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## **A POSSIBLE ALCHEMIST APPARATUS FROM THE EARLY ISLAMIC PERIOD EXCAVATED AT RAMLA, ISRAEL <sup>\*1</sup>**

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### **Summary: A Possible Alchemist Apparatus from the Early Islamic Period Excavated at Ramla, Israel**

During extensive salvage excavations carried out during the years 2004-2008 in a large Early Islamic industrial area at the vicinities of Ramla, in Central Israel, an unparalleled industrial device was unearthed. The star-shaped, soil embedded installation, whose lower part was preserved, consisted of a central pottery jar surrounded by five minor jars, linked by ceramic pipes. Evidence of heat was observed mainly around the central vessel, and metal hollow cones perforated in the tip were found inside the surrounding jars. Although the manufacturing procedures and operation techniques of the installation are not completely clear, it is proposed that the installation is part of an industrial workshop or an alchemy laboratory. Both industry and alchemy were well-developed during the Early Islamic period and very often closely related, to the point that sometimes it is difficult to distinguish between them. The identification proposed is based on comparisons with tools described in literary sources, and somewhat later drawings and etchings. Circumstantial ceramic evidence was found, as well as the proximity of a bathhouse whose guests could have been the consumers of perfumes and unguents seem to reinforce this possibility. Due to the poor state of preservation of the device and the lack of available comparisons, the identification proposed here is tentative,

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and future research coupled with eventual new discoveries is needed in order to clarify this matter.

**Keywords:** Ramla – Industry – Alchemy – Early Islamic Period

**Resumen:** Un posible laboratorio de alquimia del período Islámico Temprano descubierto en Ramla, Israel

Durante extensas excavaciones de rescate realizadas entre los años 2004-2008 en una inmensa área industrial localizada en las cercanías de Ramla, en la zona central de Israel, fue descubierta una instalación de un tipo desconocido. La instalación, empotrada en el suelo, tiene forma de estrella y esta preservada sólo en su parte inferior. Consiste en un cántaro central de cerámica rodeado por otros cinco, de menor tamaño. Todos ellos están unidos al central por medio de tubos de cerámica. Alrededor del cántaro central hay evidencia de calor, y en los cántaros circundantes fueron descubiertos conos huecos de metal con perforaciones en el extremo. Si bien aún no está por completo claro cual era el producto ni la forma de funcionamiento de la instalación, en el artículo se propone que estamos frente a un taller industrial o laboratorio de alquimia. Estas ocupaciones o artes estuvieron ampliamente desarrolladas durante el período Islámico temprano, y muy a menudo intrínsecamente relacionadas, hasta el punto de que muchas veces el límite entre ellas era bastante tenue y difuso. La identificación propuesta está basada en comparaciones con instrumentos descritos en fuentes históricas y literarias, y dibujos y grabados de épocas más tardías. Evidencia circunstancial puede hallarse en la cerámica, y en la proximidad de una casa de baños cuyos visitantes bien pueden haber sido los consumidores de perfumes, bálsamos y ungüentos producidos en el taller. Debido al pobre estado de conservación y la ausencia de material comparativo, la identificación aquí propuesta es sólo tentativa, y futura investigación unida a eventuales nuevos descubrimientos es necesaria para clarificar el tema.

**Palabras clave:** Ramla – industria – alquimia – Período Islámico Temprano

## INTRODUCTION

The site of Ramla (South) is located some 0.5 km south of the modern city of Ramla, between Road 40 (at its Ramla-Bilu Junction section) and the northern fringes of Moshav Matzliah (map reference New Israel Grid 187750: 647180:187320: 646740).<sup>2</sup> The site extends both east and west of the secondary Road 4304, which access both the Moshav and further south, Kibbutz Na'an

<sup>2</sup> Israeli Transverse Mercator (ITM) is the new geographic coordinate system for Israel, in use since January 1, 1994. The name is derived from the Transverse Mercator projection it uses and the fact that it is optimized for Israel. ITM has replaced the old coordinate system and

(Fig. 1). Based on previous surveys<sup>3</sup> and excavations<sup>4</sup> the size of the site can be estimated at 15-20 hectares. Between 2004 and 2008, a substantial portion of the site was excavated by the Israel Antiquities Authority (henceforth IAA), revealing an extensive industrial area dating mostly to the Early Islamic period.<sup>5</sup> A plethora of artifacts, industrial features and installations of diverse types and purposes were unearthed. These included mostly pottery and glass workshops, oil and winepresses, plastered vats and containers, probably related to the craft of dyeing, as well as to other industries. During excavations carried out by Tel Aviv University (henceforth TAU), evidence of flax cultivation and its retting and further processing into textile fibers was found.<sup>6</sup> Other features relating indirectly to various manufacturing processes, such as cisterns, vaulted pools, drainage vats, refuse pits, working surfaces, pipes, channels and an intricate network of water conduits were revealed as well during excavations carried out by the IAA, TAU and Bar Ilan University (henceforth BIU).

