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Salvage Excavation of an Aqueduct at Naan Kaanatt Benth el-Kaffar (East) - 2009

Final Report

Excavation Permit: B - 339/2009
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Academic Sponsor: Hebrew Union College

Figure 1: General view of the excavated aqueduct, photographed from east to west.

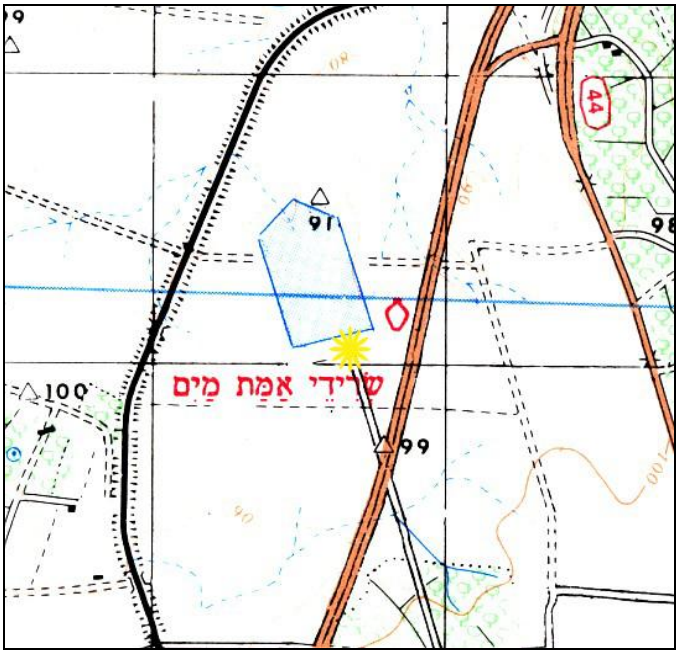

Figure 2: Location map of the excavation site (31º53’18.37’’N / 34º52’45.25’’E).

Introduction

The Ramla aqueduct is mentioned in a number of historical sources which tell us of the construction of the city of Ramla. Halif Suliman Iben el Mlik, the founder of Ramla, is said to have built an aqueduct named Kaanatt Barda during the years 715-717 CE (Zelinger and Shmueli 2002: 279).

Since the beginning of the 19th century much evidence for this aqueduct's route between Tell Gezer and Ramla has been found:

- 1874: British surveyors Conder and Kitchener expose the remains of an aqueduct and gave it the name Kaanatt Benth el-Kaffar (1882: 437).
- 1950: Yaacov Kaplan finds remains of an aqueduct that was exposed during the work on the Ramla-Nahshon road junction, and he recognizes these remains as part of the Tell Gezer-Ramla aqueduct (Zelinger and Shmueli 2002: 280).
- 1998: On behalf of the Antiquities Authority (IAA), a salvage excavation close to the railway line between Ramla and Kibbutz Naan exposes the remains of an aqueduct with finds from the Abbasid period (Zelinger 2000).
- 1999: Ground-penetrating radar is used in order to expose the aqueduct’s path without excavation (Petersen and Wardill 2001).
- 2001: A salvage excavation along the Trans-Israel Highway on behalf of the IAA exposes 150m of the aqueduct along a roughly east-west axis (Gorzalzani 2005).
- 2006: A test excavation northeast of Moshav Yashresh on behalf of the IAA exposes a section of the aqueduct (Gorzalzani 2008).
- 2008: A test excavation on behalf of the IAA along the railway line to Naan finds more aqueduct remains (Toueg, in press).

The current excavation, which was commissioned by Israel Railways as part of their rail infrastructure extension work, adds important new information about the

aqueduct. As well as adding to our knowledge of the aqueduct's route, revealed also are certain of the techniques used in order to maintain the aqueduct in an area of poor terrain. The current excavation has also shed light on what happened to the aqueduct after it had gone out of use.

