

SILOAM TUNNEL.

I.

ONE THOUSAND CUBITS.

CAPTAIN CONDER'S interesting discussion of this question in the *Quarterly Statement*, April, 1882, may lead to important results, of which he can form no conception. I think he has satisfactorily settled the question as to the actual spot where the two excavating parties met, which appears to be in the exact spot where I predicted the place of junction would be found.

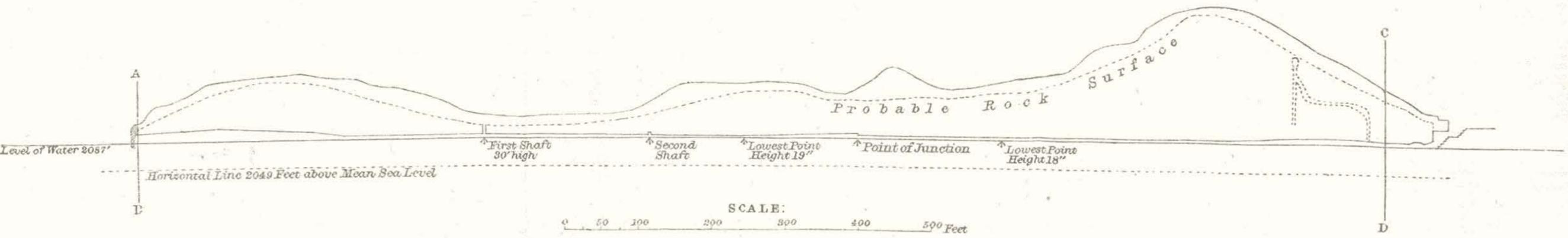
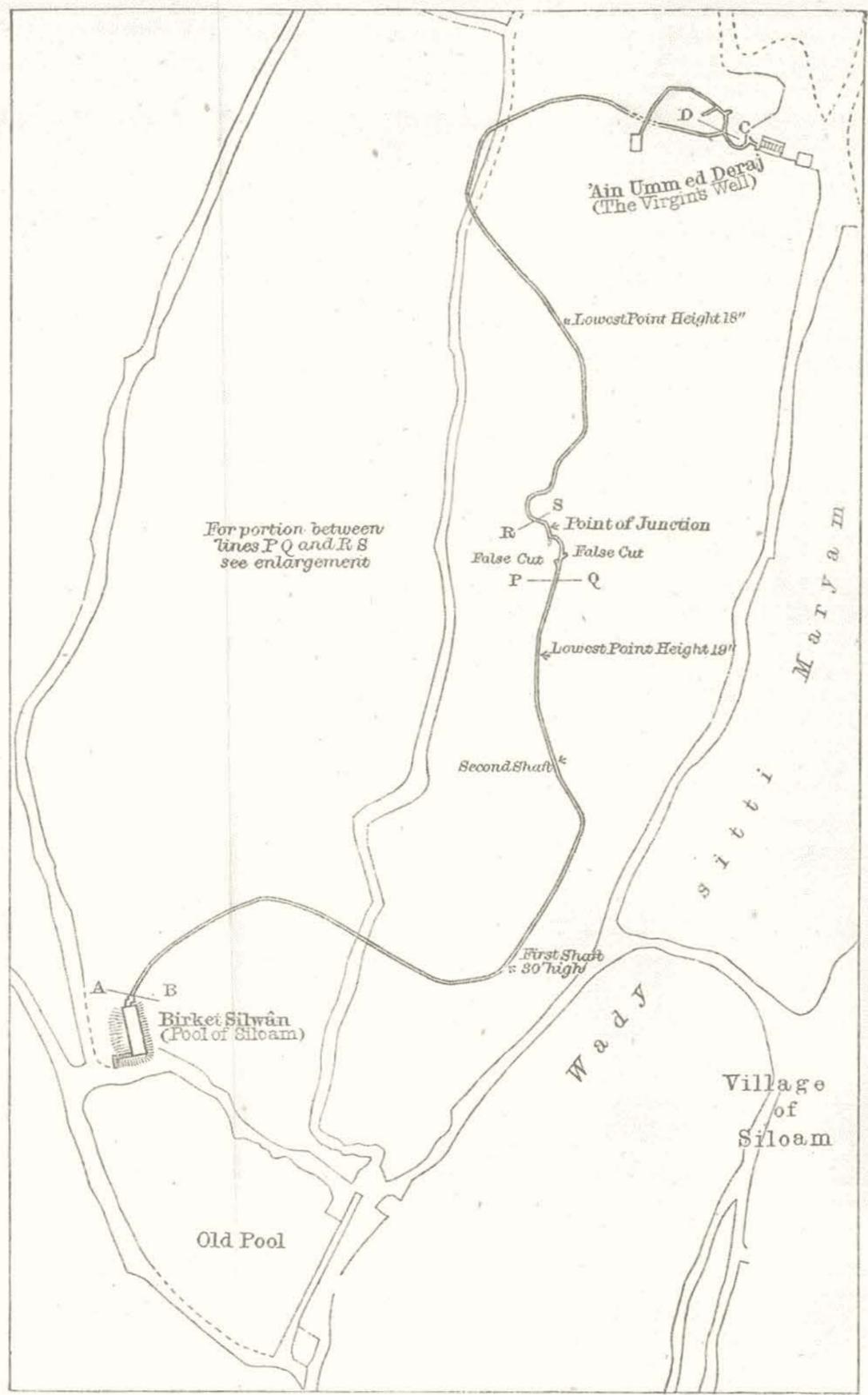
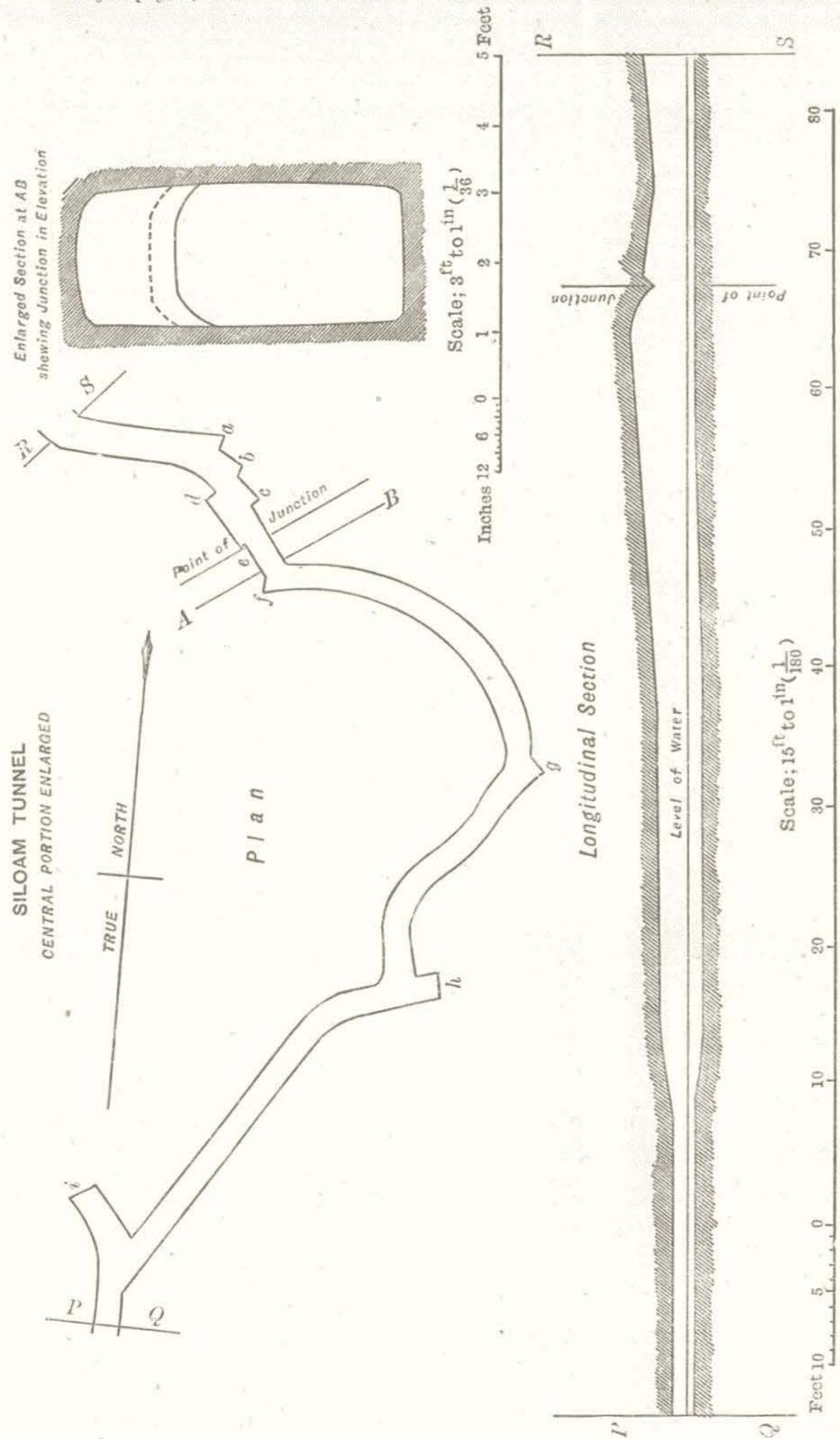
"Now if there be any likely spot where the two gangs met *it will be at this high cutting* (4 feet 6 inches) Where we find this space of enlargement at the middle of an aqueduct, there is the spot where they endeavoured to meet."—*Quarterly Statement*, October, p. 295.

