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ARTICLE XI.

THE YEARS OF PLENTY AND THE YEARS OF
FAMINE IN EGYPT.

BY G. FREDERICK WRIGHT.

THE account of the seven years of plenty and the seven years of famine during which Joseph administered the affairs in Egypt receives much light, and becomes more easily credible, from a study of the physical conditions which determine the growth of crops in Egypt. The more one studies the subject, the more he is surprised at the delicacy of the balance of physical forces which annually determines the prosperity of the Egyptian agriculturist. A friend with whom we traveled is soon to publish a work upon the pyramids, to show that they represent a series of experiments to obtain a trustworthy sun-dial from whose shadow the exact date of the winter and summer solstices could be obtained, and that this object was at last attained in the great pyramid of Cheops.

The difficulty and the importance of determining this exact point of time each year are not generally appreciated. Few realize how much we owe to the astronomical observations of the ancients in determining the exact length of the year. Since this is approximately $365\frac{1}{4}$ days, the point shifts so imperceptibly that long observations must have been required to ascertain the exact period. But it was especially necessary to determine this in Egypt, in order that the crops might be sown at a proper time. For, if the rotation of crops each year can be properly adjusted, two crops, and sometimes three, can be secured; while, if a mistake of even a few days is made in the time of sow-

ing the first crop, the second one would be imperiled, and the third one rendered impossible. Our friend suggested that the successive years of plenty and famine were occasioned by the skill with which the right time for sowing the first crop was determined in the years of plenty, and the failure to observe the most favorable seedtime in the years of famine.

From what has been said, it can be easily seen that, when population has reached the great density which it evidently had in Egypt, where the margin between plenty and want was so narrow, a slight mistake in astronomical observations might have produced a series of disastrous years. Indeed, our friend further suggested, that he was not sure but that the years of famine were produced by Joseph on purpose to secure for Pharaoh the nationalization of the land whereby, as now under the exact justice of English rule, the distribution of water could be regulated more readily by the central authorities. And it is evident that, where dependence is had upon irrigation, success can be obtained only by the strongest form of centralized government.

But, apart from such considerations, there are certain physical elements in the problem which render a solution easy without involving human nature in such questionable operations. It was long since surmised by Sir Robert Murchison, even before the lakes of Central Africa were discovered, that the inundations of the Nile indicated that Central Africa was shaped like a great saucer, in which the accumulating waters in the rainy season rising a few feet would serve as a reservoir to secure the prolonged high-water which was necessary for the fertility of Egypt.

Now we know that this is the case. The water of the rainy season accumulates rapidly in the great central lakes of Africa, but it can pass through the constricted outlet only in a limited stream, and if this outlet should be liable

to obstructions, it might occur that there would be a deficiency of outflow for a series of years, followed by an unusual abundance for another series of years, and then a still greater deficiency for a following period. It has long been known that the accumulation of vegetable matter technically known as the *sudd* has sometimes collected in the upper part of the Nile to such an extent as to obstruct the flow of water for a period, and produce great distress in Lower Egypt. It is probable that this was the cause of the extreme low water and drought which existed in Egypt from the year 1071 B.C. to the year 1064, when the whole country was well-nigh disorganized through the effects of the famine. An inscription in an island near the First Cataract, between Assouan and Philae, which dates probably from the third century B. C., describes a famine which occurred about 3000 B. C. occasioned by successive years of low water. In A. D. 1106, as is related by the Arabic historian Elmacin, there was a period of low water which caused great alarm in Egypt. Whereupon "the 'Sultan of Egypt' sent an envoy with magnificent presents to the Emperor of Ethiopia, begging him to remove the cause of the Nile's failure in that year, and so save Egypt from the horrors of famine. The Ethiopian monarch was ultimately persuaded 'to suffer a dam to be opened that had turned the river, which, taking its usual course, rose three cubits in one day.' The historian records that 'the envoy on his return received great honors' from the relieved Egyptians."¹

In the year 1899 considerable alarm was caused by the deficiency of water coming down the Nile. In a letter to the *Times*, Mr. Willcocks, the eminent English engineer in charge of the irrigation works in Egypt, describes the cause, together with the remedy, in the following words:—

¹Quoted by Mr. John Ward, in *Pyramids and Progress*, p. 265.

