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XII.—*The Ancient Harbour of Seleucia, in Pieria.* By Captain
WILLIAM ALLEN, R.N., F.R.S., F.R.G.S.

Read June 14, 1852.

SYRIA, so remarkable for great internal resources, is equally noted, in the present day, for a dangerous coast devoid of good harbours. It was not so in ancient times, when industry and science overcame these disadvantages and provided many secure ports. The most magnificent instance of this, the Harbour of Seleucia, in Pieria, is in the Bay of Antioch, near the mouth of the Orontes, which owes its name, at least, to Seleucus Nicator. This noble work* comprises a small outer port, an inland basin, and a stupendous culvert; which last was doubtless intended for the purpose of cleansing the one and feeding the other. The port is formed by two massive moles, projecting to seaward, about 240 paces apart. That to the N. can only be traced in ruins above the sand which has filled the port. The southern mole has its inner part nearly perfect, constructed with large blocks of stone placed transversely; and it must have been nearly 30 feet wide, as some of the stones measure 23 feet in length, and one which was broken was 29 feet 4 inches. It ran out W. from the shore 80 paces, and then turned to the N.W.; the latter portion is completely ruined, and can only be traced for a short distance under water. The whole area of this harbour, including a part towards the entrance of the canal, which was possibly excavated, would be about 6 or 8 acres, and was therefore small, though perhaps it answered sufficiently the purpose of receiving ships preparatory to their entering the basin, where the operations of loading and of unloading would have been carried on. It also served as a harbour of refuge in bad weather. It is now completely filled, from the bend of the pier, inwards, to the canal, the maximum thickness of the sand, &c., being about 18 feet, exclusive of the original depth of the harbour.

The basin, or inner port, seems to have been entirely an excavation. It is retort shaped, and communicated with the sea port by the *neck* part, a canal about 1500 feet in length; but whether it was open to the sea in the outer port, or being there at a higher level was entered by a lock—if the ancients knew the use of such a contrivance—I am not able to determine.† At the entrance of this Boghaz or canal is an isolated rock, with a large chamber excavated in it.

* Colonel Chesney examined it during his excellent survey of the Orontes and the Euphrates, and I should not have put my observations forth but that I have some peculiar notions as to the most feasible way of restoring it.

† Col. Chesney saw hinges for gates.

The basin is about 2000 feet long by 1350 in the extreme breadth. The W. side of it is formed by a wall of large blocks of stone, and is nearly perfect in the whole length, except where it has been broken through in an ineffectual attempt to drain the basin. Near a tower projecting seaward, it is not less than 20 feet above the level of the water within the basin. The S. is principally formed by the "toe" of a little hill, which, on the S.E. part of the basin, has been levelled to the extent of about 500 feet square. On one side a noble wall still performs its office of supporting the hill. The space thus obtained was possibly the arsenal or dockyard; it has several ruined buildings. From this part the curve of the basin is bounded by a low wall, but whether ancient or modern, I could not get near enough to see: it is doubtless on the ancient site. The slope of the hill above it is much encumbered by the ruins of buildings, and stones, &c., brought down by torrents. All round the margin, except to the W., the basin is dry; but a great part is covered with water, varying in depth, being in some places, according to the accounts of peasants, 12 feet, though others said only 5 or 6. Long grass grows in it. The water comes close up to the W. wall, where some fallen stones seem to be lying on a quay; but, though clear, the water was dark, so that we could not see far below the surface. A small stream passing through the basin prevents its being altogether stagnant. It enters on the E., and has its exit by a gap in the W. wall, before mentioned; and, flowing gently towards the shore, about 1000 feet, loses itself in the sand above the level of the sea.

Taking into consideration the undisturbed appearance of the stones forming the south mole of the sea port, as well as those of this wall, and the depth in the basin, I cannot think that the land has been raised by any volcanic agency; the sand thrown up by the action of the waves during a long period would be sufficient to make the margin of the shore encroach upon the sea; while that carried by the wind would accumulate upon the land, as is evidenced by the bank of drift-sand against the wall of the basin.