And the printed statement of Captain Conder indicates that the point of junction was exactly *where it had been predicted*. I am sorry to find in this last published statement so erroneous a statement of my theory of the Siloam tunnel as is given in the following passage :—

"Unfortunately Mr. Beswick's calculations, which reduces the length of the tunnel to 1,478 feet, is founded on a misconception (*Quarterly Statement*, October, 1881, p. 295), as the length of the branch from the Virgin's Fountain *is not included* in the total of 1,708 feet."—*Quarterly Statement*, April, 1882, p. 127.

Unfortunately this misconception is in the mind of Captain Conder. My calculations do not reduce the tunnel to 1,478 feet, nor has he included the length of the branch from the Virgin's Fount in the total of 1,708 feet. I am fully aware that the Siloam tunnel is estimated from the place where it enters the cross passage to the Virgin's Fount, and that this cross passage of 50·8 feet in length is not included in the total length of the Siloam tunnel, 1,708 feet. My calculations begin where the tunnel enters this cross passage, and where the 1,708 feet of length begin. And my theory is, that for 231 feet, where the tunnel begins at the cross passage, the tunnel forms an eastern or upper branch of large bore or broad gauge, 6 feet high ; it then changes its course, and turns south ; at the same time and place the tunnel changes its character, and becomes a southern branch of narrow bore and gauge.

Am I right in stating that the upper or eastern branch of the aqueduct, which begins at the cross passage to the Virgin's Fount, is of large bore and gauge, so large that a man 6 feet high can walk erect therein ? And am I correct in stating that the lower or southern branch, from end to end, is a narrow bore and gauge, almost too small for a man to pass through ? Its highest point, 4 feet 8 inches, is in the middle of its length, exactly at the



place where *I predicted* the point of junction of the two gangs of men would be found (*Quarterly Statement*, October, 1881, p. 295). With this single exception, the whole length is a remarkably narrow bore from end to end. I claim that the whole of this bore, or southern branch of the tunnel, is the only portion that the tablet-maker meant to be included in the 1,000 cubits mentioned in the inscription of the stone tablet. In short, I divide the Siloam tunnel into two branches, upper and lower, or into southern and eastern branches. The eastern branch is a broad bore and gauge, 231 feet in length; the southern branch is a narrow bore and gauge, 1,000 cubits = 1,477 feet in length; and the total length being 1,708 feet from the Siloam Pool to the place where the tunnel enters the cross passage to the Virgin's Fountain. I do not see how any one can misapprehend this simple and concise statement.