Excavation

The excavation included six 4 x 4m squares (Fig.3), three along the aqueduct's path towards the east (A1, A2, A3) and three additional ones (A4, A5, A6) in order to investigate a branching out of the aqueduct's path that was discovered during the area's test excavation on behalf of the IAA.

Squares A1-3: eastern continuation of the aqueduct

In this area an additional 14.40m of the aqueduct were excavated along an approximately east-west axis. A 2m-long disturbance in the aqueduct's path was exposed, in which a drain pipe had been placed in recent years. Our excavations confirmed the consistency of what previous work had shown: the aqueduct was constructed by the placement of a foundation of fieldstones with cementing material at a height of 30cm. On top of this were built two parallel walls, between which ran the aqueduct's water channel.

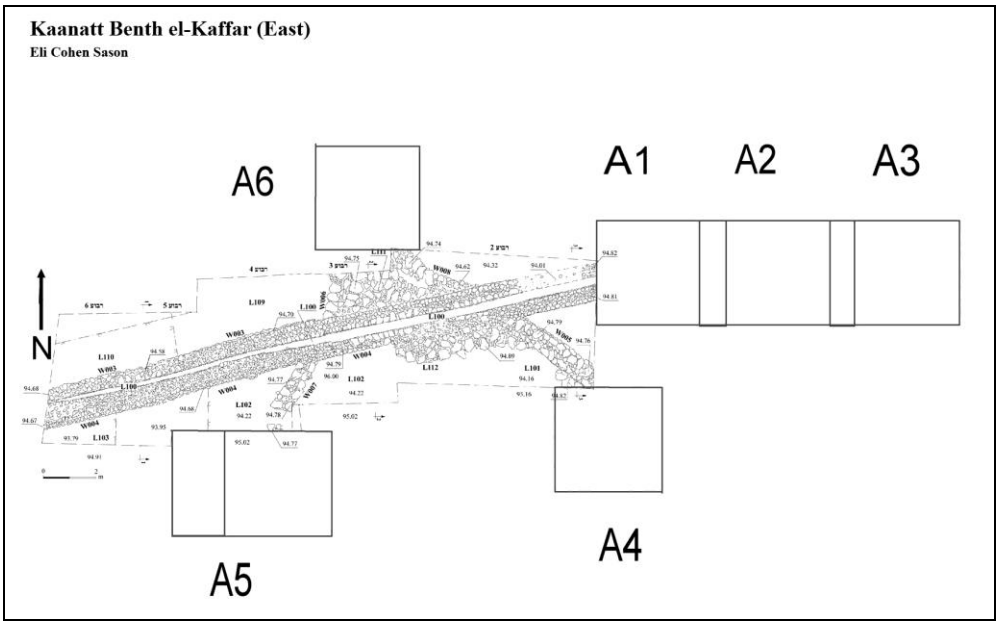

Figure 3: Location of the excavation squares overlaying the plans of the test excavation carried out on behalf of the IAA (courtesy of Ron Toueg, IAA Central District).

The southern wall – W102

The wall was constructed from four courses of limestone. The three lower courses were built of medium-sized fieldstones bonded by cementing material. The upper course was built from larger stones chiseled to rectangular shapes. Evidence of a later robbery of stones from the upper course of this wall can be seen. The height of the

wall from the base of the channel is 1m and its thickness is 55-60cm. It is possible to distinguish between two layers of plaster on the northern side of this wall (the interior of the aqueduct). The earlier (inner) layer had a reddish color, and quartz grain and potsherd inclusions. The later layer had a grayish color with evidence of accretion as a result of water running through the aqueduct. In accordance with the results of excavations at the aqueduct approximately 200m east of the current excavation (Gorzalzani 2005), it appears that the two walls of the channel were built parallel at a right angle to the aqueduct's base. In the current excavation's section of the aqueduct it can be seen that the southern wall fell into the channel and was found at an average angle of 61º (Fig.4). The reason for this is that the soil in the excavated area is a heavy clayish alluvial soil that is very prone to soil creep, due to its high moisture absorption and retaining capacity. The continued pressure of this heavy soil caused the southern wall to tilt at such an angle, and led to the channel being covered after it fell into disuse.

