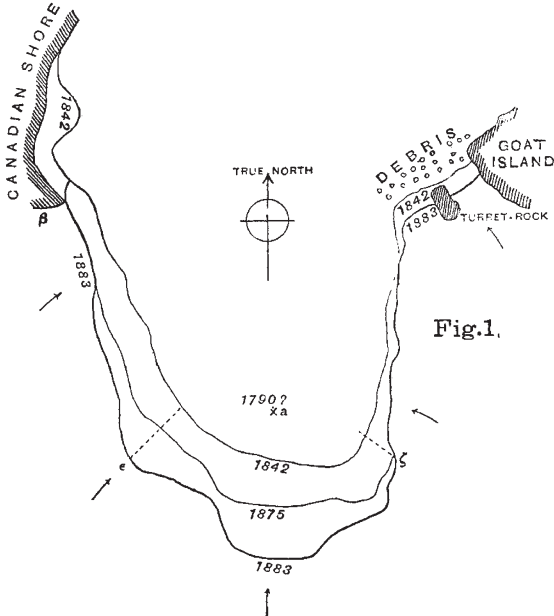


Mammoth; on February 15 a letter was read from Benzelius, stating that Kagg had received the drawing from a Capt. Tabbert, and that he could give no information as to its correctness. Again, on October 3, Benzelius exhibited a large bone, almost petrified, which was the jaw of a Mammoth, or as it was called Behemoth, received from Tobolsk in Siberia, through Capt. Clodt von Jürgensburg, and, on November 22, Benzelius exhibited "part of the tusk of a Behemoth, which was exactly like ivory." Finally, Benzelius communicated with the Russian Chief of Mines, Tatischew, who, in a letter dated May 12, 1725, had given long and important information of the history of the mammoth. This letter is printed in "Acta Literaria Sueciæ" (vol. ii. p. 36, 1725).

A. E. NORDENSKIÖLD

NIAGARA FALLS: THE RATE AT WHICH THEY RECEDE SOUTHWARDS

THE diagrams are from the map issued by the New York Commission for the establishing a State reservation at the Falls, based on surveys made in August and September, 1883, by Thomas Evershed, under direction of Silas Seymour, State Engineer and Surveyor. The scale of the diagrams is one half that of



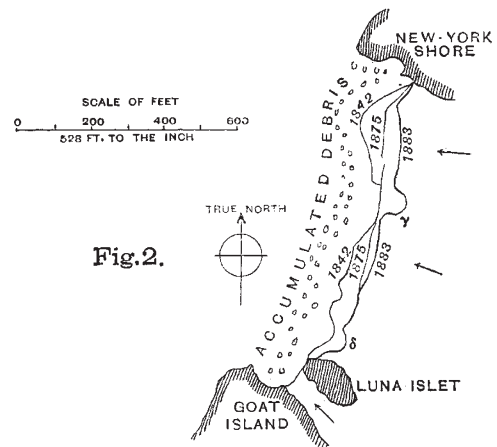
the map, which is on a scale of four chains to the inch. To have given all on one diagram with the intervening Goat Island would take up nearly an entire page of NATURE, and if the scale were smaller it would fail to show clearly the distinctive features of the changes in progress. Fig. 1 shows the Canadian or Horse-Shoe Fall, Fig. 2 the Eastern or so-called "American" Fall—a misnomer too deeply rooted in usage to be now supplanted by some more fitting name.

The rate at which the Falls are receding has been a matter of interest to geologists for over fifty years, but the results so far reached have been conflicting and inconclusive. The manner in which the Falls work backward, undermining their brink, is so well known from Lyell's clear description, that I shall not repeat it.

In 1830, Bakewell, on the basis of such information as he could gather from old inhabitants and from his own observations, concluded that during the previous forty years the Falls had receded at the rate of three feet per annum.

