Floating on Mercury in the Moonlight: "Birkat az-Ziʾbaq" in the Palace of Khumārawaīh in al-Qaṭāʾiʿ

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Abstract

In the article the author analyzes references to a basin filled with mercury ("Birkat az-Ziʾbaq") in the palace of the Tulunid Dynasty ruler Khumārawaīh in al-Qaṭāʾiʿ. This basin, which has been mentioned in several medieval Arabic sources (al-Maqrīzī, Ibn Duqmāq, Ibn Iyās, Isḥāqī) had been built in order to heal Khumārawaīh of insomnia. According to al-Maqrīzī, the basin has the dimensions of 50 × 50 cubits (ca. 25 × 25 m), however the depth of the basin has not been mentioned. The author critically analyzes the known references of the mercury basins in the palaces of Muslim rulers and advances several hypotheses explaining the construction of the basin in the palace of Khumārawaīh.

In 868, the Abbasid Caliph al-Muʿtazz appointed Commander Bākbāk to be the governor of Egypt. Aḥmad Ibn Ṭūlūn, a hereditary professional soldier brought up in the Caliph's court in Samarra, the son of a Turkic slave who was sent as a gift to the Abbasid ruler of Bukhara, Bākbāk, Ibn Ṭūlūn's stepfather, delegated him authority over the country.[1] His ambition, ability to weave and unravel intrigues, natural intelligence, and bravery enabled him to overcome his numerous rivals and become the head of the country in a ten-year period. In 879–880, Ibn Ṭūlūn appropriated the rights of *Khuṭba* and *Sikka*, which in the Muslim world were considered the outward signs of a sovereign's independence.[2] Ibn Ṭūlūn managed to create a powerful navy and an army, which consisted of Turkic, Berber, and Sudanese mercenaries, and to carry out agrarian and administrative reforms.[3] Ibn Ṭūlūn turned Egypt into a virtually independent emirate of the Ṭūlūnids, the dynasty that was to rule the country from 868 to 905.[4]

The former residence of the Abbasid governors in al-ʿAskar soon ceased to meet the changing status of the ruler of Egypt. Thus, in approximately 870, Ibn Ṭūlūn initiated the construction of his new capital of al-Qaṭāʾiʿ, for which he chose the area to the northeast of al-ʿAskar, first occupied by Christian and Jewish cemeteries.[5] He built his palace at the foot of the mountain where later, in the reign of Ṣalāḥ ad-Dīn (1171–1193), a citadel would be built.[6]

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[1] Thierry Bianquis, "Autonomous Egypt from Ibn Ṭūlūn to Kāfūr, 868–969," T*he Cambridge History of Egypt*, Vol. 1 (Cambridge, 1998), 91.

[2] Bartold Vasilij, Khalif i Sultan [Khalif and Sultan], *Raboti po istorii islama i arabskoogo khalifata [Works on History of Islam and the Arab Khalifat]*, Vol. 6 (Moscow, 1966), 27.

[3] Z. M. Hassan, "Aḥmad b. Ṭūlūn," in *Encyclopaedia of Islam*, vol. 1 (Leiden, 1986), 278.

[4] Bianquis, "Autonomous Egypt," 91–92.

[5] Ayman Fuʾād Sayyid, *La capitale de l'Egypte jusqu'à l'époque fatimide Al-Qāhira et Al-Fusṭāṭ: essai de reconstitution topographique.* Orient-Institut der Deutschen Morgenländischen Wissenschaft. Beiruter Texte und Studien, Bd. 48 (Beirut, 1998), 36.

[6] Sayyid, *La capitale de l'Egypte*, 37.