The northern wall – W103

This wall is built in a similar manner to wall W102: four courses of limestone and bonding material, with the three lowest courses made up of medium-sized fieldstones and the upper course from larger roughly-chiseled stones. Like its southern counterpart, the northern wall's height is 1m from the channel's base, but at 50-55cm it is slightly narrower. Yet despite this, the northern wall maintained its original shape and still stands at a right angle to the aqueduct channel's base. This wall was the focus of later stone scavenging, by which a 3.10m section of the wall was robbed of all its courses (Fig.7). An approximate dating can be given to the time of robbery by the remains of plaster in the missing section of the wall. There a layer of plaster without any stones was found on top of the channel's fill, 15cm above the aqueduct's interior surface (Figs.6-8). That is, the stones were robbed after the channel went out of use and filled up with 15cm of alluvium.

The interior of the aqueduct

The aqueduct was built by laying a 30cm-high fieldstone foundation with cementing material, on top of which a smooth layer of plaster was applied to a width of 40cm (the distance between the two walls of the channel). The channel's slope was graduated, measuring 0.05º over the length of the excavation area.

Figure 4: Section of the aqueduct where cut by later drain pipe disturbance.

Figure 5: The aqueduct's walls (view from above).

Figure 6: The two layers of plaster from the section where the northern wall was robbed.

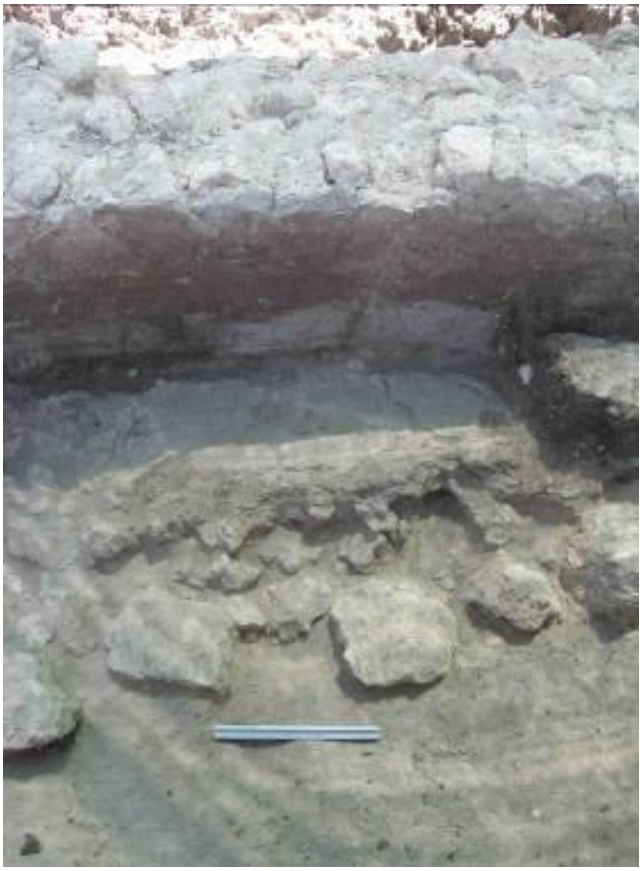

Figure 7: The stone foundation with the aqueduct channel's plastered surface on top of it, in the area where the northern wall was robbed.

Figure 8: Plaster remains on top of the aqueduct's fill in the area where the northern wall was removed.

Square A4

In the IAA's test pit a one-course, 80cm-thick wall was found projecting southeastward from the aqueduct's southern wall at a 48º angle. Square A4 was excavated in order to expose the continuation of this wall (W005). Instead, a well-leveled single course of medium-sized fieldstones was uncovered filling almost the square's 5m² (Fig.9). The limits of this leveled stone area and the area's function were not revealed, necessitating the opening of two further squares (see below, p.9).

