ENGINEERING WORKS OF THE ANCIENTS, No. 2.

Continuing our notes from Herodotus, the present paper will principally relate to the Egyptians, whose works like those of the Babylonians, have an interest for us, as giving rise also to a school on which Greek engineering was founded. It is one of the most ancient of which we possess authentic monuments and records. The Egyptians like the Babylonians principally devoted themselves to hydraulic engineering, in which they made great progress; their other works also afford convincing proofs of their attainments in other departments of the art. The account of Egypt in Herodotus might be almost termed a history of engineering in that country, where it was called into play as one of the great instruments of national advancement, the exploits of a prince consisting as much in the works he executed, as in the victories which he obtained. This is one of the features of a system of polity, to which Egypt was indebted for great social progress, and an exemption from many of the evils which afflicted surrounding nations. If from moral causes Egypt never attained the intellectual perfection of the Greeks, yet by the extent of its public works the country was brought into a high state of cultivation and productiveness, so as to make it for centuries the granary of Europe. It was less owing perhaps to the fertility of the soil, than to the facilities afforded as to internal communication, that the resources of Egypt were made so extensively available.

CAUSEWAY OF CHEOPS.

Cheops, it is said by our author, degenerated into extreme profligacy of conduct, and oppressing the Egyptians in every way, he proceeded to make them labour servilely for himself. Some he compelled to hew stones in the quarries of the Arabian (query) mountains, and drag them to the banks of the Nile; others were appointed to receive them in vessels and transport them to a mountain in Libya. For this service a hundred thousand men were employed, who were relieved every three months. Ten years were consumed in the hard labour of forming the road, through which these stones were to be drawn; a work cited by Herodotus as equal in difficulty to the pyramid itself. This causeway was five stadia in length, forty cubits wide, and its extreme height thirty-two cubits, the whole of polished marble, adorned with the figures of animals. So far our author, a modern account by Pococke and Norden, says that there is still a causeway running part of the way from the canal which passes about two miles north of the pyramids. This extends about a thousand yards in length, and twenty feet wide, built of hewn freestone. It is strengthened on either side with semicircular buttresses, about fourteen feet diameter, and thirty feet apart. There are sixty-one of these buttresses, beginning from the north. Sixty feet farther it turns to the west for a little way, then there is a bridge of about twelve arches, twenty feet wide, built on piers that are ten feet wide. Above one hundred yards farther there is another bridge, beyond which the causeway continues, about one hundred yards to the south, ending about a mile from the pyramids where the ground is higher. The reason for building this causeway and keeping it in repair seems to be the lowness of the country, the water lying on it a great while.

THE GREAT PYRAMID.—THE MIDDLE PYRAMID.—THIRD PYRAMID.

As we are rather giving common-place notes from the individual authors, than complete accounts of the works, we have less compunction in copying what Herodotus says of the much-written subject of the pyramids. Having described the causeway just mentioned, our author goes on to say that a considerable time was consumed in making the vaults of the hill on which the pyramids are erected. These he intended as a place of burial for himself, and were in an island which he formed by introducing the waters of the Nile. The pyramid itself was a work of twenty years: it is of a square form; every front is eight plethra long, and as many in height; the stones very skilfully cemented, and none of them of less dimensions than thirty feet. The ascent of the pyramid was regularly graduated by what some call steps and others altars. Having finished the first flight, they elevated the stones to the second by the aid of machines constructed of short pieces of wood (supposed by some to be the pulley); from the second, by a similar engine, they were raised to the third, and so on to the summit. Thus there were as many machines as there were regular divisions in the ascent of the pyramid, though in fact there might be only one, which being easily manageable, might be removed from one range of the building to another, as often as occasion made it necessary; both modes have been told me, says Herodotus, and I know not which best deserves credit. The summit of the pyramid was first of all finished off; descending hence, they regularly completed the whole. Upon the outside were inscribed in Egyptian characters, the various sums of money expended in the progress of the work for the radishes, onions and garlic consumed by the artificers.