“ . . . the White Nile is completely closed by the *sudd*, and the waters are wandering over the immense swamps which stretch from latitude 7 to latitude 10. The failure of this supply in the summer of 1900 will be serious. Now England holds the keys of the Nile. The waters which leave the Great Lakes are considered never to fall below 18,000 cubic feet per second (see Sir W. Garstin's last report on the Soudan, published by the Egyptian Government). The discharge at Assouan, in spite of the additions of surface and subsoil waters from the Gazelle, the Sobat, the Blue Nile, and the Atbara, has within the last twenty-five years twice fallen as low as 7,000 cubic feet per second, and may again fall as low, or even lower. What becomes of the immense body of water which leaves the lakes? After passing Lado, the White Nile splits up into numerous branches which lose themselves in the swamps. '*Divide et Impera.*' The swamps vanquish the Nile. Now if a very small expedition were to find its way to Lado *via* Mombasa, and engage laborers among the Bari and Madi tribes, it would be a comparatively easy task to close the heads of the Bahr Seraf and other channels which leave the right bank and confine the water to the Bahr-el-Jebel, which passes by Bor and Shambah. (Colonel Martyr says the *sudd* is thirty miles north of Shambah. If he had had a canal engineer with him, he might have cut the *sudd* and come on to Khartoum.) Once the waters of the Great Lakes were confined to one channel they would be able to account for any amount of *sudd*. No attempt has ever been made to cut the *sudd* with the aid of the current. This is the true way to do it, looked at from the point of view of the hydraulic engineer. Once the *sudd* is removed, it will be easy, with the aid of a dredger and willows, to confine the water permanently to one channel, because it is muddy for three months in the year. Willows will have to be imported, as none are to be found in the White Nile or the Gazelle river; and very possibly it is owing to their absence from these regions that the swamps have become so unmanageable.”

Since this letter of Mr. Willcocks's, Lord Cromer's report for the year 1900 on the "Condition of Egypt and the Soudan" gives further interesting and significant information. From this it appears that the surface of Lake Victoria Nyanza had fallen from 3 feet 2 inches in 1898 to 1 foot 7 inches in 1900, and that Major Peake was making good progress in removing the *sudd* by cutting it up in large blocks; but

“instead of *sudd* being, as had been supposed, a tangle of weeds floating on the water and descending a few feet below the surface, it proved in most cases to be a mass of decayed vegetation, papyrus roots, and earth,

much resembling peat in consistency, and compressed into such solidity by the force of the current that men could walk over it everywhere, and even elephants could, in places, cross it without danger. One block in the Bahr-el-jabel, 140 miles south of Lake No, is twenty-five miles long. Another fifty-two miles south is fifty-three miles long. In both instances the true channel of the river is blocked by *sudd*, and it now follows a false channel; in the former instance it passes through a series of broad shallow lakes."¹

In view of these lake reservoirs in Central Africa, and of the readiness with which their outlets may be temporarily obstructed, successive years of plenty and of famine in Egypt no longer seem a mystery. The real mystery of the Bible account connected with the events of Joseph's career is the supernatural revelation made to him, which, being itself a miracle, elevated the whole transaction into the realm of the miraculous. It is to be noted, however, that the biblical account is not compromised by any doubtful references to supernatural agency in the production either of the years of plenty or of famine. We may, therefore, easily imagine the progress of events to have been something as follows.

The Great Lake Victoria, which forms the principal reservoir for the regulation of the flood of the Nile, has an area of 40,000 square miles, being about twice as large as Lake Huron. A gradual obstruction of the outlet which should cause its surface to rise a few feet in the course of time, would greatly enlarge its surface by flooding the marshy tracts on either side, and thus store up an immense amount of water, compared with which, that to be ponded back by the dam which the Egyptian government is now building at Assouan, would be a mere bagatelle. That, to be sure, raises the water at Philae sixty feet, and sets it back up the river to a distance of 150 miles; but, as the river is not over a quarter of a mile wide, its total surface is scarcely over forty square miles, that is, one-thousandth

¹ *Nature*, 1901, July 25, p. 318.

part of the surface of the Victoria Lake. A rise of two or three feet, therefore, in the great lake would store an almost incalculable amount of water.

To produce the results described in connection with the history of Joseph, we may easily suppose that the main outlet at length became so clogged with *sudd* that the overflow opened up a fresh channel on one side, which, by rapidly enlarging itself, would let down an abnormal amount of water for a series of years, and so supply the conditions of successive years of plenty. At length these channels became again filled with *sudd*, thus obstructing the water and causing years of famine below, until the reservoir had again filled up with water and the channel could readjust itself in more permanent form. This succession of events is easy enough to imagine as taking place in conformity with the foreordained conditions existing in the region. Indeed, so natural does the succession of events recorded now seem, that it is capable of being perceived and believed, upon as small amount of evidence as that which would establish the occurrence of any ordinary event. The Nile itself is a wonderful illustration of the complicated character of Divine Providence. The revelation of a small section of that wonder to a divinely chosen agent, such as Joseph was, in the training of the chosen people, is as easy to believe as anything else which is supernatural.