Figure 9: Square A4 and behind it the IAA-excavated aqueduct section.

Square A5 – wall W101

In the IAA's test pit a 60cm-wide single course wall was found projecting southwestward at an angle of 42º from the southern wall of the aqueduct. Square A5 was excavated in order to expose the continuation of this wall. During the excavation a further 3.4m section of this wall was found (Fig.10). It was built of a single course, 60cm wide. Evidence of disturbance to this wall was found in a section 1.30m long. The wall's extant length from the area where it is attached to the aqueduct to its end is 6.85m (including the missing 1.30m).

Figure 10: Wall W101, with the IAA-excavated aqueduct in the background.

Square A6

In the IAA test excavation a level area of stones was found projecting from the northern wall of the aqueduct (Fig.11). This square was excavated in order to expose more of this leveled stone area. Its extent was found. The leveled stone area is of a triangular shape in plan, being built of medium- and large-sized fieldstones that were placed in one course and which abut the aqueduct's northern wall. The entire area of the triangle is 9m². The lines of the triangle's edges also extend southeastward and southwestward on the other (south) side of the aqueduct, in squares A4 (W005) and A5 (W101) (see Fig.3).

Figure 11: The stone triangle in square A6.

Test sections through the leveled stone area south of the aqueduct

As mentioned above (‘Square A4’, p.7), in the IAA test excavation a single-course wall 80cm wide was found projecting southeastward from the aqueduct. A4 was excavated in order to expose the continuation of the wall. During the excavation a leveled stone area was discovered covering the entire square. Therefore the excavation was expanded south-eastward by two additional squares. The leveled stone area, built from one course of medium-sized stones, was eventually shown to measure approximately 3.5 x 10m (Fig.12). However, it is emphasized that this was not the full original extent of the feature. The edge of our excavation area was reached at a point of disturbance to the leveled stone surface by a drainage pipe. It was possible to see in the baulk section that the stone area continues to the east of the disturbance, under the ground that was prepared in association with the adjacent highway (No.6). This area was not excavated by us and therefore the full extent of the stone level has not yet been exposed.

In order to better understand the nature and function of this feature it was decided to cut through it at two points (Fig.12): the first at the meeting point of W005 and the leveled stone area; and the second through the leveled stone area itself.