Let us examine the inscription more closely. It says, "And there flowed the waters from their *outlet* to the Pool for a distance of 1,000 cubits." The 1,000 cubits is measured from the "*outlet* to the Pool." The Pool we know, but where is the "*outlet*?" It cannot mean the *beginning* of the tunnel, for that would be the "*inlet*" and not the "*outlet*." The word in the tablet is well known, and its meaning determined: it never refers to the beginning nor the end of a passage, but always to the length or course of the passage. And this fact settles the question, that the 1,000 cubits is not to be measured from the beginning of the tunnel, but to some point in its course. When Hezekiah stopped the "*watercourse*" (2 Chron. xxxiii, 30) of the fountains this word was used in the original Hebrew, מוציא *motza*. It is always applied to the watercourse, passage, tunnel, or goings-forth, but never to the ends of a tunnel. The word "*outgoing*" is more expressive of the actual meaning of the word than the word "*outlet*," which Professor Sayce has given to it. As in the Psalms (lxv, 8): "Thou makest the *outgoings* of the morning," where the Hebrew is *motza*. In this case, as in every other, the word cannot be applied to the beginning of the day, but to the course of the day *from the morning*—its *outgoings* during the day.

The radical meaning of the word is to press, squeeze, make narrow, tight passage, to squeeze through, to make straight. The Arab is ماض *maaza*, to press tight and squeeze, as when the hands rub corn. And I cannot see any other inference to be drawn from the meaning of this word in the tablet than this: that it refers to that length of the tunnel which is emphatically a narrow bore, a tight passage, a straight place, to be squeezed through if you get through at all. This is its radical and common meaning—the length of the passage, and not to one of its ends. It seems to say, when a free translation is given:

"The waters flowed from (תמוצא) the *narrow bore* to the Pool for a distance of 1,000 cubits."

Just as the persecutors are overtook between the "*straits*," מצר *metzar*, (Lam. i, 3); see Job xxxvi, 16; xxxvii, 10. This narrow bore, or straitened passage, is the only part of the passage to which the tablet-

maker could apply his measure of 1,000 cubits—from the beginning of the narrow bore to the Pool: so that the proof seems complete, that the 1,000 cubits is the measure of this narrow bore, or lower branch of the tunnel.

II.

THE TABLET-MAKER'S CUBIT.

CAPTAIN CONDER briefly alludes to the inscription, line 2, in relation to the "*three cubits*" to be broken through when the excavators first met at the place of junction. And he remarks, "the party at *d* were just *three cubits* of 16 inches from them." It is unfortunate that the actual distances of the sides and set backs at this place of junction were not taken with some degree of careful precision, or if taken, that they were not given except by way of inference, which would be, in a general or random way = 48 inches. Had the exact distances been given or taken, carefully measured without regard to theory, we could have used them as valuable factors in settling the value of the cubit.

Again, in the last line of the inscription we read, that "three-fourths" of a cubit was the height of the rock over the head of the excavation. If this be the correct reading, then the difference of height of the two channels at the point of junction would be—

inch cubit	inches
16'000 × .75	= 12'000
17'724 × .75	= 13'293
18'000 × .75	= 13'500
21'000 × .75	= 15'750

Captain Conder admits "the difference of height of the two channels at the point of junction is just 13 inches, or close upon *three-fourths* of a cubit of 16 inches." How much closer it would have been to a cubit of 17'724 inches, such as I suggest, had a very close measurement been made, it is difficult to say. But if this measurement of *three-fourths* of a cubit = 13 inches, then 3 cubits ought to have been 52 inches instead of 48. Then, again, admitting the diagram produced by Captain Conder, and using it as a guide, the distance between the workers being "yet three-cubits to be broken through," as stated by the inscription, that distance would be represented in the *inscription* by the following words:—

(Line 3) "The excess of rock on the right. They rose up . . . they struck on the west of the—

(Line 4) excavation, the excavators struck, each to meet the other "pick to pick."