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It is believed that Ibn Ṭūlūn was born and raised in Samarra, where the residence of the Abbasid rulers was moved from Baghdad in 836, and created al-Qaṭāʾiʿ to a large extent imitating his hometown. Like Samarra, the bulk of the residents of the new capital consisted of soldiers and officers of Ibn Ṭūlūn's army, who were resettled according to their ethnic origin. The Turks, the Berbers, the Sudanese, and the Greek mercenaries lived in separate districts (*al-qaṭāʾiʿ*).[7]

Not far from the palace, in the very center of al-Qaṭāʾiʿ, Ibn Ṭūlūn ordered a mosque to be erected that could accommodate the entire population of the new capital. The architectural design of the minaret leaves no doubts that its prototype was the minaret of the mosque in Samarra.[8]

Al-Qaṭāʾiʿ reached its heyday during the reign of Ibn Ṭūlūn and his son Khumārawaīh. Khumārawaīh generously spent the treasury filled by his father on the construction and decoration of his residence, probably trying not only to match the luxury of the palace buildings of the Abbasid caliphs in Samarra, but to exceed them.[9] Unfortunately, we must judge the architecture of al-Qaṭāʾiʿ mainly from the information of the Arabic historians, as the only building that has survived from the capital of the Ṭūlūnids is the famous mosque of Ibn Ṭūlūn.

The description of the palace buildings at the time of Khumārawaīh's rule is contained in the *al-Mawāʿiẓ wa al-Iʿtibār fi dhikr al-khiṭaṭ wa al-āthār*, commonly referred to as *Khiṭaṭ,* the main work of the historian Taqi al-Din Abu al-Abbas Aḥmad ibn ʿAli ibn ʿAbd al-Qadir ibn Muhammad al-Maqrīzī (1364–1442). According to al-Maqrīzī, Khumārawaīh expanded the palace of his father. He laid out a new *maydan*,[10] while the *maydan* built by Ibn Ṭūlūn, was turned into a garden with exotic trees.[11] The trunks of the trees were covered with gold and silver.[12]

In the palace there was a reception hall called "the house of gold" (*bayt al-dhahab*). Its walls were covered with gold, lapis lazuli, and decorated with the reliefs of the ruler, his mistresses, and singing girls, carved of wood in full size. According to al-Maqrīzī, nothing in the world could compare with the beauty of that building.[13]

Al-Maqrīzī also writes about "the house of lions" (*dār al-sibāʿ*). It consisted of individual vaulted rooms with a lion and lioness living in each of them. Each room was serviced by a special person whose duties were to care for the lions, to feed them, and to walk them.[14]

Finally, al-Maqrīzī mentions a pool filled with mercury (*birkat az-ziʾbaq*):

> وجعل بين يدى هذا البيت فسقيّة مقدّرة وملأها زئبقا وذلك أنّه شكا إلى طبيبه كثرة السهر فأشار عليه بالتغميز فأنف من ذلك وقال لا أقدرعلى وضع يد أحد علىّ فقال له تأمر بعمل بركة من الزئبق فعمل بركة يقال أنّها خمسون ذراعا طولا فى خمسين ذراعا عرضا وملأها من الذئبق فأنفق فى ذلك أموالا عظيمة وجعل فى أركان البركة سككا من الفضّة الخالصة وجعل فى السكك زنانير من حرير محكمة الصنعة فى حلق من الفضّة وعمل فرشا من أدم يحشي بالريح حتّى ينتفخ فيحكم حينئذ شدّة ويلقى على تلك البركة الزئبق وتشد الزنانير الحرير التى فى الحلق الفضّة بالسكك الفضّة وينام على هذا الفرش فلا يزال هذا الفرش يرتج ويتحرّك بحركة الزئبق ما دام عليه فكانت هذه البركة من أعظم ما سمع به من الهمم الملوكيّة وكان يرى لها فى الليالى المقمّرة منظر عجيب إذا تألّف نور القمر بنور الزئبق....
> وما عرف ملك قطّ تقدّم خمارويه في عمل مثل هذه البركة[15]

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[7] Sayyid, *La capitale de l'Egypte,* 37.

[8] Sayyid, *La capitale de l'Egypte,* 54

[9] Sayyid, *La capitale de l'Egypte,* 61.