Lyell, from such materials as he could obtain during his own visit in 1841 and 1842, estimated the annual retrograde motion at only a foot. It is sufficient to recite such discordant results arrived at by two careful investigators to show how imperfect were the materials at their disposal, nor will any one who has been on the spot wonder at their differing so greatly. It would be possible to roughly compute the southward movement of the innermost recess of the Canadian Fall by referring its position from time to time to some fixed points on the adjoining shore, but any conclusive determination of the movement of the entire Fall could not be obtained in this way. The map referred to gives the outline of the Falls as determined by three surveys: the New York Geological Survey of 1842, the U.S. Lake Survey of 1875, and Evershed's Survey of 1883. The contours of the brink as established by these enable us to measure the total movement.

I divide the contour from β to Goat Island into thirty-three sections, disregarding for obvious reasons the overflow north of β, on the Canadian shore. From β to ε are eleven sections, from ε to ζ are twelve sections, from ζ to Goat Island are ten sections. It is obvious that much the greater work has been done between β and ζ, and that the innermost recess has kept in the same relative position.



The means of the measurements on the sections, along perpendiculars from the contour at the date of each survey, measured on a tracing of the published map, give the following results for the Canadian Fall:—

	33 years ending in 1875 ft.	8 years ending in 1883 ft.	41 years ending in 1883 ft.
Mean aggregate recession along contour of 2000 feet, from β to Goat Island =	80	—	114
Mean aggregate recession along contour of 1200 feet, β to ζ =	—	60	—
Mean annual rate of regression along the whole contour where a visible change was effected =	2½	7½	2¾
Total maximum regression at the innermost recess =	118	135	253
Annual rate of maximum regression =	3¾	16½	6¼

The "American" Fall, measured in ten sections, gave a total mean recession of 37½ feet in the 41 years ending in 1883, which is at the rate of about 10 inches per annum.

I do not know that I have seen any estimate attempted of the relative volumes of water passing over the two falls. From such imperfect data as I have, referring to depth and swiftness, I should think that the rate of erosion for each fall gave some approximation to the

volume of water discharged over each; that is to say, $2\frac{3}{4}$ feet per annum for the Canadian Fall, $\frac{3}{8}$ foot per annum for the "American" Fall, would signify that the former pours over its brink three times as much water as the latter.

At the rates of recession above shown it is evident that at no very remote age the two falls were united in one when abreast of the point in Fig. 2 marked "New York Shore," and the entire width was about the same as that of the present Canadian Fall alone. Moreover, the mean width of the fall, from the time it commenced its work at the "heights," seven miles below its present position, according to Lyell's statement as to the gorge of Niagara River, was not greater than the present Canadian Fall. Adding together the present work done by both falls, we should have about $3\frac{1}{2}$ feet per annum as the backward work performed when the entire volume poured over a single fall of the width of the present Canadian Fall.

At this rate 10,000 years would seem sufficient time for the cutting out of the present gorge terminating at the "heights" towards Lake Ontario, instead of Lyell's estimate of 35,000 years. All attempts to calculate the rate of movement proceed on the assumption that the hardness of the lime-rock and shale, the volume of water, and the height of the fall, were, for the whole distance, much the same that they now are; I merely use these same assumptions. It in no wise reflects on Lyell's judgment that he should have erred so greatly in attempting to estimate the rate of regression, while yet the contour of the fall at different periods had not been fixed by triangulation. He was ever the first to lay aside a conjecture when he could lay hold of something more solid in its stead, and it was by his candour and sound judgment in discussing natural phenomena that my interest in such matters was chiefly awakened.

The statement made by him that Hooker, his guide in 1841, reported that an indentation of 40 feet had been made in the "American" Fall since 1815 seems to contain the basis on which he estimated the rate of regression for both falls, as this amounts to a little over one foot per annum. A reference to the results given by me show this to have been approximately correct for the mean rate at the "American" Fall, but wholly inapplicable when applied to the much more important Canadian Fall.

A consideration of his section of the Niagara River leads me to suppose that the falls in the earlier part of their history worked even more rapidly than now in undermining the brink, but I will not venture further upon your space at present.

EDWARD WESSON

Providence, R.I., U.S.A., June 1.