The most remarkable feature connected with the port of Seleucia is the long culvert excavated in the adjacent hills. To examine this, we descended about the middle by a staircase cut in the rock, on its left side, near a little foot-bridge, which also appears to be a part of the rock. Exploring our way upwards, we came to an open valley, across which, just below a sharp turn in it, are the remains of an ancient wall or "bend" of massive dimensions.* This confined the mountain torrent to its original direction, and towards the excavation or culvert from which we had just emerged.

* Similar to the Bends at Belgrade, which dam up the water in valleys for the supply of Constantinople.

It is in good preservation at the two ends, but in the middle part there is a huge gap, where, in all probability, had been originally sluice gates, for the passage of the water requisite for feeding the basin. The dilapidation is attributed to the Turks, but neglect of the gates, and the large boulders brought down by the torrents, would be sufficient to account for it.

Returning to the "culvert," at 50 paces from the W. end of this great wall, the excavation commences with a tunnel, remarkably well cut in the rocky hill, 142 paces in length, with an aperture 21 feet square. In the middle is a channel about 3 or 4 feet in depth and breadth, and at the left side is a conduit, like a grooved shelf in the rock, which is carried nearly horizontally as far as the stairs by which we descended—406 paces. Here it meets the surface of the hill, and was doubtless continued thence to supply some part of the town with water. At the termination of the first tunnel is a fine "cutting" of 88 paces in length, open to the surface of the hill, the vertical section of which, at the upper end, is about 150 feet, declining, so that where the second tunnel commences, it is but 75 feet high. On the left of this cutting are the remains of a staircase in the rock, with the lower part broken away. The second tunnel is precisely the same as the first, but only 45 paces in length. After this, the open cutting is continued to the termination of the culvert. The vertical section of the upper part, that is, on leaving the second tunnel, is about 50 feet; and it declines gradually, varying with the undulations of the hill.

The two tunnels, *only*, have channels in the middle.

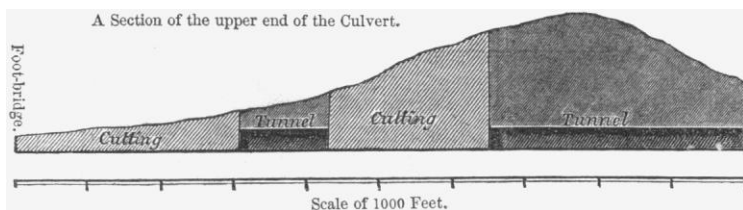
At the distance of 406 paces from the bend, is the little foot-bridge before mentioned—an arch spanning the cutting, about 20 feet deep, here. It is much worn in the middle by the many feet which have crossed it during more than 2000 years.

At 438 paces, a small lateral valley crosses the culvert; and here a wall on the left hand would be necessary, to preserve the course of the water, but it escaped my notice.

At about 750 paces the hill had declined so much, that for about 40 paces the left side was formed by a wall of squared stones, which was broken through some years ago in the hope that the torrent would clear the port; but it was mismanaged, and did great mischief by bringing down large stones and silt which completed the filling up of the Boghaz, and destroyed a great deal of valuable garden-ground.

The culvert, about 1200 paces from the bend, opens out and terminates near the north pier of the sea port, for the sluicing and cleansing of which, as I have said before, for feeding the basin by the gates, in the bend, and for carrying off the waste water, it was no doubt intended. Both of these purposes it might again be

made to serve. Its magnitude has astonished travellers, and has been thought greater than was requisite; but it must be considered, that in mountainous countries, and in such a climate, during the rainy season, a passing cloud might pour down torrents, bringing with them detritus from the mountains, that would soon choke the tunnels if space were not left to facilitate its removal. For this purpose the ledges were provided on either side of the channel, where men might stand to work. In the cuttings this was not necessary, as there is ample space above. It is true that, although neglected for so many ages, the culvert is nearly free from obstructions; but this may perhaps be attributed to the partial dilapidation of the bend, which has thus afforded a "safety-valve." The course of the culvert is more tortuous than I have laid it down on the plan; the fall is, perhaps, about 1 in 50 as far as the little foot-bridge, but below that much greater; and in several places it is very abrupt.



