

opportunities for instruction which the Garden will afford, Bronx Park will be a constant delight. But far beyond these limits, wide as they are, the Garden will exert a profound and beneficial influence. Other cities will surely be stimulated by this noble movement and enrich their park systems with an educational aid of the greatest value.

Formerly Botanic Gardens, attached even in a remote manner to educational institutions, were largely used for the cultivation of medicinal plants and for the reception of species from distant lands. Of course, this use, although its importance is now relatively less than ever before, will still long continue to be a factor in the direction of activities. But here and there new phases of plant relations are being displayed in the greater gardens, and with the most gratifying results. Geographical questions are asked and answered by skilful grouping of species, and in the most attractive way. The bearing of climate on the structure, habit and possibilities of plants is made prominent in an interesting fashion. The capabilities of useful plants and the extension of their range of usefulness comprise another phase of illustration which always sets visitors to thinking. Beyond and, we may say, above these questions, which are pretty strictly utilitarian, there comes nowadays another class of illustrations which are of the highest educational value in a community, namely, the biological features which are invested with such important relations to all departments of intellectual activity. The manifold relations of plants to their surroundings and to other organisms constitute in some of the botanical gardens of the present day the most attractive sections. The special interest in this can be more plainly seen if attention be called to the groups of climbing plants. Think of reading Darwin's work on climbing plants with the living illustrations be-

fore one! This is only one of many stimulating exhibitions in a garden adapted to modern wants.

The Arnold Arboretum, a department of Harvard University and an adjunct of the Boston Park system, has become one of the most charming places for certain studies of a general nature within reach of the public of Boston. And yet it is confined chiefly to woody plants. Without such limitations the New York Garden may, perhaps, offer even a wider field for general study to the public now so eager to learn something about nature at first hand.

With the secure foundation of the New York Garden, three of our cities will be well provided with botanical establishments of the highest class. We venture to hope that many other cities will soon emulate the example of Boston, St. Louis and New York.

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*THE SUBMERGENCE OF WESTERN EUROPE
PRIOR TO THE NEOLITHIC PERIOD.*

THE veteran geologist and archæologist, Professor Joseph Prestwich, has recently contributed a suggestive memoir on this subject to the Philosophical Transactions of the Royal Society.* It treats of 'the evidence of a submergence of Western Europe and of the Mediterranean coasts at the close of the glacial or so-called post-glacial period and immediately preceding the neolithic or recent period,' and is accompanied by an original map showing the chief arc submerged.

The memoir deals in turn with the character and distribution of 'rubble, loess, breccia, ossiferous fissures, rai breaches, bone caves, shell beds, and presents the results of many years research over this wide field. In a previous paper communicated to the Geological Society

* Vol. 184, 1893, A., pp., 903-984. Plate Price 5 s. 6 d.

London in 1892,[†] the author gave the evidence deduced from personal observation of the submergence of the south of England not less than 1000 feet between the glacial or post-glacial and recent or neolithic period and proposed the term 'rubble drift' for the peculiar superficial drift then deposited. In the memoir under notice Professor Prestwich cites the phenomena he relies on as proofs of this submergence in England and traces their extension over large continental areas.

The author describes the 'rubble drift' as sometimes simulating other drift deposits, but maintains that it cannot be included with them on account of its varied physical distribution and faunal divergences. It is distinguished chiefly by the absence of all marine and fluviatile shells; the included remains are those of land animals and land shells alone, and of land plants derived from a land surface only. He points out that mammalian bones from the ordinary Quaternary deposits are very fragmentary, characterized by the absence of wear and also devoid of traces of gnawing in contradistinction from those of the caves, 'which have commonly been gnawed by predaceous animals,' and from those of the fluviatile deposits, which are usually worn.

The *detritus* of the 'rubble drift' is always of local origin, and as a rule unstratified. Professor Prestwich considers therefore that it can only be accounted for by an upheaval of a submerged land surface after widespread submergence, the consequent divergent effluent currents of water sweeping the *detritus* of the submerged surface from the higher to the lower levels. "A body of water 1,000 feet deep forms an engine of enormous power." He maintains that all the phenomena of this 'rubble drift' are explicable only upon this hypothesis.