[10] *Maydans* were primarily intended for playing polo, as well as for all sorts of equestrian sports. For example, thirteen *maydans* for polo were excavated in Samarra; they were located near the palaces of Abbasid rulers of various periods. One of the excavated *maydans* was 525 × 66 m in dimension; C. Robinson, ed., *A Medieval Islamic City Reconsidered: An Interdisciplinary Approach to Samarra*, Oxford Studies in Islamic Art 14 (Oxford, 2001), 61.

[11] *A Medieval Islamic City,* 61.

[12] Zaky Hassan, *Les Tulunides. Étude de l'Egypte musulmane à la fin du IXe Siècle 868–905* (Paris, 1933), 127.

[13] Hassan, *Les Tulunides,* 127.

[14] Hassan, *Les Tulunides,* 127.

[15] Maqrīzī, *Al-Mawāʾiẓ waʾl-iʿtibār fī dhikr al-khiṭaṭ waʾl-āthār* (Al-Qāhirah, 1270 [1853]), 317.

"And he set a pool[16] in front of this building and filled it with mercury. This was because he complained of frequent insomnia to his doctor, and [the doctor] advised him to have a massage. But [the governor] did not like it. And he said, 'I cannot have someone's hand touch me.' And then [the doctor] said to him, 'Order to make the pool of mercury'. And he made the pool about which it is said that it was 50 cubits long and 50 cubits wide, and filled it with mercury. And he spent a great fortune on this. And at the corners of the pool he made the posts[17] (?) of pure silver and hung skillfully-made curtains of silk on the posts on the rings of silver. And he made a leather mattress, filled with air, so it could be inflated and made hard, and could be put on this mercury pool and attached with silk cords to silver rings on the silver posts, and [the governor] could sleep on the mattress. And this mattress did not stop shaking from the movement of the mercury while it was on it. This pool was more magnificent than any of king's undertakings that we heard of. An amazing sight appeared on moonlit nights when the moonlight merged with the light of mercury." And further, "Not a single rule was known before Khumārawaīh who would make such a pool."

Ibn Duqmāq (1349–1406) provides additional details, presenting the story of the mercury pond in the following way:

شكا أبو الجيش خمارويه بن احمد بن طولون الى طبيبه كثرة السهر فاشارعليه بالتغميز فذكر له كراهته ان تقع يد أحد عليه فقال له تأمر بعمل بركة وتملأ زيبقا فأمر بعملها فعملت له فى هذا القصر المعروف بالميدان وجعل فيها زيبق بمال عظيم وجعل فى أركانها سكك فضة بحلق وزنانير وجعلت الفرش على الزيبق و هى من أدم وشدت بتلك الزنانير التى فى الحلق والسكك فاذا نام لم تسكن حركة الفرش بحركة الزيبق[18]

"Abu 'al-Jaysh Khumārawaīh, the son of Aḥmad Ibn Ṭūlūn, complained of frequent insomnia to his doctor. And the doctor gave him advice to have a massage. However, [the governor] reminded [the doctor] that he was disgusted when [someone else's] hand touched him. And then [the doctor] told him, 'Order to make a pool and fill it with mercury, and make it in the very palace on the meydan.' And they filled it with mercury of enormous cost. And they set posts of silver with rings at the edges of the pool and hung curtains. And they put mattresses made of leather. And they stretched those curtains which passed through the rings which (hanged) on the posts. And while he slept, the movement of mattresses did not cease from the movement of mercury."

