

## EROSION AT NIAGARA.

IT seems to have been a matter of common observation among the early colonists of America that the Niagara Falls had receded from the escarpment at Queenston to their present position six miles up the gorge. In spite of the view then frequently held that ravines were to be accounted for by violent rendings of the crust, those six miles, even in the eighteenth century, were appealed to as a natural time-scale. It was, moreover, felt that the rate of recession might give us a measure of the antiquity of the earth. James Hall in 1842 established a series of marks and monuments to which subsequent surveys might refer, and Mr. G. K. Gilbert<sup>1</sup> now draws conclusions from the work of his predecessors in 1842, 1875, 1886, and 1890, and from Mr. W. C. Hall's re-examination of the edge for the United States Geological Survey in 1905. He reproduces some of Captain Basil Hall's drawings, made with a camera lucida in 1827, and interesting photographs taken from 1855 onward. The former, which appear to be of great accuracy, throw doubt on certain de-



The Horseshoe, the true head of the Niagara Gorge, about 1886. The notch in the farther margin was not present in 1827.

tails of the map of 1842. Mr. Gilbert regards the survey of 1905 as of especial importance, since it is the last record of the Niagara River in a natural condition. "The Erie Canal is supplied with water from the Niagara River at Buffalo, the Welland Canal is supplied from Lake Erie, and the Chicago Drainage Canal draws water from Lake Michigan. All the water thus diverted is withdrawn from the cataract. So also is the water diverted from the river above the falls for factory purposes and for use in the generation of electricity" (p. 12).

The really active line of erosion is at the lip of the Horseshoe Fall. Very little recession occurred here at the head of the gorge between 1827 and 1842, but the rate between 1842 and 1875 was about 4 feet per annum, and from 1875 to 1905 nearly 6 feet per annum (p. 15). "The distance through"—Mr. Gilbert writes "thru"—"which the Horseshoe Fall has retreated since it parted from the American Fall is about 2500 feet. Allowing 5 feet per annum as the rate of recession, the parting took place about five hundred years ago." The present average rate

of recession of the American Fall is probably only 0.2 foot per annum.

Mr. Gilbert, in view of the importance of local and temporary conditions, such as the position of joints in the limestone shelf, wisely makes no estimate of the time that has elapsed since the falls occurred at Queenston. But his study will be welcome in the literature of geology and geography alike, since it deals with one of the most famous types of river-erosion in the world. G. A. J. C.

A YEAR'S WORK OF THE CARNEGIE INSTITUTION.<sup>1</sup>

THE Carnegie Institution was founded, and endowed with 2,000,000., in order "to encourage, in the broadest and most liberal manner, investigation, research and discovery, and the application of knowledge to the improvement of mankind." The year-book for 1906 contains a general report on the work of the year, and short abstracts of the special investigations in progress. To the reader it affords abundant opportunity of "fine confused feeding"; to the reviewer a mass of projects and results of which it is hopeless to give any adequate account.

The trustees' plan of campaign has not yet been thoroughly worked out, and, indeed, in detail at least, must vary with the time. At the outset they had hosts of applications for assistance in research. The universities and colleges of the United States are now largely staffed by men brought up on research, who find themselves without the time or the appliances for the work they have prepared themselves to do. It was natural that they should appeal to the institution for assistance, and that the trustees should respond by making grants in aid to individual investigators on a somewhat extensive scale. But difficulties have made themselves manifest, especially in the supervision of miscellaneous investigations; and experience has convinced the trustees that there is a greater prospect of a valuable return from large projects carried on under the direct supervision of the institution than from minor projects entrusted to individuals. Accordingly, during 1906, while the larger projects have been increased, a smaller number of minor grants have been made than in former years.

There are at present forty-five of these minor projects in progress. They are for the most part researches in mathematical, physical, and natural science, and in history, literature, and philology; but they include also the preparation of such works as the "Index Medicus." The grants in aid of them range from 50l. to 2000l., and seem to be made for the provision of assistants, apparatus and materials, and for the publication of results. The total amount thus allotted during the year was about 19,000l.

The larger projects may be divided into four classes—astronomical, geophysical, biological, and economic and historical. Astronomy has always been

<sup>1</sup> "Rate of Recession of Niagara Falls." By G. K. Gilbert, accompanied by a Report on the Survey of the Crest, by W. Carvel Hall. Pp. 31+11 plates. (Bull. U.S. Geol. Survey, No. 506, 1907.)

<sup>1</sup> Carnegie Institution of Washington, Year-Book No. 5, 1906. Pp. viii+266. (Washington: Published by the Institution, 1907.)

a favourite researching ground in America. Few of its larger universities are without observatories, and many of the smaller colleges possess them also. The institution seems to aim at extensive schemes which are beyond the scope of the universities. In the department of solar physics 28,000*l.* has been expended on the buildings and equipment of the Mount Wilson Observatory, and the year's work under Prof. Hale includes photography of the sun and of the spectra of sun-spots and flocculi, spectroscopic study of solar rotation, and bolographic study of solar absorption. It is interesting to note that, notwithstanding its princely endowment, the institution is glad to announce a gift of 9000*l.* for the provision of a mirror of 100 inches aperture for a great reflecting telescope, to be used for the analysis of the light from faint stars and nebulae. The second astronomical department, that of meridian astronomy, has been organised in the present year, and Prof. L. Boss has been appointed, with an appropriation of 40,000*l.*, to superintend the preparation of a catalogue giving the precise positions of all stars down to the seventh magnitude. As an essential feature of the work he is to establish a temporary observatory in the southern hemisphere.