Such a large amount and concentration of industrial devices in a single site is without precedent in the region. However, it should be stressed that most of the above described features are well known and largely attested to in previous excavations at the city of Ramla and its surroundings. The following article deals with a most intriguing set of artifacts that were ascribed to

sometimes it is also referred to as the "New Israeli Grid". The new system relocated the Y axis 50 km westward and the X axis 500 km southward so that now the entire country is covered by positive coordinate values.

<sup>3</sup> Shmueli and Kanas 2007.

<sup>4</sup> Gorzalczy 2008a, b, c; Gorzalczy and Spivak 2008, Gorzalczy and 'Ad 2010; Gorzalczy, Yehuda and Torge 2010; Gorzalczy and Marcus 2010; Tal and Taxel 2008a: 9; 2008b.

<sup>5</sup> The site was surveyed by Oren Shmueli and Tzach Kanas under Permit No° A-3784/02, and excavated under the following Permits: A-4144/04, A-4739/05, A-4910/06, A-5118/07, A-5168/07, A- 5311/07, A-5331/07-08, A-5331/08, A-5473/08 (Amir Gorzalczy), A-4454/05, A-4674/05 and A-4725/06 (Alexander Onn) on behalf of the IAA, and licenses B-298/05, B-306/06 (Oren Tal and Itamar Taxel) and B-326/08 (Ytzhak Paz *et al.*) on behalf of TAU. Permit A-4144/04 was granted first to Yehiel Zelinger, who was replaced later by Amir Gorzalczy. Permit A-5168/07 was a joint venture of the IAA and TAU. The salvage excavation of Area C was carried out by BIU (License B-299/05, Rona Avissar and Joe Uziel). Field photography was carried out by Tzila Sagiv and Amir Gorzalczy. Studio photography was carried out by Clara Amit. The surveyors were Vadim Esman and Mark Kunin, and the final plans were prepared by Irena Belashov. The drawings were prepared by Irina Lidsky-Reznikov. Arie H. Rochman-Halperin and Silvia Krapiwko, from the IAA Archive Branch were most helpful during all stages of the present research. Lilly Gershuny most kindly revised and improved the English. All the graphic material in this paper is by courtesy of the IAA. The authors are deeply grateful to all of them.

<sup>6</sup> Tal and Taxel 2008a; 2008b: 123-124.

Stratum IIIa, which is dated to the end of the 8<sup>th</sup> and the beginning of the 9<sup>th</sup> centuries CE.<sup>7</sup>

### THE INSTALLATION

The installation (L2150, Figs. 2-6) was overriding robber trench W2154 (Stratum IIIB, late 7<sup>th</sup> and early 8<sup>th</sup> centuries CE), thus postdating it. The device was set into the *hamra* soil to a depth of 0.1-0.3 m, a thin layer of ash was observed close to it, attesting to some moderate (?) heat that was apparently involved in its operation. The installation consisted of a central hub (possibly the bottom of a storage jar, diameter 0.4 m and depth 0.11 m), which was apparently connected to four other smaller jars, surrounding it in a way that resembled a star (L2156, L2157, L2158 and L2159, diameter 0.2-0.3 m), roughly oriented in the major compass directions. The preserved (lower) part of the feature is embedded into the soil and coated with a revetment of small fieldstones. As the central hub and the surrounding containers were damaged and only their lower parts were preserved, it is impossible to establish whether they were regular jars typical of the period, assigned to that specific use, or vessels made *ad hoc* especially for the purpose of the device. The bottom of the containers closely resembles the known bag-shaped storage jars from the period, but since most of the body and of course the neck and rims are missing, the exact identification is difficult.

The central and surrounding containers were presumably connected by short (length 0.25-0.3 m) ceramic pipes. The best preserved pipe, having a diameter of 0.12 m links the central container with jar L2158. This pipe was preserved up to half of its diameter, while the other pipes did not survive. However, their shapes can be reconstructed following the negatives left in the soil. A conical-shaped hollow brass (?) device was found inside each of the surrounding jars, except for L2156 (the one pointing to the north), which were obviously part of the installation (Figs. 7-11). The brass device missing in L2156 was probably found in L2159, which contained two such cones.<sup>8</sup> The devices could have

<sup>7</sup> It was revealed in Square B23 in Area I. The excavation of Area I was supervised by Tzach Kanias.

<sup>8</sup> The brass devices were cleaned in the IAA metallurgical laboratory by Lena Kupersmidt. The photos were taken by Clara Amit and the drawings were done by Irina Lidsky-Reznikov. The cones underwent XRF analyses in the Laboratory of Comparative Microarchaeology of the TAU. The authors are grateful to Yuval Goren, Dana Ashkenazi and Elad Gilon.

acted as funnels or even as pipettes, for pouring fluids and had similar measures, as seen in Tab. 1 below. The fragmentary condition of the fourth cone (Figs. 7: 3; 8) found in L 2157, did not allow to take measures.