NOTES

THE Hon. William Macleay, one of the members of the Senate of Sydney University, has undertaken to give four fellowships, of 400*l.* a year each, for natural science, and to bequeath a sum sufficient to endow them permanently. In order to prevent any sleepy Fellows, we are told, from being quartered on this foundation, he stipulates that they must all have taken the degree of B.A. in the University, must be actively engaged in original study and research, and must not hold any other lucrative appointment, and the appointments are to be renewed every year, so as to give an opportunity for correcting any abuse.

THE Darwin Medal—founded by the Midland Union of Scientific Societies in honour of the great naturalist, and for the encouragement of original research—has been awarded for the current year to Mr. W. J. Harrison, F.G.S., of Birmingham.

THE long excursion of the Geologists' Association this year will be to Belgium (the Meuse and the Ardennes, Brussels, Dinant, Namur, Liège, Maestricht), under the direction of M. Ed. Dupont (Director of the Museum, Brussels, and of the

Belgian Geological Survey), Prof. A. Renard, Dr. E. Purves, and Prof. J. Gosselet. The party will meet in Brussels on Monday, August 10, and will proceed the same evening to Charleroi. Further particulars as to fares, routes, &c., will be given in a special circular, which will also contain full particulars of the geology, with illustrations and references. The total expense during the five days of the excursion (Tuesday to Saturday) will vary from 15*s.* to 20*s.* per day for each person. This will include conveyances; also a special steamer on the Meuse, stopping at the various points of interest. By this arrangement much can be seen in a short time. The papers on the geology of Belgium read at the July meeting will be printed, with map and illustrations, for the use of the members during the excursion. Those proposing to join this excursion are requested to give early notice to the Secretary, who will supply further information if required.

A MONUMENT was unveiled last week at the École Normale, Paris, to Dr. Thuillier, the member of the French scientific mission to Egypt who died of cholera at Alexandria in 1883.

THE anniversary meeting of the Sanitary Institute is held to-day at the Royal Institution at 3 p.m. The chair will be taken by Sir John Lubbock, Bart., D.C.L., F.R.S. An address will be delivered by Prof. W. H. Corfield, M.A., M.D., entitled "The Water Supply of Ancient Roman Cities."

THE new buildings which have been erected in Chancery Lane and Fetter Lane for the purposes of the Birkbeck Literary and Scientific Institution were opened on Saturday afternoon by the Prince of Wales. The building, of which the foundation-stone was laid by the late Duke of Albany, contains accommodation for 6000 students. On the first floor are the library, reading and coffee rooms, and on the three floors above are the class rooms. A sum of over 20,000*l.* has been expended on the premises, which appear to be admirably adapted to the purposes for which they are intended.

THE Swedish Government have despatched Capt. R. Nissen to Kiel and Hamburg for the study of the chronometer observatories there and matters relating thereto. A sum of 250*l.* has been further awarded to Capt. Nissen for his valuable meteorological, astronomical, and magnetic observations during the recent cruise of the *Vanadis* around the world. A sum of money has also been granted to Dr. G. Tiselius, for the study during the summer of the attempts in progress in certain parts of Sweden of forest-cultivation from seeds; and a similar sum to Herr L. Baltzer for the drawing of the Runic inscriptions in the province of Bohus. It has further been decided to appoint an agent in London for one year to study and report on the fresh fish trade between Sweden and England, and the means to be adopted for its advancement.

THE Swedish Government have granted Dr. A. W. Liungman a sum of 350*l.*, in addition to his yearly salary, for the study of the herring and herring-fisheries of the west and south coast of Sweden, and the publication of the material collected.

AN unusually bright meteor was observed at Södertelje, near Stockholm, on the night of June 5, at 11.5 p.m. It came from the south, and went in a straight line west-east at about the height of Orion above the horizon. It could be followed with the eye in its course between Sirius and Algol, where it disappeared. The apparent size was one-fifth of that of the moon, and the colour brilliant white.

ADVICES received from Iceland by the last mail are of a very disquieting character. Of the bodies of those killed by the avalanche in February last, twenty-four have been recovered, and the authorities have prohibited rebuilding in the valley. The weather during the spring has been exceedingly bad, snow falling incessantly from May 18 till June 5, and although the sea is open