In the department of geophysics, the work has been conducted hitherto by individuals. But their investigations on the flow of rocks, the elasticity and plasticity of solids, and mineral solution and fusion under high temperatures and pressures, have been so successful that an appropriation of 30,000*l.* has been made for the purchase of a site in Azadia, D.C., and for the building and equipment of a laboratory. In another geophysical department, that of terrestrial magnetism, Dr. L. A. Bauer, with a grant of 11,000*l.*, has been carrying out a magnetic survey of the Pacific Ocean, as well as of the island of Hainan and a number of islands of the southern Pacific.

There are five biological departments. The widest in scope is that of experimental evolution, under the direction of Prof. Davenport, who has been provided with a laboratory specially designed for the study of the phenomena of heredity, hybridisation, and mutation, "by substantially the same methods as those applied to the stars by the astronomer or by the chemist to inorganic matter." The director is hopeful of success, and has already some results to report; but he points out that "a decade is the smallest convenient unit of time for measuring the progress of the more important investigations now under way." The department of marine biology is under the direction of Dr. A. G. Mayer, who has been provided with vessels, buildings, and docks, and with the aid of specialist guests is studying the fauna of the Florida coast. More novel in its aim is the department of desert botany, which has a domain and buildings in Arizona, and is directed by Dr. D. T. MacDougall. It is devoted to research on the flora of arid regions, and the influence of altitude and climate on vegetation. The director is establishing small plantations at various heights above sea-level, and denuding areas here and there that he may study their re-occupation by desert plants. He is also making systematic observations on the shores of an accidentally formed lake, 500 square miles in area, in the Salton Basin, California. The channel between the lake and the Colorado River, by the overflow of which it was formed, has now been closed, and during the gradual disappearance of the lake the re-occupation by desert vegetation of the areas left bare by the recession of the water is to be studied.

The department of horticulture is on more ordinary lines, plant, flower, and fruit development forming its scheme of work. The department of nutrition is

less conventional in its character, its aim being to extend our knowledge of the physics and chemistry of normal nutrition and of the conditions and remedies for abnormal nutrition. As in previous years, its work is entrusted to individual investigators—three, working on distinct lines—at whose disposal a sum of 3000*l.* has been placed, but the provision of a special laboratory is under consideration.<sup>1</sup>

Finally, we have the related departments of historical research and of economics and sociology. Prof. J. F. Jameson, who directs the former, is engaged mainly in the preparation and publication of guides to the materials for American history to be found in the archives of Washington, Cuba, Great Britain, and Spain, to be extended as soon as possible to France, Mexico, and Rome, also in the publication of documents bearing upon the history of the United States. About 3000*l.* has been allotted to this department during the year. In economics and sociology, Dr. C. D. Wright and his 130 collaborators, with a grant of about 6000*l.*, have been making a bibliographic index to the public documents of the various States of the Union, and are studying population and immigration, agriculture and irrigation, manufactures, transportation, labour and industrial movements, taxation, and the negro problem, with a host of questions which these subjects suggest, ranging from railway pools to the need of church federation in Vermont.

It will be noticed that in the selection of larger projects the trustees have kept in view Mr. Carnegie's expressed wish that not merely knowledge itself, but the application of knowledge to the improvement of mankind, should be advanced. Most of the departments which have been organised have a distinct practical bearing, and some, such as the desert botany and the terrestrial magnetism departments, have blocked out work of great importance from both points of view. That the "mankind" of the articles of incorporation is being interpreted in the first instance in a somewhat local sense is natural. Charity begins at home. And it must be remembered that we are all interested in the ocean magnetic fields in which the great Republic has a special interest, that we must all benefit by a thorough knowledge of the history and the social condition of the United States, and that year by year we are all becoming more painfully affected by those abnormalities of nutrition to which the strenuous life of her citizens is supposed to give rise.

Little space remains to notice another department of the work of the institution, viz. the issue and distribution of publications. So far, fifty-seven volumes have been published, and thirty-one are now in the press. During 1906 nineteen volumes appeared, the expenditure on them being about 8500*l.* Lists of the publications are sent to about 10,000 individuals and institutions, but as the standard edition is 1000 copies only, but one-tenth of the 10,000 can be expected to respond. This restriction to 1000 copies is the most un-American feature of the policy of the institution, and in the interests of the advancement of knowledge is to be regretted. No doubt even an endowment of 2,000,000*l.* gives a limited income. But if the scientific work which it produces is of value, the publications describing the work should be widely distributed. And the president seems to take a perverse view of the question when, in order to meet anticipated criticism, he says:—"If the bibliophile has found reason for dissatisfaction in the distribution of the publications of the Institution he may be disposed to be lenient with the latter on learning that he is one of many thousands soliciting favors."

<sup>1</sup> Since the issue of the Year Book it seems to have been decided upon.