Nº	Basket	Locus	Length	Base diam.	Tip inner diam.	Wall Thickness	Figure	Remarks
1	21514/1	2159	130 mm	15 mm	4.5 to 5.6 mm	0.4 to 0.5 mm	7: 4; 10	Thicker close to the tip
2	21514/2	2159	100 mm	20 mm	7.2 mm	0.25 mm	7: 2; 9	
3	21513	2158	120 mm	20 mm	4.4 mm	0.3 mm	7: 1; 11	
4	21515	2157	Not available	Not available	Not available	Not available	7: 3; 8	Fragmentary

**Table 1.** Comparative measures of the brass conical devices.

It may be worth noting that another fragmentary cone was found in a refuse pit located in Area B, some hundreds meters to the east, which was rich in Early Islamic pottery.<sup>9</sup> No exact comparisons for the cones are known to us. Nevertheless, slightly similar devices, albeit decorated with incisions and relief and still unpublished, were found in excavations at Horbat Zefat 'Adi, in the Eastern fringes of the Akko Valley, between Shefar'am and 'Ibilin,<sup>10</sup> The purpose of the devices and their context remain so far unclear.<sup>11</sup>

In addition, the central hub was connected via a longer pipe (1.6 m) to another jar, similar in size to those that surrounded it. This container was barely preserved and only the marks it left in the soil were visible. The same applies to the pipe, which could only be traced by the negative pattern (0.15-0.2 m width) remaining in the soil and flanked by a pebble bedding. The vanished pipe was probably a metal one, which was robbed to be either “used as is” or recycled.

The four surrounding jars had two different sizes: L2156 (preserved depth 0.22 m) and L2157 (preserved depth 0.21 m) located in the northeast and southwest directions had a diameter of 0.2 m, while L2158 (preserved depth

<sup>9</sup> The cone (labeled B3852) was found in L419, Sq. F11, Area B (supervised by Lisa Yehuda).

<sup>10</sup> Smithline and Stern 2004.

<sup>11</sup> The authors are grateful to Howard Smithline and Edna Stern who kindly allowed them to quote here this unpublished data, and to Lena Kupersmidt (IAA metal treatment lab) who called their attention to these artifacts.

0.19 m) and L2159 (preserved depth 0.25 m), positioned in the southwest and northeast respectively, were 0.3 m in diameter.

Although no comparable device could be found, some points are self-evident. It seems clear that a moderate amount of heat, controllable to a degree, was used in operating the device, and some material, liquid or vapor, was transmitted between the central container and the surrounding jars.

The direction of the flow (from the central hub to the adjoining containers or vice versa) can not be inferred from the slope, which is negligible due to the short distance. Nevertheless, the central container was positioned higher than the adjacent containers, which were dug deeper into the surrounding soil. Moreover, the connection of the pipes to the central core vessel was located very close to its bottom (10-11 cm above the bottom), while the exit that presumably directed some vapors or liquid to the surrounding containers was located probably at mid or one third of their height, leaving some space, between 20 to 25 cm in which the product could accumulate, below the level of the cones. The volume of the receptacles, from the level of the ceramic pipe and the assumed location of the brass cone to the bottom of the container, was calculated as follows:<sup>12</sup> The central vessel could have had a capacity of *ca.* 7.6 liter (about 7600 ml). Of the four surrounding containers, L2156 had a capacity of *ca.* 3.9 liter, L2157 of *ca.* 3.6 liter, L2158 of *ca.* 3.5 liter while L2159 (the larger one) had a capacity of *ca.* 7.7 liter. Therefore, if the system operated continuously, the combined volume of the four surrounding vessels (*ca.* 19 liter) could have been enough to contain all the contents of the central container, and the process could be finished before the product began to return to the core jar due to the hydraulic law of connected vessels.

This, of course, is true if we accept that the flow direction of the product was from the central hub to the surrounding jars. Having said that, it should be stressed that the possibility of the fluid running in the opposite direction i.e., from the surrounding containers to the central hub cannot be entirely ruled out. Similarly, it is not certain that all the containers had operated simultaneously. Rather, they could have operated in succession, one after the other. If the center to periphery premise is accepted, then the cones were probably applied to the end of the pipes, with the point aiming toward the surrounding containers and with the joints between the pipes and the jars sealed with bonding such as cement, plaster or some other putty. In this case, they could have functioned as a check valve that only allowed a unidirectional flowing or passage of liquid, thus keeping the manufactured products from returning to the central

<sup>12</sup> The volume was calculated by Shlomo Pongratz, to whom the authors are deeply grateful.



hub. Why such wide pipes linked the core to the surrounding vessels, is still unclear.

Another possibility that should be considered relates to the cones which were not located in the hole that connected the pipes to the containers, but higher up close to the top of the vessels, that were not preserved. Such a setting is indeed more compatible with the general idea of distillation-sublimation, in which differences in boiling temperatures and sublimation processes are used to separate selected materials from complex mixtures. However, it is difficult to explain in this case why the cones were found inside the containers; if they were located at the top, visible and easy to remove; they would most probably have been robbed or recycled when the installation was abandoned. Furthermore, it is difficult to accept that they dropped inside the containers when the device was damaged, since the upper part of the containers, had there been one, and the containers were not broken intentionally prior to their installation, was not found at the bottom of the jar. Therefore, the option in which the cones were located at the end of the ceramic pipes, inside the target containers and at mid or a third of their height seems more plausible.