Ibn Iyās (1448–1524) and Isḥāqī (d. 1649 or 1650) repeat almost the same words about the pool of mercury.[19]

According to the descriptions of Arab historians, life at Khumārawaīh's court was filled with luxury and voluptuousness. Khumārawaīh surrounded himself with numerous concubines, and the best singers feasted his ears. The ruler was always accompanied by a blue-eyed lion named Zurayk who ate together with Khumārawaīh and was kept near the bed of the ruler during sleep.[20]

Fantastic stories about the wealth of the ruler and his vagarious taste, apparently were told in Cairo as late as the seventeenth century. Incidentally, they are preserved in the *Description de l'Égypte*, compiled by the Abbot Le Mascrier (1697–1760) on the basis of the memories of de Maillet, the Consul

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[16] For the translation of فسقية as a reservoir for the water or pool in the garden, see M. Silvestre de Sacy, *Relation de l'Égypte par Abd-Allatif, médecin arabe de Bagdad: Suivie de divers extraits d'écrivains orientaux, et d'un état des provinces et des villages de l'Égypte dans le XIVe. siècle, le tout tr. et enrichi de notes historiques et critiques* (Paris, 1810), 308–9.

[17] The word has two basic meanings: "coin," and "road," "way." However, according to the context, al-Maqrīzī obviously had in mind some post between which the curtains were stretched. E. Quatremere also translates this word as "post," Étienne Quatremère, *Mémoires géographiques et historiques sur l'Égypte et sur quelques contrées voisines,* Islamic geography, vol. 252–53, Institute for the History of Arabic-Islamic Science at the Johann Wolfgang Goethe University (Frankfurt am Main, 1996), 466.

[18] Ibn Duqmāq, *Kitāb al-intiṣār li-wāsiṭat ʿiqd al-amṣār*. Bayrūt, al-Maktab al-Tijārī lil-Ṭibāʿah wa-al-Nashr wa-al-Tawzīʿ (Cairo, 1966), 122.

[19] Ibn Iyās, *Kitāb tārīḫ Miṣr al-mašhūr bi-Badāʾiʿ al-zuhūr fī waqāʾiʿ al-duhūr* (Cairo, 1311–1312 [1893–1894]), vol. I, 41; ʿAbd al-Muʿṭī Isḫāqī, *Akhbār al-uwal fī-man taṣarrafa fī Miṣr min arbāb al-duwal* (al-Manṣūrah, 2000), 244.

[20] Hassan, *Les Tulunides*, 124.

General of France in Cairo (1656–1738). Le Mascrier wrote that Khumārawaīh would never mount twice the same horse and would never wear the same clothing.[21]

The rule of Khumārawaīh lasted for no more than twelve years. He was killed in 895/6 in Damascus at the age of thirty-nine in a palace conspiracy.[22] Despite the fact that the Abbasid Caliph granted Khumārawaīh and his descendants the *de jure* governorship of both Egypt and Syria for a period of thirty years,[23] in 904, under the pretext of suppressing the Qarmatian revolt in Syria, the Caliph's army invaded, plundered, and destroyed al-Qaṭā᾽iʿ.[24]

However, we should return to the pool of mercury. At first sight, the probability that such a structure might have existed in reality is extremely low, primarily because it seems to be technically difficult to carry out such a project.

According to al-Maqrīzī, the pool had the dimensions of 50 × 50 cubits. Cubits of different length were in use in Egypt in the Medieval period. Most likely in our case a regular cubit (*adh-dhirā ash-sharʿīya*), which equals 49.8 cm, is implied.[25] Therefore, the pool might have had the approximate dimensions of 25 × 25 m. If the depth of the pool was a half meter, it would take 312 m^3 of mercury to fill it. With the density of mercury reaching 13.6 g/cm^3 the amount of mercury would weigh 4,250 tons. Even if we assume that the depth of the pool was 25 cm, the amount of mercury needed (2,125 tons) still looks fantastic.

