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THE CLOSE OF THE CENTENNIAL EXPOSITION.

With ceremonies as simple and yet as befitting as those which marked its opening, the Centennial Exposition has closed, and so our grand celebration passes into the history of the country. The present is hardly the time to view it in the light of a single event, still less to attempt to point out its results and probable effect upon the industries of the nation and our future intercourse with the rest of the world.

That the Centennial, both intrinsically as a display and in the circumstances connected with it, has been successful far beyond the lot of all previous world's fairs, is plainly evident. The exhibits collectively were, with few exceptions, splendid representations of the resources and skill of the contributing nations. Never before has there been gathered such a collection of wonderful productions as the English and German pottery, the French silks and tapestries, the Chinese carvings, the Japanese bronzes, the Austrian art work, the Belgian laces, the superb records of the vast engineering works of Holland, the exquisite Italian mosaics, the Bohemian glassware, the Russian silver and gold objects and precious minerals, the Swedish iron and steel, the magnificent groups of Australian products, and our own labor-saving machinery.

The extortions and privations which visitors to Vienna encountered at every turn were in Philadelphia rarely met with. Within the grounds the provisions for the public comfort were such that even the colossal crowds, which at times filled the buildings, failed to disarrange them. And then the crowds themselves! Where could two hundred thousand enthusiastic people be gathered within such narrow limits for a day, and yet not a single accident, no injuries to individuals, and no acts of lawlessness occur? What a magnificent proof of efficiency, for our railroads to be able to point to the fact that eight million people have been transported to Philadelphia from every portion of the country, over a period of six months, and but one casualty wherein life was lost had occurred! Eleven years ago, these eight million people were engaged in a bitter and terrible internecine war. Now, great national gatherings have taken place day after day, unmarred by a word of sectional strife or ill feeling. For three years the nation has been suffering under a shrinkage of values and a financial stress which has brought ruin to thousands, and of which no one has escaped the evil effects. Yet despite all the privations and suffering incident thereto, a vast national enterprise has not only been successfully carried through, but has included such a representation of the fruits of American industry and genius as has never before been seen.

While we cannot yet point to special results due to the Centennial, we may at least be assured that it has imparted to our people a valuable and healthy appreciation of the "goodness which lieth abroad." Its tendency has been to break down that bulwark of intolerance and self-sufficiency which Brother Jonathan too often deems in accordance with his independent notions of self-sovereignty, and which has caused him to depreciate the productions of older nations. On the other hand, it has opened the eyes of the world to the fact that we are ready to compete for precedence in the trade in certain products, hitherto monopolized abroad, notably our steel, our porcelain, our cotton goods, and our silks. We have also learned to compare our own work with that done in Europe; and having found where we are excelled as well as where we excel, we have stored up a stock of ideas, sure to bear rich fruit in the future.

In these ideas and thoughts suggested, in extended commerce due to the closer intercourse with, and hence better knowledge attained of, other nations, in the consequent impetus to our industries and educational systems, and in a broader cosmopolitan spirit diffused over the whole country, do we look for the best results yet to be gained from the Centennial Exposition.

INTERMITTENT RECORDS AND THEIR INTERPRETATION

A few years ago, men wrote universal history with the utmost precision and confidence, as though the doings and developments of humanity, during all ages and in every part of the world, were perfectly known. The threads of human history, so far as then possessed, plainly converged toward a little tract of country east of the Mediterranean Sea; and believing that the Scriptures contained a divinely inspired account of man's origin there, men not unreasonably inferred that all the world outside their knowledge was actually or practically blank. But for the past half century, intelligent people have ceased to entertain that view, except with great and various modifications, determined by a more or less honest desire to maintain the integrity of the scriptural record. As soon as the matter began to be critically investigated, it became very clear that, so far from being complete and continuous, the chronicles which had been woven so often into exhaustive histories, were disconnected and fragmentary, extremely limited in scope, and wretchedly deficient every way. Even when fullest, they gave but scanty information of the daily lives of the people, the movements of nations, the rise of empires, the progress of invention and discovery, indeed of everything now considered most valuable and important, historically considered.

Gradually historical research and archæological investigation came in to discover and imperfectly bridge over enormous gaps in the history once thought complete; highly important events were found to have been lost track of; during long periods of time no records had been kept, and of records carefully made only disconnected fragments have survived; unmentioned or falsely mentioned empires were found to have flourished side by side with those which had professed to be not only the people but the only people of their day, while others a little further off were utterly unknown. Splendid civilizations, lasting many centuries, had contributed nothing to the written chronicles of the nations whose records remained; and others which had apparently burst in full panoply upon the gaze of an astonished world, were found to have had their beginning in barbarism, and to have slowly risen to the lofty stage at which history had formerly found them.

Still more fatal to the ancient view of universal history were the discoveries that, at the general y accepted date of man's beginning, Egypt was in her decline, the grandeur of her civilization having reached its culmination before Satan talked with Eve in the garden, and that other parts of the world which had been accounted historically blank could show, like China and Peru, the remains of civilization certainly as ancient as that of Egypt.

Then geology came forward to show that the six thousand years of Hebrew chronology, or the doubly extended chronology of Egypt, covered but a minute fraction of the time since man made his first recognized appearance on our globe, and that all we know of human history is as nothing compared with the unrecorded ages of which we only know that man existed. Evidence of the gaps in the story of humanity, gaps of enormous duration, are indeed overwhelming. Evidence of what man was doing during those ages is for the most part nil. It is possible, however, to bridge over some of those periods by inferences which cannot be considered wholly illegitimate. We know that, back of every civilization which has been critically studied (no matter how abruptly that civilization may have first seemed to come upon the stage of history), there have been found evidences of lower and still lower culture. In some cases it has been possible to trace the successive steps of progress almost continuously from barbarism upward, and everywhere the drift of evidence touching early races is such as to justify the conviction that civilization has always been a product of human effort and time. Even when the antecedents of a civilization are lost entirely, we still know enough of human development not to believe that the nation began when and as it first appeared on the stage of history.