As for the heat source, the possibility that it could have originated in the single jar located to the east, which was linked to the central jar via the 1.6 m long pipe, was considered. If so, the presence of a bellows, perhaps made of leather, is conceivable. Such a device could have been helpful in controlling the heat involved in the manufacturing process. However, the ashes were concentrated in the area surrounding the central hub, and it seems that this was the spot where the heating took place. The heat was probably applied by piling hot ashes on the outer walls of the core, as it occurs in the traditional Arab oven (*tabun*). This burning material could have been chopped straw, sawdust, dung or even press residues, such as waste of crushed olives.<sup>13</sup> The process possibly started in the far jar, from where some raw material was poured into the central jar to be boiled. The incline in the fragment between the core and the far jar could not be checked, because the linking pipe was missing and its existence could only be inferred from its negative in the soil. Hence, the question of the flow direction in this segment of the system remains, for the time being, unsolved. Nevertheless, the option in which all the production procedure started in the far surrounding jar, from where raw material was poured into the central core vessel to be processed, seems credible.

The presence of the hollow metal cones that exhibit a narrow hole in the sharp tip, suggests that the production process included the passage or flowing

<sup>13</sup> Avitsur 1976: 109-114; Figs. 300a-b.



of a liquid, or vapor whose amount was carefully controlled. Therefore, the procedure could have been related to some kind of industry relating to distillation or sublimation, for example the production of beverages or the manufacture of medicines or perfumes. There is no direct evidence of production or trade in medicines or drugs in Ramla, yet in this regard, it should be mentioned that later sources, dated to the Mamluk period (1250-1517 CE) mention a perfumer in Jerusalem, who also used to sell drugs and medicines.<sup>14</sup> We also know of a hospital in Jerusalem, built close to the perfume market and another perfume market in the city of Ramla.<sup>15</sup>

Another tempting possibility that can not be ruled out is that we have before us an alchemical device, perhaps a sort of alchemical still,<sup>16</sup> such as an alembic intended for the production of potions or elixirs, or the manufacture of some other unknown product.

The art or science of alchemy is of great antiquity, as it was practiced since the second century BC in Hellenistic Egypt, particularly in Alexandria, and had spread through the Greek-speaking world.<sup>17</sup> Nestorians and Monophysites exiled from Byzantium were acquainted with the alchemical doctrines and carried these through Syria and Persia, whence they spread further after the rise of Islam, when scholars translated the texts and offered them to the Arabic-speaking world. After 1100 CE certain Arabic texts from that period were later translated or quoted into Latin, and such later texts may be judiciously used to understand the enigma before us. The art of the alchemist also flourished in Persia, India and China. It was a subject of great interest to various elites, from kings to philosophers, and also to common people, including smiths, dyers and tinkers. The mundane knowledge was applied to produce drugs, poisons and cosmetics, as well as many products for daily use or even counterfeiting coins, especially silver ones.<sup>18</sup> As a forerunner of modern chemistry, alchemy attained important achievements and greatly contributed to the development of science.

Alchemy has a twofold nature: On the one hand it has an outward or exoteric component, while on the other, it possesses a more hidden, mystic or esoteric constituent. The two kinds were often inextricably mixed. During the Islamic periods, the art was highly developed, together with other hermetic sciences

<sup>14</sup> Little 1984: 211.

<sup>15</sup> Gat 2004: 151.

<sup>16</sup> For a comprehensive review of medieval glass and pottery distilling-apparatus retrieved in British sites, as well as technology and terminology, see Moorhouse 1972.

<sup>17</sup> Martens 2002.

<sup>18</sup> Keyser 1995-1996: 210.

that reached their peak of development in that era. This is due to the fact that by then various branches of technology had already attained a high degree of efficiency, e.g., metallurgy, ceramics, glass making, dyeing, coloring, weaving and brewing.<sup>19</sup> Since the Hellenistic period, Jews had engaged in these activities, with Maria the Jewess and Abufalah being major names.<sup>20</sup> Later on, under Islam, a strong revival and development of alchemy was noted<sup>21</sup> and the Arabs and Muslims became enthusiastic alchemists. As early as the Umayyad period, people like Khalid Ibn Yazid Ibn Mu'āwiya (died 708 CE), reputed to be the first Islamic alchemist, are known,<sup>22</sup> as well as books concerning this issue. The first manuscript known to us is *The Book of Crates* dated to the 9<sup>th</sup> century CE.<sup>23</sup> Other important Islamic alchemists in the 8<sup>th</sup> century CE were Jābir Ibn Hayyan (or Dschabir, in Latin Geber)<sup>24</sup> and Abu al-Qāsim Muhammad Ibn Ahmad al-Irāqi.<sup>25</sup> Among their best known successors, it suffices to name Al-Razi (died 924 CE), Al-Majriti (died 1007 CE) and Ibn Sina (Latin; Avicenna, 980-1037 CE). The last was also a well-known philosopher and physician who wrote *De Anima* on alchemy<sup>26</sup> and the *Canon Medicine*, superseding all others, even Galen and Al-Razi, until the time of Paracelsus.<sup>27</sup>