Mercury, Hg (Lat. *Hydrargyrum*), is the only liquid metal under natural conditions. It sometimes occurs in its native state, but is commonly produced by reduction of its most common mineral, cinnabar. Al-Bīrūnī (973–1048) thus describes this process: "it is taken out of red stones (cinnabar). These stones are heated upon fire till they burst, and the quicksilver begins to pour forth out of the perforations. Some people bruise these stones, and distil them."[26]

The closest cinnabar deposits to Egypt are located in Spain, in Almadén (from the Arabic "*al-maʿdin*," "the mine"), 125 km from Cordoba.[27] This mine started to be developed in the Roman times[28] and up until the mid-twentieth century provided up to 60 percent of the world demand for this metal.[29] The most intensive development of the deposits was carried out in the sixteenth and seventeenth centuries, after B. de Medina in 1555 suggested the use of mercury for extracting silver from the ore in the process of amalgamation. Experts estimate that in the sixteenth and seventeenth centuries, some 17,250 tons of mercury were produced in Almadén.[30] Mercury was extensively mined during the Spanish Civil War and World War II, since it was an important component in the manufacturing of detonators. In this period, according to the available data, mercury mining reached its peak in 1941 when 82,000 flasks of liquid metal (2,830 tons) were produced.[31] These statistics seems to be convincing evidence that the Almadén mines in the ninth century could not have possibly produced the amount of mercury needed to fill the pool of the ruler of Egypt.

Even if we suppose that the needed amount of liquid metal could have been mined in Spain for several years and then moved to Egypt (which obviously was a difficult but technically possible task), there

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[21] Jean-Baptiste Le Mascrier, *Description de l'Égypte, contenant plusieurs remarques curieuses sur la Geographie ancienne et moderne de ce pais*... (The Hague, 1740), 142.

[22] U. Haarmann, "Khumārawayh b. Aḥmad b. Ṭūlūn," in *Encyclopaedia of Islam*, vol. 5 (Leiden, 1986), 49.

[23] U.Haarmann, "Khumārawayh," 49.

[24] Bianquis, "Autonomous Egypt," 103.

[25] W. Hinz, "Dhirāʿ," in *Encyclopaedia of Islam*, vol. 2 (Leiden, 1991), 232.

[26] http://www.farlang.com/gemstones/biruni-book-gemstones/page_222.

[27] Évariste Lévi-Provençal, *L'Espagne musulmane au X^eme^ siècle: institutions et vie sociale* (Paris, 1932), 176.

[28] Yet, there is a view that the mercury at this Spanish location might have been produced as early as the fourth century BC, see C. Seybold and M. Ocaña Jiménez al-Maʿdin, in *Encyclopaedia of Islam*, vol. 5 (Leiden, 1986), 994.

[29] A. Hernández, M. Jébrak, P. Higueras, R. Oyarzun, D. Morata, and J. Munhá, "The Almadén Mercury Mining District, Spain," *Mineralium Deposita* 34 (5–6), (1999), 540.

[30] Hernández et al., "*The Almadén*," 540.

[31] Hernández et al., "*The Almadén*," 540.

is another not less serious reason to doubt the reality of the mercury pool, mentioned by the Arabic authors. This reason is the high toxicity of mercury.

According to the *Encyclopedia of Islam*, it is for this reason that Muslim physicians rarely used mercury for making medicinal potions.[32] Arabic medical treatises contain warnings to avoid inhalation of mercury vapor, because this might cause hemiphlegia, tremors, fainting, loss of hearing and vision, or madness. Mercury was also a part of poison against mice, rats, snakes, and scorpions.[33] T*he Canon of Medicine* of Avicenna (ca. 980–1037)—the medieval Arabic compendium constituting the most complete collection and analysis of medical knowledge—mentioned mercury only twice: the first time in the section on poisons and the second time in the section of medications. Avicenna, however, mentions only one medicine produced using mercury: according to the *Canon*, "killed" mercury (that is, mercury obtained by distillation) mixed with rose oil was the effective remedy against head lice and nits, as well as malignant ulcers.[34] According to Avicenna, mercury vapor only had a maleficent effect on the human body: it caused paralysis, shaking, and intertwining of internal organs; mercury smoke deprived people of hearing, and after fumigation produced stench from the mouth; odor of mercury deprived people of vision.[35] Al-Bīrūnī wrote that "it is deleterious to artisans and goldsmiths. It generates wastage of the body, inflammation and paralysis."[36]

Thus, we may say with some confidence that the medicine of the ninth century when Khumārawaīh lived, did not consider mercury as an effective remedy for healing any diseases except lice infestation.

