we demur to the principles and ideas ascribed by the author of this volume to the uniformitarians, we gladly accept his work as an additional proof, if such were required, that old-fashioned "catastrophism" in geology is now quite extinct. More than this, we think that the protests and cautions of so distinguished and able a reasoner as Prof. Prestwich will render a real service to geology in calling attention to somewhat unwarrantable assumptions that have been made by some theorists. With our author's complaint against what he justly compares to *the closure*, as applied by physicists and mathematicians to the legitimate speculations of the geologist, we entirely sympathise. "It would," as he justly says, "be an unfortunate day for any science to have free discussion and inquiry barred by assumed postulates, and not by the ordinary rules of evidence as established by the facts, however divergent the conclusions to which those facts lead may be from the prevailing belief."

The second essay in the volume is a weighty criticism of the astronomical theory of glacial epochs. The only objection which we think can be taken to the essay is that the author identifies the upholders of this theory with the uniformitarians. The late Sir Charles Lyel never accepted the theory of Mr. Croll, and many holding the strongest uniformitarian views have always maintained that geological facts are opposed to any of those

explanations of vicissitudes in climate in past geological times, which are based on astronomical considerations.

In the third article, Prof. Prestwich discusses "the primitive characters of the flint implements of the chalk plateau of Kent, with reference to the question of age and make." The author of this essay, thirty-six years ago, took a leading part in making known the evidence in the Somme Valley and elsewhere, which is now universally accepted as establishing the antiquity of man. In the essay before us, he insists that, before the times when men fashioned the beautifully chipped implements of our river valleys and caves, a still more primitive people employed rough flints as scrapers, just as did the recently extinct race of Tasmanians. The beautiful series of plates accompanying this article will, we think, carry conviction to the minds of most archæologists and geologists, that the existence of such primitive races has been established by the author. Prof. Prestwich, however, argues that the antiquity of the men of the river valleys and caves, and of still more primitive people who used the flints of the Plateau period, though very great, was probably less than some theorists have imagined.

The three last articles, "On the Agency of Water in Volcanic Eruptions," "On the Thickness and Mobility of the Earth's Crust," and "On Underground Temperatures," are well known to all geologists; but for the present volume these memoirs have been revised, and some very important and valuable additions have been made to them. They will be much more convenient for purpose of reference than in the journals in which they originally appeared.

There is one aspect of the work before us to which we cannot avoid alluding before concluding this notice. All the articles are controversial, as indicated by the title; but the work might fairly be cited as an example of the spirit in which scientific discussions ought to be carried on. No geologist, who takes up this work, but will find cherished ideas reasoned against, or pet notions boldly assailed. But from beginning to end of the volume, he will find that no word has been written which is calculated to give pain to the most sensitive opponent. This is high praise; but it is not higher than might have been anticipated as the due of one who has in a long career inspired such universal admiration, esteem, and affection as the successor to the chair of Buckland and Phillips in the University of Oxford.

JOHN W. JUDD.

POPULAR WEATHER FORECASTS.

My Weather-wise Companion. Presented by B. T. (Edinburgh and London: William Blackwood and Sons, 1895.)

DOES "B. T." stand for Barometer and Thermometer, the instruments which some people are foolish enough to think necessary for forecasting the weather, or in this simple guise does modesty shelter itself from too great publicity and the evils that popularity brings? The connection is curious, but probably accidental, for the book is free from all scientific technicalities, and the author would like us to forget that such things existed, and adopt processes that can be practised by all, without any outlay on costly apparatus, without eigraphic

information, and the weariness of preparing synoptic charts. Herein "B. T." is wise, for he is assured of a much larger audience, since the instruments with which he works are in the hands of every one, and no previous knowledge is required for their use. The sky, the clouds, the moon, animals, plants, &c., these are the tools our author uses; but even these may at times be a little inconvenient and difficult in their application. For instance, some of us might very well have wished to know that the winter through which we have just passed was likely to prove more than ordinarily severe, in order to take necessary precautions about water-pipes and such-like necessary evils. Here is the method of test: "If the mole dig his hole two feet and a half deep [this sounds like a sum in simple proportion, but such a conclusion would be premature], expect a very severe winter; if two feet deep, not so severe; if one foot deep, a mild winter." No one would probably care to contradict this; it may be perfectly true, but then as a rule people do not go about the country with pickaxe and shovel, looking for mole-holes, and laboriously and exactly determining their depth. Such severe exercise would be undertaken only by a very ardent meteorologist, and even he might be discouraged, for the author does not say that the winter will be severe or otherwise, but only that it may be expected.

In another respect our author shows much worldly wisdom. It may be assumed that what the public look for from the maintenance of Weather Bureaus and Meteorological Offices, is to know whether it is going to rain. A forecast that says that the wind will be from the south-east, possesses little general interest; what a man wants to know is whether it be possible to dispense with an umbrella, or whether one must submit to the extra care and anxiety the carriage of one entails. It may be to some a matter of the keenest excitement to know whether a depression exists on the coast of Ireland; while some, again, will even speak disrespectfully of an anticyclone in Central Europe; but the "man in the street" will be perfectly satisfied if he can be assured that the next hour or two will remain fine. Hence the author wisely concerns himself principally with the signs that make for rain. This kind of information, as the author is careful to point out, is welcome alike "to the prince and peasant, to the anxious hostess who trembles for the success of her garden-party, to the tinker who seeks the friendly shelter of a wayside hedge, down to the dandy in Pall Mall, who hates to carry an umbrella." And on the subject of this umbrella we think we have some right to complain. He, it would seem, has carried one and the same umbrella through a period of fifteen years, carried it, nay used it, amidst aristocratic surroundings, and occasionally under circumstances likely to test the constitution of the most carefully constructed; and yet we gather that it is still a presentable article, and one that could be unfurled in Piccadilly with confidence by the most fastidious. Why could he not have given us the recipe that preserves to an umbrella such a long life of usefulness? This contribution to economics would have been a valuable testimony to the accuracy of his conclusions and the keenness of his observation, since it might be fairly inferred that this protection was not carried when it was not wanted. But, alas, we have to