The 'rubble drift,' widely, if sparsely, spread over the Southeast of England, can

be traced over much of western Europe and the Mediterranean coasts. It has been personally observed by him in parts of France and Italy. Other geologists have noted similar phenomena elsewhere without attempting to account for their origin. Professor Prestwich holds it to be impossible that the confusing accumulations of superficial debris lying on the surface of the land without apparent order or stratification could all be due to the *transient* action of water, and that glacial, fluviatile and meteoric action fail to account for *all* the phenomena. To the residue he applies the name of 'rubble drift,' as distinguished from the term *diluvium*, which is still variously employed on the continent to denote fluviatile, sub-aerial and other drift beds, and does not include the more important phases of the 'rubble drift' period, "which marks the last stage of a long series of earth movements of variable intensity and duration." "Whilst admitting the permanence of the laws of nature, it is impossible to suppose that at all former periods the effects produced by these laws, though not equal in kind, were equal in degree."

The absence of marine sediments in the 'rubble drift' is not to be regarded as fatal to his theory if the submergence were of short duration, which would also militate against the migration and establishment of a marine fauna on the submerged area. All the component materials of the 'rubble drift' are of local origin. It includes remains of a land fauna alone, the mammalian bones are ungnawn yet sharply fractured. The submergence hypothesis he includes not only 'meets the requirements of each particular case, but shows them all to be concordant, and such as would pertain to one common and general cause.'

Professor Prestwich thus proceeds to restate his long-held convictions that Croll's estimate of the lapse of 80,000 years since the close of the glacial period is not sup-

[†] Quarterly Journal Geological Society of London, vol. 48, p. 263. 1892.

ported by geological facts, nor the history of the development of human culture. Progressive early quarternary man could not have remained stationary for 70,000 years without advancing further than the status attained by 'man of the early stone period.' "There is nothing to represent geologically that long period of time, nor have biologists been able to detect any essential structural differences between paleolithic man and neolithic man in support of such a conclusion; all the evidence tends, on the contrary, to prove that late glacial (or post-glacial man), together with the great extinct mammalia, came down approximately to within some 10,000 to 12,000 years of our own time, and that the 'rubble drift' marks the stroke of the pendulum when the glacial period came to a close and the Neolithic age 'commenced.'"

It is well known that the stern repression of the physicists has compelled the majority of geologists and biologists to make considerable reductions in their estimates of the duration of geological time and of the ages requisite for the evolution of life on the earth. These conjectures have varied from Mr. J W McGee's revised maximum of six thousand millions of years to Professor Winchell's modest minimum of three millions. Mr. C. D. Walcott, who has recently passed this subject in review (*American Geologist*, December, 1893), came to the safe conclusion that "the earth is very old and that man's occupation of it is but a day's span compared with the eons that have elapsed since the first consolidation of the rocks with which the geologist is acquainted."*

With regard to the approximate duration of this 'span,' however, quarternary geologists and archæologists are by no means agreed. Mr. Warren Upham would extend

its limits to 100,000 years at least. Professor Prestwich would make it much shorter. He ascribes from 15,000 to 25,000 years to the glacial epoch, and to the post-glacial period at most 10,000 years; from 20,000 to 30,000 years in all to paleolithic man. (*Quart. Journ. Geol. Soc.*, London, p. 407 Vol. 43, 1887).

Historic archæologists, on the other hand, are daily accumulating evidence that the dawn of civilization was remote from our era, that the arts and sciences began long, long ago. Drawing, painting, sculptures, writing, calculating and astronomical observations were fully developed and widespread at the earliest historical period, and their origin lies far beyond our ken. The researches of Prof. Norman Lockyer have revealed a knowledge and practice of the elements of astronomy in the Old World as far back as the history of Egypt and Asia Minor can be traced, while those of Mrs. Zelia Nuttall on 'the calendar system of the Ancient Mexicans' have demonstrated the hitherto unsuspected facts that such knowledge was developed and observations practiced in the New World at an almost equally remote period of time.

Of a truth there is no finality about science. The enunciation of modern theories postdating the antiquity of man coincides with facts antedating the dawn of human civilization. Unless we may assume with Professor Prestwich, that the two periods overlapped in Europe and Asia, that while man in a more advanced state flourished in the East he may have been in one of his later post-glacial stages in the West, or are permitted to apply to human culture the principle of 'accelerated development' so dear to American biologists, the reconciliation of two such apparent contradictions must still be left a 'Problem of the Future.'

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* The majority of estimates now range from fifty to ninety-five millions, more than one hundred millions less than Darwin suggested as the age of the world.