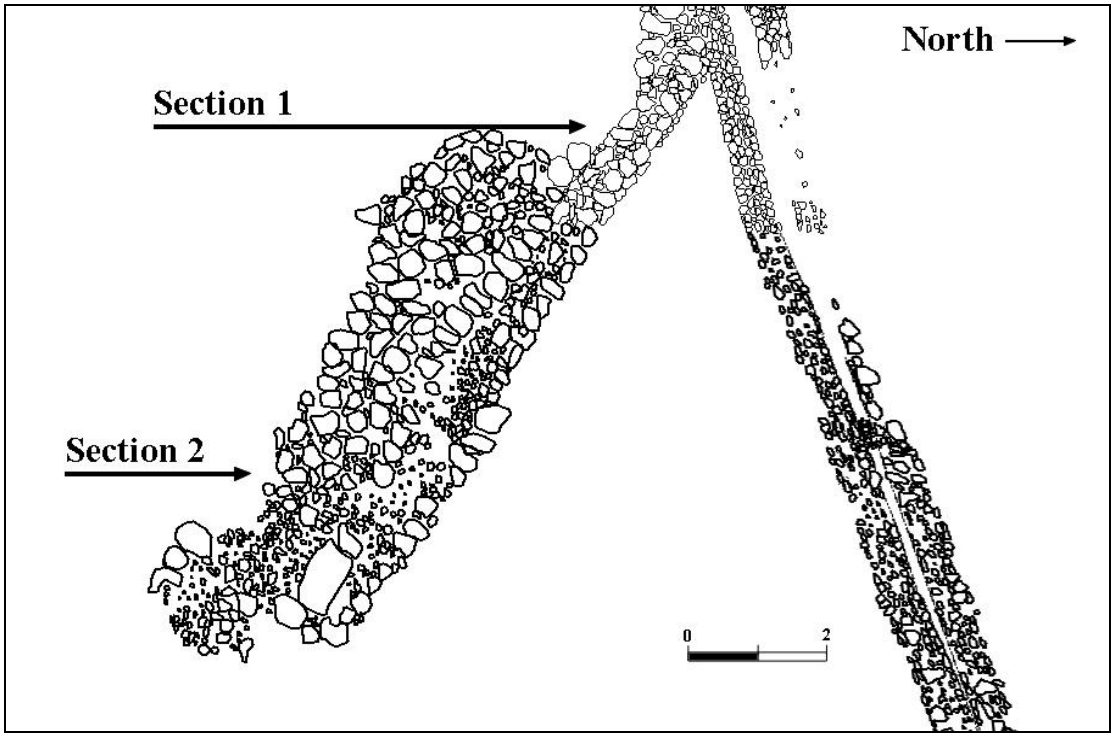

Figure 12: Location of the sections through the leveled stone area.

Section 1

In order to make this section, a meter-long cut into wall W005 was excavated 45 cm deep (in order to reach the ground level on which the stones of W005 were placed). However, little information was added about the function of the wall or leveled stone area. The section showed a course of medium-sized stones that were placed on top of the virgin soil, with W005 set 25cm deeper into the ground than the leveled stone area (Figs.14-15).

Figure 13: The location of section 1 before the excavation.

Figure 14: Section 1 after excavation.

Figure 15: Section 1 from the north side, showing the difference between the depths of W005 and the leveled stone area south of them (behind).

Section 2

In order to create this test section a 50cm-wide area running southwest-northeast through the entire width of the leveled stone area was excavated (Figs.16-17). Here

too, however, no significant evidence was found that might shed further light on the stone area's function. Section 2, however, does support what section 1 indicated – that W005 is set 25cm deeper into the earth than the relatively shallow single course of fieldstones that makes up the leveled stone area.

Figure 16: The leveled stone area before digging the section.

Figure 17: The leveled stone area after excavating the section.

Summary

The current excavation contributes to our corpus of knowledge regarding the the Kaanatt Benth el-Kaffar aqueduct. Firstly, we have learned something of the construction's taphonomy, what it underwent after it had gone out of use. Furthermore, we have learned more about the different techniques used in order to maintain the aqueduct's route in an area of difficult terrain.

From the test section that was excavated through the aqueduct in the area of the later disturbance it can be seen that most of the stress acted on the southern wall, all of which collapsed northward and essentially sealed the aqueduct channel. By contrast, the northern wall retained its vertical form throughout the centuries. This wall was the focus of a later stone robbery carried out after the aqueduct had fallen into disuse (but not considerably later, as we can infer from the presence of plaster immediately overlying the aqueduct's fill).

The stone features found in squares A4-6 may have been constructed in order to counteract the soft ground of the area (also perhaps the reason for widening the aqueduct channel along this section). The leveled stone area extending southeast through and beyond A4 may have been part of an ancient paved road or work area laid down on this soft ground.

The three additional squares we excavated (A4-6) have shed new light on the aqueduct's engineering specifics. Already in ancient times it was understood that heavy clayish alluvial soil of the kind found in this area can be problematic for certain construction types. The IAA test excavation revealed that external reinforcements – i.e. W101, W005, and the stone triangle in square A6 – were built in places of such difficult soil in order to preserve the aqueduct's walls. These reinforcements were effective. By contrast, for some reason no reinforcements were put in place in the area of the current excavations and as a result the unforgiving soil caused its southern wall to collapse into the aqueduct.

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