Distillation, which consists of purifying a liquid by heating it so that it becomes a gas and then letting it cool to become liquid again, pouring it through a pipe and then through a narrow valve into new container, is one of the principles of alchemy and a standard basic procedure in this art, as are sublimation, digestion, putrefaction, dissolution, coagulation, calcination, dealbation, rubification, ceration and fixation.<sup>28</sup> Alchemical apparatus and distillation devices, such as stills and alembics made of ceramic, glass and metal, are discussed and illustrated in ancient manuscripts, drawings and etchings.<sup>29</sup> The feature unearthed at Ramla (South), consisting of a central container distributing some material to surrounding containers, is reminiscent

<sup>19</sup> Holmyard 1957: 13-14.

<sup>20</sup> Patai 1994: 50-91, 98.

<sup>21</sup> Patai 1994: 98; Hopkins 1934: 134-156.

<sup>22</sup> Stillman 1960: 174-183.

<sup>23</sup> Stillman 1960: 175.

<sup>24</sup> Holmyard 1928; Stuart 2008: 45-64.

<sup>25</sup> Holmyard 1923.

<sup>26</sup> Partington 1960: 27-28.

<sup>27</sup> Hopkins 1934: 157-186.

<sup>28</sup> Linden 2003: 167; Moran 2005: 349.

<sup>29</sup> E.g. Livabius 1597: 78-86; Holmyard 1957: 45-57; Figs. 2, 4 and 6; Valentine 1992: 97-105; Pls. 1-5 (Basil Valentine was a pseudonym used by Johann Thölde).

of depictions of alchemical instruments, known as *tribicos* or *tribikos*, where the distribution is to two, three four or more smaller vessels. These instruments are also known as *alambics à trois récipients*<sup>30</sup> or *three-armed stills*.<sup>31</sup>

Specimens in which the distribution is to two vessels are known as *dibicos*, *dibikos* or *alambics à deux recipients*.<sup>32</sup> Similar mechanisms appear in ancient drawings, as the Gaster manuscript, folios 138a-b; 139a-b; 140a-b.<sup>33</sup> It is feasible that the feature discovered at Ramla, although dug in the soil, stationary rather than portable, and distributing to four containers (a "*tetrabikos*"?), operated in a similar manner. The immobility of the device discussed here should be possibly attributed to its antiquity. It is a prototype that later evolved into portable equipment. In this regard, it may be noteworthy that four and multiple recipients used for distillation are skillfully represented in drawings and woodcuts of the 16<sup>th</sup> century CE, published in Strasbourg.<sup>34</sup> It is true that the system described in all the illustrations was heated with open fire applied from below during the distillation process. This heating method (used in the presently discussed case) was impractical in Ramla where the device was interred in the soil, unless we consider the possibility that an underground heating facility, such as a boiler or an oven, had been present. Nevertheless, this presumed appliance, perhaps dug into the soil or built of mud bricks could not be found in the excavation, and the heating process involved was most probably as described above, namely external heating by either actively burning fire or a pile of ember and ashes leaning against the walls of the central jar. It is possible that the temperature of the process was controlled with the help of a bellows system located nearby (in the remote surrounding jar?). Similar blowers are known from pictures and etchings, representing medieval alchemy laboratories.<sup>35</sup> The central jar may have been the location where the actual heating, boiling and posterior distillation of the original substance was carried out, and later on, the desired product was poured into the target containers through the ceramic pipes, which were connected to the brass hollow distillers. The apparatus could have included glass parts, such as transparent bottles, which were not preserved. It seems reasonable to assume that when complete, the system was tightly sealed so as to avoid wasting the processed materials. The connecting channels may have presented a circular section,

<sup>30</sup> Berthelot 1889: 138-139; Fig. 15; 141; Fig. 17; 161; Fig. 37; 163; Fig. 38.

<sup>31</sup> Taylor 1949: Fig. 3.

<sup>32</sup> Berthelot 1889: 138-139; Fig. 14; 14 bis.

<sup>33</sup> Patai 1994: Figs. 33.2, 3, 4, 5, 6, 7.

<sup>34</sup> Brunschwig 1512.