Both gangs of men seemingly worked on this excess of 3 cubits, and struck the excess of rock, each to meet the other, pick to pick. Therefore, if *e* in the diagram be the point of junction, the space between them would

be that which lies between the set back at *d*, where the excavators have struck and cut the rock "on the west of the excavation." But the diagram itself shows clearly that the intervening space so struck is over 52 inches. If both gangs struck the rock of 3 cubits, as the tablet says they did, "each to meet the other pick to pick," then the intervening space would be from the set back at *f* working up stream, to *d* working down stream, and meeting at *e* the point of junction. The intervening space would then be "three cubits" of 17·724 inches = 53·172 inches. For the slight set back down stream at *e* is less than 24 inches from the set back *f*. The total space between the set back at *f* and the set back at *d* is nearer 53 inches than any other figure. Captain Conder assumes: "The party at *e*, in the meanwhile, seemed to have stopped working, which they would naturally do, to avoid injuring or being injured by the others." But this is opposed to the statement in the inscription, which says, "the excavators struck, each to meet the other pick to pick," after they had found out there was but 3 cubits between them. It seems more likely that the excavators forming the down stream party worked from *f* to *e*, and the up stream party worked from *d* to *e*, where both met at *e*, the point of junction. Both parties would be too eager to meet for one of them to stand still, with 3 cubits of solid rock in front of them.

I am fully prepared to enter into an elaborate test of the actual length of the cubit measure in use in and around Jerusalem during biblical times, and during the time of Herod. But the present is not the proper time, and space in this *Quarterly* will not permit it. However, the following cases being of a purely topographical character, and the main factors having been furnished by the Ordnance Survey, may be cited with confidence and profit, independent of their importance and interesting nature.

III.

TEST CASES.

Case I. The large foundation stone in the south-east angle of the Haram was sunk into the rock at a level of 2,272·25 feet above the Mediterranean. This is generally regarded as the chief foundation stone in the substructures of the Haram, and probably was the first stone laid in the structure. Now add 100 cubits to its height, and you obtain $100 \times 1·477044 = 147·7044$ feet. Hence:—

$$2,272·25 + 147·70 = 2,419·95 \text{ feet.}$$

And you obtain the exact mean level of the Haram. The Ordnance Survey gives 2,420 feet as the general level of the Haram area. Colonel Wilson, in his Ordnance Survey Notes, and in all the maps (*Quarterly Statement*, January, 1880), gives 2,420 feet as the general level of the Haram. Captain Warren, in all his works, gives 2,420 feet as the general level of the Noble Sanctuary. Captain Conder, in all his works, follows suit with 2,420 feet as the general level. Indeed this factor has never been

questioned, and has obtained universal acceptance. And yet, according to my estimate of the true value of a cubit, 100 cubits is the exact difference between the level of the substructural foundation and the general level on top of the substructure.

Case II. Josephus describes the general height of the Gentile or outer Court, which was about equal to that of the general rock level of the Haram as we find it to-day, namely, 2,420 feet. He says :

“The lowest part of this Court [Gentile] was erected at the height of 300 cubits, and in some places more.”