The middle pyramid, attributed to the daughter of Cheops, is stated to have an elevation on each side of one hundred and fifty feet.

Chephren, the brother of Cheops, is mentioned as the builder of the third pyramid, which was less than his brother's. It has no subterraneous chambers, nor any channel for the admission of the Nile. The ascent is entirely of Ethiopian marble of divers colours, but it is not so high as the larger pyramid by forty feet. The pyramid stands on the same hill as that of Cheops, which hill is near one hundred feet high.

DOCKS.

Psammitichus, as a reward for services rendered in war, conferred on the Ionians and Carians certain lands, which were termed the Camp, immediately opposite to each other, and separated by the Nile. They were the first foreigners whom the Egyptians received among them; and "within my remembrance, in the places which they formerly occupied, the docks for ships, and vestiges of their buildings, might be seen," continues our author.

CANALS.—RED SEA.—SLUICE.—BOLBITINIAN.—BUCOLIC.—MEMPHIS.—AN ENGINEERING KING.—CIVIL ENGINEERS.—ENGINEERING THREE OR FOUR THOUSAND YEARS AGO.—SURVEYORS.

Pharaoh Necos, the son of Psammitichus, was, according to Herodotus, the prince who first commenced the celebrated canal leading to the Red Sea, which Darius, King of Persia, afterwards continued. The account of Herodotus is this:—The length of the canal is equal to a four days journey, and it is wide enough to admit two triremes abreast. The water enters it from the Nile, a little above the city Bubastis; it terminated in the Erythrean Sea, not far from Patumos, an Arabian town. They began to sink this canal in that part of Egypt, which is nearest Arabia. Contiguous to it is a mountain, which stretches towards Memphis, and contains quarries of stone. Commencing at the foot of this, it extends from west to east, through a considerable tract of country, and where a mountain opens to the south is discharged into the Arabian gulph. From the northern to the southern, or as it is generally called, the Erythrean Sea, the shortest passage is over Mount Cassius, which divides Egypt from Syria, whence to the Arabian gulph is exactly a thousand stadia. The way by the canal, on account of the different bends, is considerably longer. In the prosecution of this work under Necos, no less than one hundred and twenty thousand Egyptians perished. He at length desisted from his undertaking, being admonished by an oracle, that all his labour would turn to the advantage of a barbarian. Diodorus Siculus gives an account which brings the progress of the work down to the time of the Greek kings; he says:—The canal reaching from the Pelusian mouth of the Nile to the Arabian gulph and Red Sea was made by hands—Necos, the son of Psammitichus, was the first that attempted it, and after him Darius the Persian carried on the work somewhat farther, but left it at length unfinished; for he was informed by some, that in thus digging through the isthmus he would cause Egypt to be deluged, for they showed him that the Red Sea was higher than the land of Egypt. Afterwards Ptolemy, the Second finished the canal, and in the most proper place contrived a sluice for confining the water, which was opened when wanted to sail through, and was immediately closed again, the use of it answering this purpose extremely well. The river flowing through this canal is called the Ptolomean, from the name of its author. Where it discharges itself into the sea it has a city named Arsinöe. So far our authors; we may farther mention that the site of this canal, although it could not be found by Norden, was distinctly ascertained by the scientific commission attached to the French army, and that plans have been proposed by Mehemet Ali for restoring.

Of the seven mouths by which the Nile disgorges itself into the sea, two are stated to have been produced by art, the Bolbitinian and the Bucolic,* a circumstance that shows the importance which the Egyptians attached to ready access with the sea, as a means of promoting their maritime commerce. This, fostered as it was by the extent of inland navigation, was, whether in the hands of foreigners or natives, carried on upon a large scale, embracing not only domestic productions, but also the transit trade with India and the East, of which Egypt was so long the channel, and the value of which, as our subsequent observations will show, was appreciated at an early period. It is true that these two canals were also required for agricultural purposes, but we think we do not err in attributing also another motive. The order in which the seven branches of the Nile lie from

* Herodotus Euterpe.