<sup>35</sup> E.g. Partington 1960: 35, Fig. 23.

with the brass conical device attached to the end and pouring the distilled liquid into the four sealed receptacles. Not much can be said about the final product. It could have been some kind of elixir, drug, cosmetic good or perfume. It is conceivable that this kind of device was originally used by alchemists and later on, the perfume industry adopted it. In fact, the boundary between alchemy and industry was quite often diffused and tenuous.<sup>36</sup> An opposite scenario, in which the device was in use in the perfumery or pharmacological craft and later on, it found its way into the alchemy realms, can not be disregarded. On this issue, it may be worth noting that potsherds were found in the vicinity of the device (Loci 2116 and 2103, Squares A-B17),<sup>37</sup> identified as fragments of sphero-conical containers or “grenade” vessels, of the type known as incendiary bombs of “Greek Fire”.<sup>38</sup> Similar containers are known from different sites, such as Kursi,<sup>39</sup> Kh. al-Karak,<sup>40</sup> Hammat Gader,<sup>41</sup> Tiberias<sup>42</sup> and Kh. al-Mafjar.<sup>43</sup> Their identification ranges from weapons (fire-bombs), via beer gourds to hash pipes.<sup>44</sup> Most researchers tend to identify them as mercury or perfume containers<sup>45</sup> or receptacles for valuable liquids, such as perfumes, medicines, mercury used in the goldsmith craft<sup>46</sup> or other substances like “water-white” used for fighting disease and infections in Islamic medicine.<sup>47</sup> Such identification could be compatible with the presence of the industrial device discussed here, despite the relatively small amount of vessels of this type retrieved from the excavation.

Another interesting point that became apparent while checking the related finds in the area was the unusually high amount of potsherds that belonged to the well-known Early Islamic class of *Kerbschnitt* ware, characterized by cut ornaments in repetitive patterns around the outer surface of the vessels, usually bowls.<sup>48</sup> These bowls formed 10% of the pottery baskets retrieved from

<sup>36</sup> Martínón-Torres 2003, especially pp. 385-387.

<sup>37</sup> The pottery from the site was studied by Yael Arnon, to whom the authors are deeply grateful.

<sup>38</sup> Foerster 1993: 1471.

<sup>39</sup> Tzaferis 1983: Fig. 8:26.

<sup>40</sup> Delougaz and Haines 1960: Pl. 56: 2.

<sup>41</sup> Ben Arie 1997: Pl. XV: 14-10.

<sup>42</sup> Stacey 2004: 138; Fig. 5.52.

<sup>43</sup> Baramki 1944: Fig. 5:1.

<sup>44</sup> Ettinghausen 1965; Ghouchani and Adle 1992; Keall 1993.

<sup>45</sup> E.g. Ettinghausen 1965: 218-229.

<sup>46</sup> Arnon 2008: 31.

<sup>47</sup> Sharvit 2008, with discussion and references therein.

<sup>48</sup> Arnon 2008: 34; Stacey 2004: 93, both with further discussion and references therein.

Area I, a surprisingly high portion, particularly when the ware is considered a luxury item that is rarely found in excavations.

It is difficult to suggest that the bowls from Ramla were related to the production and packing of some unguent, lotion, cream or balm, as they are open and usually, large vessels. However, one can ask whether their dominant presence in the vicinity of the device is only fortuitous. In this regard, it may be noteworthy to mention that the apparatus was in the vicinity of a bathhouse, located in Area II, some 6 m to the north. Remains of the *hypocaust* (Figs. 5: 1; 12) were revealed,<sup>49</sup> including the columns used to support the suspended floor (L7010). The presence of both installations so close to each other is probably not a coincidence, and it is conceivable that unguents, ointments and balms that brought relief and solace to the visitors of the bathhouse were produced in the environs, as part of the comfort package and services offered to the guests. In this hypothetical scenario, where the vessels did not withstand a long journey and were rather used immediately and on the spot, open luxury bowls could have served to deliver the products from the device to the neighboring bathhouse.

The current paper is an initial effort to present a primary insight and propose an interpretation for the peculiar apparatus excavated at Ramla. It should be stressed that this device is the first of its kind to be found in the region and probably elsewhere in the country. The above proposed operation methods should be regarded as tentative attempts to comprehend its purpose. Further research, combined with new discoveries of hopefully similar, although better preserved devices, is required to fully ascertain its function.

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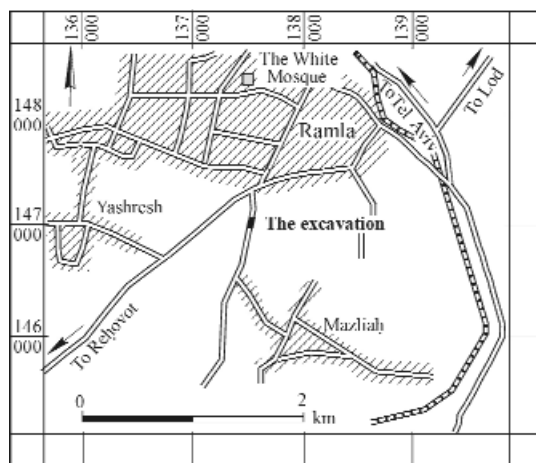
<sup>49</sup> The excavation of Area II was supervised by Ron Lavi.