Mercury started to be used actively for medicinal purposes in the late fifteenth to sixteenth centuries. The liquid metal was used for treating syphilis on account of the outbreak of a syphilis epidemic in Europe. Until recently, mercury was used in dentistry for making dental amalgam for filling cavities. However, at the present time, due to its high toxicity, mercury is almost completely removed from pharmacology and is still used only in medical thermometers.

Chronic mercury poisoning known as "constitutional mercurialism" chiefly leads to mental disorders, which used to be called the "mad hatter disease," since mercury(II) nitrate $HgNO_3$ was used for softening wool in the production of felt hats. This disorder is described in *Alice in Wonderland* by Lewis Carroll as the behavior of one of the characters: the Mad Hatter. It does not matter whether mercury enters the body through the respiratory tract, digestive tract, or through the skin, it is only known that the greatest adverse effect is produced by mercury vapor getting into the body.

Acute poisoning occurs in 8 to 24 hours. It is characterized by the symptoms of acute inflammation of the upper respiratory tract (rhinitis, tracheitis, bronchitis), stomatitis, often accompanied by ulcerative processes, gingivitis, disorders of the nervous system, subsequently joined by severe damage of the kidneys and intestines.[37] Mercury, including its organic and most of the inorganic compounds, are industrial poisons of the first class of danger with pronounced toxic properties.

These data seem to suggest a considerable degree of skepticism concerning the existence of a pool filled with mercury. It seems that an extended stay next to an open reservoir filled with mercury would lead to the results that were directly opposite to those allegedly sought by the physician of

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[32] O. Kahl Ziʾbaḳ, in *Encyclopaedia of Islam*, vol. 11 (Leiden, 2002), 496.

[33] O. Kahl Ziʾbaḳ, 496.

[34] Abu Ali Ibn Sina (Avicenna), *Kanon Vrachebnoj Nauki [The Canon of Medicine]* (Moscow-Tashkent, 1994), 247–48.

[35] Abu Ali Ibn Sina (Avicenna), *Kanon,* 247–48.

[36] http://www.farlang.com/gemstones/biruni-book-gemstones/page_222.

[37] Here is how the state of a worker, poisoned by mercury during the gilding of the dome of St. Isaac's Cathedral in St. Petersburg is described, "A trestle-bed stood apart from the common bunk beds, and the man lying on the trestle-bed was tied to it with ropes. He could lie on the bed only thanks to the ropes – such was the force of him shaking. If the ropes were untied, the man would have fallen right down to the floor.

The appearence of the sleeping person was horrible. Saliva flowed down to his beard from the open mouth; a swollen tongue which apparently did not fit in the mouth, was stuck between the swollen toothless gums; bad breath poisoned the air; his face wet with sweat and saliva, seemed green under the yellow light, or maybe it was actually green.... For a few seconds tremors subsided and then started to throw up his body again and again..." [Georgi Boutikov, *Muzej "Isaakievsrij Sobor"* [Museum "Saint Isaac's Cathedral"] (Leningrad, 1991), 76].

Khumārawaīh's court. Inhaling the vapor of mercury, which would apparently quite actively evaporate in the Egyptian climate, would upset even more the bad sleeping of the governor and would lead to his death. However, as mentioned above, the reason for the premature death of the ruler was not mercury poisoning.