There are several inscriptions on the sides of the culvert nearly illegible. The following fragments are all that could be copied :—

ΕΠΙΚΑΙΠΟΥ
ΓΤΙ////CKΟΥ
ΕΚΑΤΟΝΤΑΡΧΟΥ
ΛΕΓΕΩΝΟΣ
ΤΕΤΑΡΤ///Λ
ΟΕΝΑΡΧΙΗ

MCPPAI/////////
/////////NEX////NIS
LEG///NEUC

At 925 paces is the third inscription, much defaced :—

IMCAESARITAEHO
HAL////NOA/////////R
RIO////RAMI/////////
/////////
/////////
/////////
NORICAVG

High up in the rock, two other inscriptions, in sunk tablets, near an arch left in the cutting, are quite illegible.

From what has been said it will appear—

1st. That the outer harbour is nearly filled with sand thrown up by the sea, being quite dry from the turning of the south pier, at the water line, to the inner part, where the thickness of the sand may be about 15 to 18 feet.

2nd. That though a great portion of this pier is nearly perfect, the outer part is useless.

3rd. That the northern pier is almost entirely destroyed.

4th. That the canal of communication, or Boghaz, is filled with silt and boulders in its whole length, the thickness of the detritus at the outer and narrower end being, perhaps, as much as 25 feet, but less near the basin.

5th. That the basin is partially filled with silt, and the W. wall of it, the only part of the circuit not bounded by rising ground, is partially dilapidated.

6th. That the great culvert is injured at the artificial walls only.

It is thus evident that in its present state this noble work is useless; but such is its solidity and intrinsic excellence, that I presume restoration would not be difficult; since, of the three main features, namely, the great culvert, the inland basin, and the sea port, the two first require but little labour to restore them, though they would still be unavailable without the third—a sea port for communication with the basin. This also might be easily accomplished, as there is great abundance of material at hand, the shore is gradual, the bottom good for pile-driving, and labour is very cheap.

I am not able to make a correct calculation of the cost for clearing out the old sea port, if it would be feasible, nor of constructing a new one; but by a rough estimation, on the assumption that the bottom of the basin originally corresponded with 3 fathoms in the sea port, there may be about two millions and a half of cubic yards of silt in the inland basin, which is about ten times as much as was found in Ramsgate Harbour at the latter end of the last century. To remove this, according to the rate of wages in the country, would cost about 33,000*l*.*

But it is useless making vague calculations of what the mere manual labour would cost, when the object may be attained more speedily and more economically by simply converting the basin into a wet-dock above the level of the sea, with which it should communicate by locks. This could very easily be done by raising and strengthening the W. wall, the only part of the circuit not bounded by rising ground. The perennial stream now running through it being then stopped by a sluice-gate, in the present gap, would fill the basin to any depth required. It would then be

* I have since found that Col. Chesney estimated the expense at 31,000*l*.
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necessary to clear the Boghaz or canal, only to the level of the bottom of the basin. The mere manual labour of digging and removing the detritus between the basin and the sea, a distance of 500 yards, might, perhaps, be done by 300 men in 150 days, at a cost of less than 1000*l*. But by making use of the appliances left by the ancients, it would be easy to enlist nature to do the greater part of the work, and thereby save a vast deal of time, labour, and expense.