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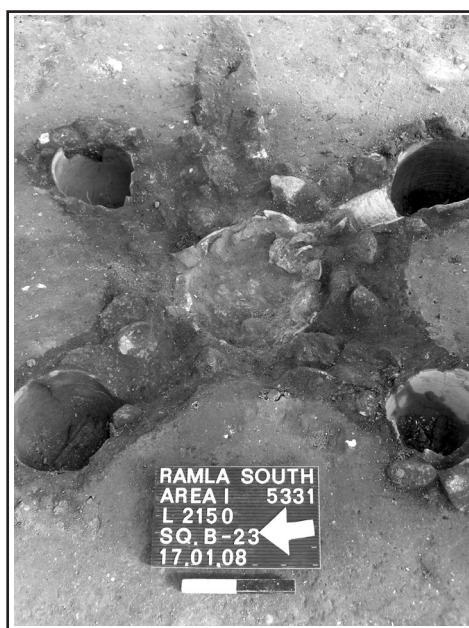
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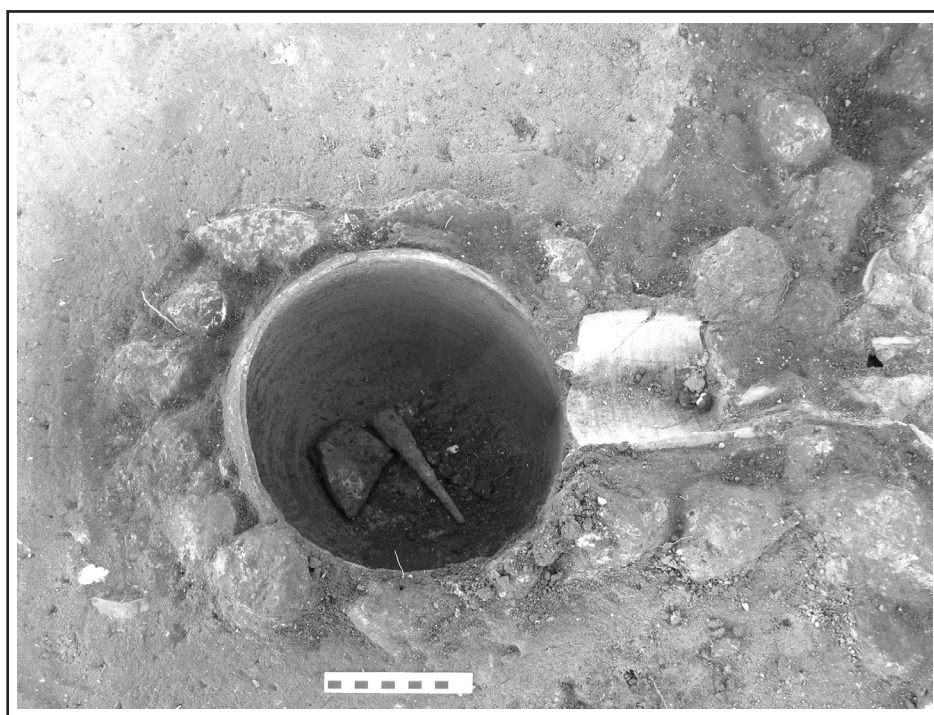
**Figure 1.** Map of the southern fringes of Ramla, showing the excavation (Irena Belashov, courtesy of the Israel Antiquities Authority).



**Figure 2.** The apparatus, the central hub and the surrounding jars linked by ceramic pipes, looking east (Photo Amir Gorzalczany, courtesy of the Israel Antiquities Authority).