All this is now common place enough, we are well aware; and it would be unworthy of serious rehearsal here were it not for the instructive parallel which may be drawn between it and the historical interpretation of the equally intermittent and fragmentary records of geology, touching which there is still a great deal of misunderstanding.

In the early days of geological observation, men proceeded just as they had done in the case of human history. It was assumed that the rocks contained a divinely appointed record of the earth's history, from which men could gather an exhaustive knowledge of the whole earth's experience. The strata of England and Western Europe were studied with great enthusiasm; their relative ages were determined, and their fossil remains were arranged according to the assumed order of their creation, with more or less forcing to make them tally with the Mosaic days. Everything seemed straightforward and easy. If fish appeared in great numbers in one stratum, it was because they were created then and there; if monstrous lizards swarmed suddenly in another, it was because a new chapter had been begun in the geologic history; and so on to the minutest detail.

But as knowledge increased by the study of outlying strata, grave doubts began to arise with regard to the completeness of the supposed "perfect" record and the correctness of previous interpretations. The times of "first" beginnings had to be pushed back again and again. Formations supposed to have succeeded each other immediately were found elsewhere to be separated by deposits of vast thickness, requiring enormous periods of time for their deposition. Creatures supposed to have come suddenly into being in one age were found to have existed at periods immensely more ancient. Gaps were discovered where none had been suspected; broad distinctions of age and formation were ruthlessly wiped out; and as the work went on, it became more and more apparent that the classifications and chronologic schemes, which had been so confidently adopted, were largely misleading or meaningless. To those who studied geology in books, the completeness and continuity of the geologic record remained undoubted; to those, however, who were engaged in the study of the record itself, its intermittent and fragmentary nature was most apparent. It was seen that only under rare and exceptionally favorable conditions was it possible that any record of life could be made. It was only under still more exceptional conditions that the record, if made, could be preserved. And when the limited scope of geological investigation was taken into the account, the absurdity, of the early deductions considered as comprehensive and exhaustive, became ludicrously plain. Yet when Mr. Darwin appealed to the imperfection of the geologic record, closet geologists everywhere raised a great laugh of derision, as though he had invented the plea to cover the weakness of his case. Public opinion on this point had indeed to undergo the same course of instruction and enlightenment that we have noticed in connection with the history of man, a course which it has not yet by any means completed. Even men who consider themselves competent to discuss publicly the deeper problems of geology, evolution, and so on, not un-

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II. ENGINEERING AND MECHANICS.—The Great Suspension Bridge between New York and Brooklyn, with 4 illustrations.—Description of the Mode of Making and Laying the Cables, the Cradles, and Temporary Foot Bridge.—Phosphor Bronze, a valuable paper, showing its Uses, with Tables of its Comparative Strength.—The Use of the Magnetic Needle in Searching for Iron Ore, by Professor J. C. Smock. Showing the Magnetism of Mineral Rocks, the Styles of Compass best suited for Exploration of the Ground Surface, Methods of Use, Manner of Surveying, etc. A valuable and interesting paper.—Compass Corrections of Iron Ships, by SIR WILLIAM THOMSON.—Report of the Western Union Telegraph Company, Progress of Pneumatic Tubes in New York.—The Copper Deposits of America, by T. STERRY HUNT.—The Process of Hydraulic Mining at Dutch Flat.—Spring Motors, with 5 figures.—Plan for Street Car Propelled by Rubber Springs, 2 figures.—Combined Spring Motor, by C. J. SCHUMACHER, 3 figures.—Natural Gas.—Water Railways, with 4 illustrations.—The Proposed Road Locomotive, 238 feet long, 135 feet high, intended to run on the bottom of the English Channel, between France and England, 2 figures.—The Water Railway now in operation at St. Malo, France, 4 engravings.—The New 100 Ton Gun made for the Italian Government, 1 engraving.—Trials of the New 81-ton Gun, England. How the 81-ton Gun was Made, with 8 figures.—Oils and Fat Destructive to Iron.—Centroids and their Application to Mechanical Problems.—A Steam Lamp.—Experiments on the Turning of screw steamers, by Professor OSBORNE REYNOLDS.—New Standards of Weights and Measures, by Professor HENNESSY.
III. TECHNOLOGY.—Manufacture of Artificial Butter, by Henry A. Mott, Jr., E. M. P. D., of New York, with six engravings.—Being a full description of the Method of Manufacture, Apparatus, Cost and Profits.—A full and valuable paper, clearly explaining the entire process.—Action of Alcohol on the Brain.—A New Voltaic Cell, paper read before the British Association, by C. H. W. BRIGGS.—Professor Bel's Speaking Telegraph.—Specimens of Conversation as Carried on Over Telegraph Wires.—Photographs of an Enamel or Porcelain. Newton's New Process for Photo-Engraving Plates.—How to Use Photographic Backgrounds, by L. W. SEAVEY, of New York, with fourteen illustrations. Professor Seavey is the acknowledged master of the art of producing and using photo-backgrounds; and in this paper he fully explains the methods adapted for the production of the best practical effects in photographic portraiture. Every artist should read this valuable paper.
IV. LESSONS IN MECHANICAL DRAWING, No. 28. By Professor C. W. MACCORD, with 16 illustrations.

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