This could be done by making temporary sluice-gates at the inner part of the encumbered canal, and when the basin is filled, by using its immense volume as backwater. If, at the same time, the dilapidations in the culvert were repaired, the force of the winter torrents might be brought in powerful aid, and the combined effect would soon clear or scour a channel to the sea. The principal expense would then be for locks and masonry.*

The restoration of such a port, larger than our East India export and import docks together, being about 47 acres, where so many ships might load and unload at the quays, would stimulate and draw to itself, as the best outlet, all the trade, not only of Syria and Mesopotamia, but of the western parts of Persia, which now, small in amount, is transported by camels over the difficult and dangerous pass of Beilan, to the unhealthy port of Iskanderun or Alexandretta; whereas, a good road, without the impediments of mountains, might easily be made from Seleucia to Aleppo, and thence to the Euphrates, which noble river would again become what it appears to have been destined for—the means of communication between the regions of the east and of the west.

It is not unreasonable to suppose that if this were accomplished, the fine climate of the beautiful valley of the Orontes would attract settlers from England, as well as many Christians from all parts of Syria; while the native population of the northern bank of the river, who are nearly all Christians, and who, though industrious and well disposed, are poor and stationary on the soil, would have elasticity imparted to their present inert condition, by the example and stimulus of new ideas and new sources of prosperity. From these germs improved grades of society would spring, and thus in a short time a large town might arise to emulate the glories of ancient Seleucia.

The same elements of prosperity which called forth and rewarded the exertions of the former possessors, still exist in the

* The method here proposed proved to be effectual in clearing Ramsgate Harbour, where, on experiment, it was found that three discharges from one sluice-gate of a small backwater, had such power that they cut a channel down to the chalk 6 feet in depth, 10 feet wide at the surface and 3 feet at the bottom, and 100 feet long. Masses of chalk of several cwt. were ploughed up, and the force of the stream was continued a distance of 200 or 300 feet beyond low-water mark.

inexhaustible fertility of these favoured regions. To these the cities of the Tetrapolis, viz., Antioch, Apamea, Laodicea, and Seleucia, with many others, owed their origin and rapid prosperity; and if it was worth while to construct such magnificent works for the convenience of *their* commerce, it surely ought to be worth the while of their successors—the present occupants—since the riches of the soil are still to be obtained by industry, to avail themselves of these noble legacies, and especially to restore the port of Seleucia, which would require so small a proportion of the labour and expense originally bestowed upon it.

The result would be very beneficial to the Turkish empire, by adding to the revenues of the Sultan, and by infusing vigour into the provinces which now languish through the efforts made for the prosperity of the capital.

To Great Britain, also, the advantages would be undeniable, in opening new channels for our commerce, and by facilitating the communication with her Majesty's eastern dominions.

XIII.—*An Attempt to account for numerous Appearances of sudden and violent Drainage on the Sides of the Basin of the Dead Sea.*
By Captain W. ALLEN, R.N., F.R.S., F.R.G.S.

Read January 10, 1853.

THE Dead Sea, or Lake Asphaltites of the ancients, is now generally understood to have a depression, below the level of the Mediterranean Sea, of more than 1300 feet: yet, hitherto, no satisfactory account has been given of the cause of this phenomenon.

If I venture on the subject, it is simply to record impressions, forced on my mind by certain features that arrested attention in approaching its mysterious shores by the route of Jericho.

These were principally—

1st. Some indications of alluvial deposit on the mountain sides, a little below the supposed point of the level of the Mediterranean, most apparent on the opposite range of Belka.

2nd. A succession of sand cliffs on both banks of the river Jordan, of corresponding forms and appearance.

3rd. Several parallel lines of pebbles, about 50 feet in width, near the northern shore of the Dead Sea. These were the more remarkable because, for several miles, not a stone had been seen; and between the lines the soil was a soft alluvium. They have the appearance of raised beaches, and perfectly resemble the actual beach of the lake, which is formed principally of flat pebbles of bituminous shale, with fragments of Lydian stone. No other specimens of bitumen were seen.