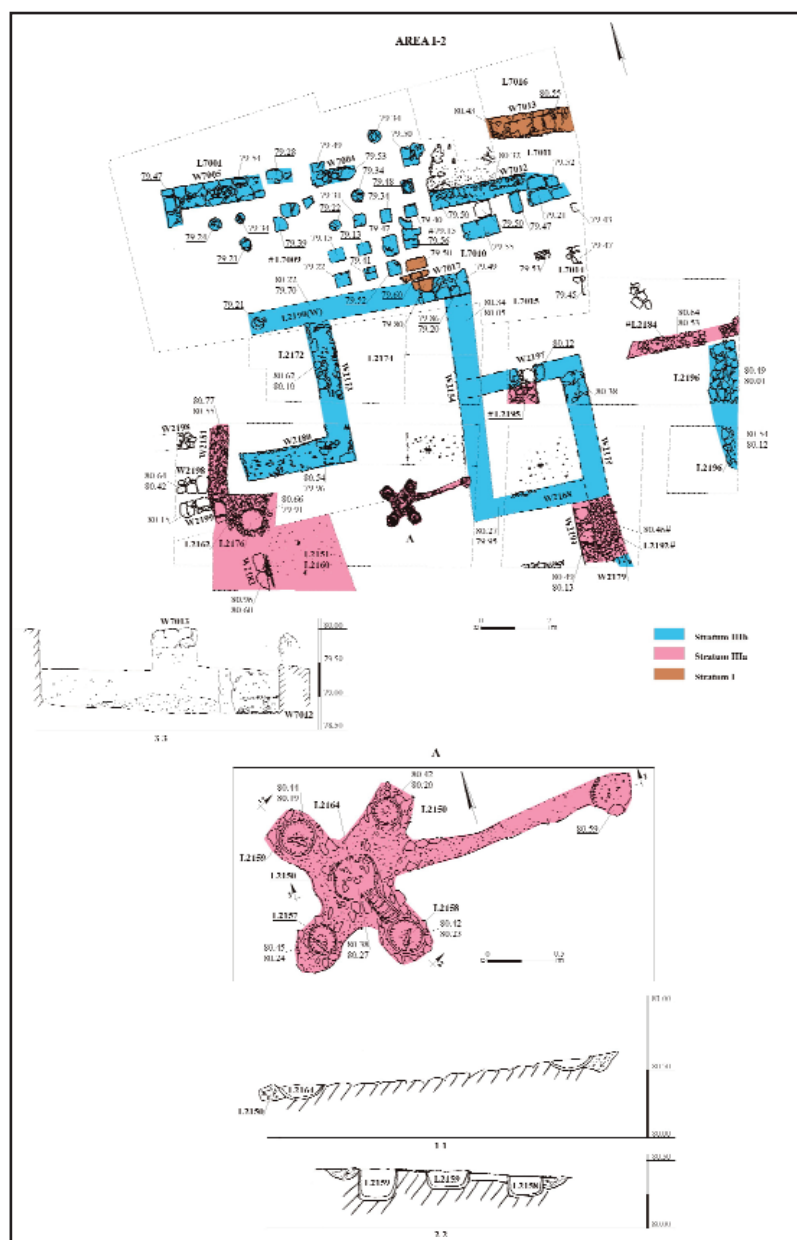


**Figure 3.** The apparatus and its surroundings, looking west. The remains of the bathhouse can be seen in the background (Photo Amir Gorzalczany, courtesy of the Israel Antiquities Authority).

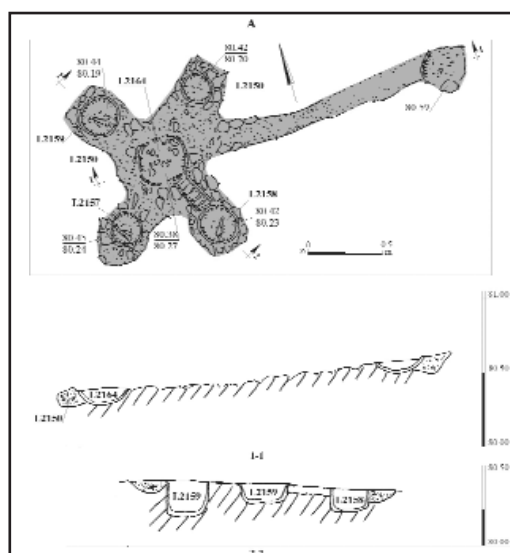


**Figure 4.** One of the conical devices, as found in the surrounding jar L2158 (photo Amir Gorzalczany, courtesy of the Israel Antiquities Authority).

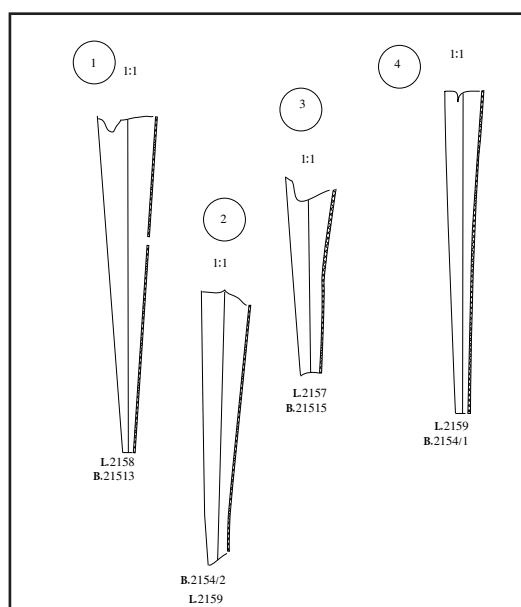




**Figure 5.** The apparatus and its surroundings (plan and sections).The remains of the bathhouse can be seen, marked in blue color (Irena Belashov, courtesy of the Israel Antiquities Authority).



**Figure 6.** The apparatus plan and section (Irena Belashov, courtesy of the Israel Antiquities Authority).



**Figure 7.** The four conical brass devices (drawing Irina Lidsky-Reznikov, courtesy of the Israel Antiquities Authority).



**Figure 8.** The cone 21515, found in L2157 (photo Clara Amit, courtesy of the Israel Antiquities Authority).



**Figure 9.** The cone 21514/2, found together with cone 21514/1 in Locus 2159 (photo Clara Amit, courtesy of the Israel Antiquities Authority).



**Figure 10.** The cone 21514/1, found together with cone 21514/2 in L2159 (photo Clara Amit, courtesy of the Israel Antiquities Authority).



**Figure 11.** The cone 21513, found in L2158 (photo Clara Amit, courtesy of the Israel Antiquities Authority).





**Figure 12.** The hypocaust of the bathhouse in Area I2, looking west. The soothed remains of the columns that supported the suspended floor can be observed in the foreground (photo Amir Gorzalczany, courtesy of the Israel Antiquities Authority).