

Mr. Harwood, the taxidermist who accompanied the expedition and by his work materially assisted Mr. Weld Blundell and Lord Lovat in forming so fine a series of birds.

The mission despatched to Sierra Leone by the Liverpool School of Tropical Diseases for the investigation of malaria may be expected to send home some interesting specimens. Mr. E. E. Austen, the dipterologist of the British Museum, is a member of the party. He will, of course, give most attention to the special objects of the mission—the connection of malaria with mosquitoes—but, besides collecting these winged insects and acquiring valuable knowledge as to their habits and life histories, he will endeavor, as far as possible, to make collections of other groups, some of which are very incompletely represented in the Museum. With reference to this question of mosquitoes and malaria it may be added that, owing to the official steps taken by the Colonial Office, the Foreign Office, the India Office, and the missionary societies, the British Museum will soon be in possession of a unique collection of these insects. As a result of the official circular issued on the subject, hundreds of mosquitoes have, we are informed, already arrived at the Museum from every part of the British Empire, and these are believed to be only a very small portion of the consignments which are to follow in course of time.

SOME NEW DATA FOR CONVERTING GEOLOGICAL TIME INTO YEARS.

WHILE conducting the Union Pacific Expedition through central Wyoming last August, I came upon what appears to be some valuable data for converting geological time into years. For a number of days we were encamped on the rim of Bates' Hole, near Lone Tree Cr., and studied the Miocene beds, which are quite extensive in

that region. Bates' Hole is a vast depression produced by the erosion of Tertiary beds and varies from six to twelve miles in width, and approximates twenty miles in length. In depth it varies from 500 to 1500 feet below the rim, and is one vast expanse of rough and broken country, surrounded by bluffs so precipitous that up to this late date there has been but a single wagon road made to enter it from the southern end; and this is far from being ideal. The bluffs that surround this very singular depression take on all of the peculiar erosion topography seen in the 'Bad Lands' elsewhere, and in many respects surpasses any of the 'Bad Land' scenery yet described. The Miocene beds are made of whitish bands chiefly and in the vicinity of Lone Tree Cr., there are many slopes of about 30° reaching upwards from the valley, and above them terrace after terrace of harder bands that represent the castle like erosion. The slopes, as well as in many places the bluffs, are partially covered with pine trees (*Pinus murryana* Eng.). The trees on the slopes are stunted, gnarly and knotty, and are strongly marked by their great struggle for existence under the most unfavorable conditions. The oldest of these trees vary in diameter from eighteen inches to two feet, and have been recording the rate of erosion on these slopes for about 300 years.

Erosion has been so rapid that the oldest trees are now standing upon their stilt-like roots, with their trunks elevated from the slope some three or four feet. The rate of erosion appears to have been uniform with the growth of the trees. The trunk of the sapling remained on the ground; while the trunk of a tree six inches in diameter was often several inches above the surface, and the tree a foot in diameter was already upon stilts. On account of the shortness of our stay, absolute measurements of a large number of trees could not be made. Nor

could the exact age of a number of trees be determined. This has been planned for future work and will be executed at the earliest possible date. The fact, however, that these trees have acted as silent guards for centuries over these slopes and have recorded with unerring accuracy the rate of erosion is apparent, and as soon as the data can be secured, there will be a valuable factor for converting geological time into years.

By approximating the various estimates in connection with the date the following may be of interest: The Hole where the observations were made was about six miles wide. The trees were 300 years old and there had been on an average of three feet of rock removed from their roots. This would require one hundred years to remove a foot of the formation. Considering that the erosion started in the center of the Hole, there has been three miles removed from either side, which at the rate of one foot per century would require 1,584,000 years. Without question this erosion commenced at the close of the Miocene and hence represents the entire Pliocene and Pleistocene Epochs. The exact time relation of the Pliocene, and Pleistocene in relation to Eocene and Miocene has not been established; but if the Pliocene and Pleistocene Epochs represent 1,584,000 years it would not be out of the way to estimate Cenozoic time at 4,000,000 years. If this value be substituted in the ratios of geological time suggested by Dana:—Paleozoic: Mesozoic: Cenozoic as 12:3:1 then all geological time since the beginning of the Cambrian would be represented by 64,000,000 years. This estimate is not inconsistent with some already made; but when founded on absolute data may vary much from this. Nevertheless, whatever the results may be when found upon a complete investigation of this subject, they will furnish valuable scientific data that will aid materially in

giving us a better understanding of geological time in terms of years.

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October 2, 1899.

SCIENTIFIC BOOKS.

La géologie expérimentale. Par STANISLAS MEUNIER, Professeur de Géologie au Museum d'histoire naturelle de Paris. With 56 figures in the text. Paris, Ancienne librairie, Germer Baillière et cie. 1899. Pp. 311. (Bibliothèque Scientifique Internationale, XCII.). Price, 6 frs.

Just twenty years have elapsed since Daubrée brought out his famous work *Études synthétiques de géologie expérimentale*, and laid thereby the foundations of the school of French experimentalists. This book was translated into German in the following year, 1880, but never found an English interpreter. That such an edition was needed is shown by the reference in Dana's Manual of Geology to an alleged experiment of Daubrée with plates of *ice*, which should have been rendered plates of *glass*.

The mantle of Daubrée seems to have been taken up by M. Stanislas Meunier, who enjoys the distinction of having reduced the odds and ends of experiments, performed in the imitation and illustration of geologic processes, to a system of lectures for the entertainment and instruction of a large class of students. The present book is a *résumé* of these lectures as given in the year 1898 at the Museum of Natural History in Paris.

The scope of the work is general, in that the experiments described relate to a wide range of phenomena, *e. g.*, the formation of rain-prints, stream channels, deltas, solution furrows, weathering, disintegration and decomposition of rocks, the striation of rocks, sedimentation under varied conditions, the production of faults, folds, and systems of fracture and displacement. The treatment of the subject, however, is somewhat narrowed by the fact that the author deals almost altogether with his own experiments, with only incidental reference to the work of others. The book cannot be said, therefore, to represent fairly or comprehen-