And yet, the Arabic sources contain further evidence of the use of the pool, filled with mercury in the residences of Muslim rulers. The work of al-Maqqarī, the Arabic historian of the sixteenth or seventeenth century, contains the description of "the Hall of the Caliph" (Qaṣr al-Khalīfa) in the palace of Madīnat az-Zahraʾ, built by ʿAbd-ar-Rahmān III (912–961) 8 km from Cordoba. The description mentions a lovely fountain of Byzantine work, filled with liquid metal. In this case, the historian notes that mercury in the fountain was constantly mixed so that the light reflected in the metal would play on the walls of the building, decorated with gold, silver, and the thinnest marble slabs.[38] Al-Maqqarī cites another historian Ibn Bashkuvāl who mentions that a huge pool filled with mercury was located in the center of "the Hall of Caliph."[39]

Thus, it appears that pools filled with mercury were one of the elements of palace architecture both in Islamic Spain and in Egypt of the Ṭūlūnid period. The rulers of these two countries, seceded from the power of Baghdad, were united by the desire to surpass the court of the Caliph, which was taken by them as a model, in luxury and splendor.[40]

The sources describing the residences of the Abbasid rulers do not mention the swimming pools or fountains of mercury. However, *The History of Baghdad* by al-Khaṭīb al-Baġdādī, the Arabic historian of the eleventh century, contains some information which may serve as the key to solving the mystery of the mercury pool. Writing about the palace of Caliph al-Muqtaḍir (908–932) in Baghdad, the historian provides the following description of Greek ambassadors' visit to the palace: "Then they were taken to the palace which housed one hundred lions; fifty on the right side of the building and fifty on the left side. Each lion was assigned a special person. [Each] lion was on a chain; its head and neck were fettered in iron. Then the ambassadors were shown the palace, located between two gardens. In the middle of the palace there was a pond of lead,[41] surrounded by a channel of lead which shone brighter than polished silver. The length of the lake was 30 cubits, and its width was 20 cubits." In addition, the historian mentions the garden where trees with gilded and silver-plated branches grew; birds made of gold or silver were sitting on the branches.[42]

As we can see, the description of palace architecture in the capital of the Baghdad Caliphs to a large extent resembles the above descriptions of Khumārawaīh's residence in al-Qaṭāʾiʿ. This is quite understandable. During the short period of their stay in Egypt as country rulers, the Ṭūlūnids were not able to develop their own architectural style, which was entirely borrowed from Baghdad and Samarra, where Ibn Ṭūlūn had spent his youth and Khumārawaīh had spent his childhood. In their Egyptian capital, they tried to recreate a familiar architectural environment. However, in the description of Caliph al-Muqtaḍir's palace we are primarily interested in the description of the pond. Al-Baġdādī does not mention what it was filled with, but the reservoir itself was made of lead that was polished to shine. In our view, the information that the metal was shining, in this case, has fundamental importance.

In the work *Al-Khiṭaṭ* already quoted, in the chapter on Fayyūm, al-Maqrīzī retells the legend about Joseph (Yūsuf) and Potiphar's (al-ʿAzīz's) wife Zuleika (Zulīkha), known from the Old Testament and the Quran. Writing about the events that preceded Joseph's arrival to Egypt, al-Maqrīzī describes the

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[38] Henri Terrasse, *L'art hispano-mauresque des origines au XIIIe siècle* (Paris, 1932), 102.

[39] Aḥmad ibn Muḥammad Maqqarī, *The History of the Mohammedan Dynasties in Spain: Extracted from the Nafhu-t-tíb min ghosni-l-Andalusi-r-rattíb wa táríkh Lisánu-d-Dín Ibni-l-Khattíb* (London, 1840–1843), 236.

[40] For ʿAbd ar-Rahmān III, the ruler of Andalusia, this rivalry had a pronounced ideological character, since in 961 he proclaimed himself the Caliph, thereby rising to the level of the Abbasid Caliph who ruled in Baghdad; see Jerrilynn Dodds, "The Art of al-Andalus," in S. Khadra and M. Marin, eds., *The Legacy of Muslim Spain,* HdO Abt. 1, Nahe und der Mittlere Osten, 2 vols. (Leiden-New York, 1994), 603.

[41] رصاص قلعي, lit. "lead from Ḳalʿ." I was not able to identify the place name.