Now 300 cubits would be equal to $300 \times 1.477044 = 443.114$ feet. All the heights of Moriah and Ophel and Mount Sion have their ravines and depths drawn together at only one point, a deep well south of the city called Bir-Eyub. The united ravines come together here. It is the lowest level to them all. Its rock surface has a level of 1,977 feet, with a general surface level all round of 1,979 feet. Let us now estimate from this lowest level of the ravines around the Haram, and add the height given by Josephus, namely, 300 cubits, and we obtain the following result :—

$$300 \times 1.477044 = 443.114 \text{ feet.}$$

$$1,977 + 443.114 = 2,420.114 \text{ feet.}$$

And we again obtain the general level of the Haram, or of the lowest height of the Courts in Herod's Temple, *as stated by Josephus*.

The real test of any value given to the cubit is best seen in large values, where the error, if any, is magnified to a degree to make the erroneous estimate palpable. In small quantities of a few cubits the error is so insignificant, that the difference is usually attributed to carelessness in the workman, or the slack use of round numbers and measurements by the engineer and constructor, as if they were never very particular. But magnify the distance to 50 or 100 cubits, and the error then increases into yards and rods.

Case III. In 1 Kings vii, 2, we read of Solomon building his palace 100 cubits in length. And in verse 6, he is said to have built a porch in front of the palace. Its length across the front of the building was 50 cubits, and its depth or breadth 30 cubits, making a total length of 100 cubits, and a breadth of porch of 30 cubits = 130 cubits total length.

Now, if we admit that the Royal Palace was built on Mount Moriah, along the length of the south wall, where Herod placed his Royal Triple Cloisters, the substructural foundations must have been of the same extent. Let us see what evidence exists. The value of 130 cubits = 192 feet.

$$130 \times 1.477 = 192 \text{ feet.}$$

The original passage of the Triple Gate terminates at a distance of 19 feet exactly. And at very nearly the same distance from the Double Gate, the original double tunnel terminates. And in the plate given in “Recovery of Jerusalem,” Captain Warren has marked the total length 192' 0', or 192 feet and a fraction less than an inch. The proof which this result furnishes of the original substructures being equal to the length of the Royal Palace and porch of Solomon, cannot but be regarded as interesting and valuable to our topographical knowledge of Ancient Jerusalem.

I am prepared to supply important test cases by the score, of great topographical interest, in and around the Haram, in illustration of the true length of the cubit, which I estimate at $\sqrt{3 \cdot 14159} \times 10 = 17 \cdot 724$ inches. And it seems to me very likely that this narrow bore, forming the southern or Siloam branch of the aqueduct of 1,000 cubits = 1,477 feet, is a confirmation of that estimate.

*Strathroy, Ontario,
Canada.*

S. BESWICK.

I AM sorry to have misunderstood Mr. Beswick's view as to the tunnel. He, however, appears to suppose our survey of the tunnel to be much rougher than is really the case. Every offset has been carefully measured within an inch or so, and the whole of the passage has been carefully planned from a chain and compass traverse, which can be consulted for any measurements required. The bore of the tunnel, from end to end, is nearly uniform, but the height varies constantly in different parts; as a matter of fact, the southern part of the tunnel is much the highest (12 to 16 feet). The cross passage to the Virgin's Pool is low (about $2\frac{1}{2}$ feet). The section (*Quarterly Statement*, April, 1882, p. 123) gives a general idea of the heights along the canal.

The statement I have made as to the "three cubits" was not either general or random, but founded on the traverse, which can be published if necessary. There is no distinct alteration of the tunnel at 231 feet from the north end, either in gauge or in height. The exact distances were taken carefully without regard to theory, as we have no theory to support in the matter. Mr. Beswick's "Test Cases" appear to me very inconclusive, and not to be compared with the deductions from widths of passages, intervals of buttresses, and dimensions of stones, which I enumerated some time since in the *Quarterly Statement* as indicating the length of the cubit.

C. R. C.

THE ANNUAL MEETING OF THE GENERAL COMMITTEE.

THE Annual Meeting of the General Committee was held at the Offices of the Society, on Tuesday, 17th June. The chair was taken by Mr. JAMES GLAISHER.

The minutes of the last meeting were read and confirmed.