[42] Al-Khatîb al-Bagdâdhî, *L'introduction topographique à l'histoire de Bagdâdh*, BEHE, IVe section, Sciences historiques et philologiques (Paris, 1904), 137–38.

splendor of the palace buildings, erected by al-ʿAzīz for the young pharaoh. In particular, the historian mentions that chambers of colored glass were built in the palace. These chambers were surrounded by water with swimming fish and scattered crystals. The rays of the sun reflected in them, causing magnificent effects of light:

> وعمل له مجالس من زجاج ملوّن وحولها ماء فيه أسماك مفرطة وبلّور ملوّن فكان اذا وقعت عليه الشمس ظهر له شعاع عظيم...[43]

In the same chapter, in the story about the return of the victorious army of the Pharaoh to Memphis, al-Maqrīzī tells us how the vizier, in the preparation for meeting his lord, built up for him a pavilion of colored glass, decorated it with the best fabrics, planted around trees and flowers, made a pool of sky-blue glass, and placed the figurines of fish of white glass on the bottom:

> وكان العزيز قد بنى له مجلسا من زجاج ملوّن وفرشه بأحسن فرش وغرس حوله الأشجار والرياحين وجعل فيه بحرة من زجاج سماويّ وفى أرضه شبه السمك من زجاج أبيض...[44]

The evidence from the Arabic sources strongly suggests that in addition to their main purpose, which is to give coolness, the pools had to please the eye of the ruler and the courtiers by the effects of light, whether it was the light of the sun or the moon. The builders of such pools achieved the desired effect by using various materials for making the container for the water. In one case it was made of lead, while in another case it was made of glass.

As far as *birkat az-zi'baq* in the palace of Khumārawaīh is concerned, it is possible that the pool was made of some kind of metal and then silvered using mercury. The effect of the silvering might have been the same as if the pool was filled with liquid metal. There were no technical obstacles for creating such a pool in the ninth century. Contrary to the common view that the amalgamation was invented in Mexico only in 1557 by B. de Medina, the properties of mercury to dissolve gold and silver have been known at least since antiquity.[45] Thus, according to Pliny the Elder (ca. 73 BC) "All substances float upon the surface of quicksilver, with the exception of gold, this being the only substance that it attracts to itself. Hence it is, that it is such an excellent refiner of gold; for, on being briskly shaken in an earthen vessel with gold, it rejects all the impurities that are mixed with it. When once it has thus expelled these superfluities, there is nothing to do but to separate it from the gold; to effect which, it is poured out upon skins that have been well tawed, and so, exuding through them like a sort of perspiration, it leaves the gold in a state of purity behind."[46] Al-Bīrūnī in his *Mineralogy*, says that in India, the gold that was washed away by the river Sindh was mined in the following way. People would dig pits on the bottom and fill them with mercury. After a year the mercury would become filled with gold.[47] In Egypt, amalgam was used for gilding and silvering since the Ptolemaic period.[48] Al-Bīrūnī writes: "Since mercury readily unites with iron only in the presence of gold, chain armor and helmets are gilded using the amalgam of gold, and then they are silver-plated using the amalgam of silver."[49] Thus, the pool of mercury in the palace of Khumārawaīh could well have been a reservoir of metal, covered with silver amalgam. After being polished, the amalgam had mirror-like surface which reflected the light of the sun or moon.

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[43] Al-Maqrīzī, *Mawāʿiẓ wa-al-iʿtibār fī dhikr al-khiṭaṭ wa-al-āthār*, in MIFAO 49 (Cairo, 1924), 144, [3] (5–6).

[44] Al-Maqrīzī, *Mawāʿiẓ wa-al-iʿtibār*, 147, [3] (15–18).

[45] Alexander Del Mar, *A History of the Precious Metals from the Earliest Times to the Present* (New York, 1968), 134.

[46] http://www.perseus.tufts.edu/hopper/text?doc=Perseus%3Atext%3A1999.02.0137%3Abook%3D1%3Achapter%3Ddedication.

[47] http://www.farlang.com/gemstones/biruni-book-gemstones/page_226.

[48] Jack Ogden, "Metals," in Paul Nicholson and Ian Shaw, eds., *Ancient Egyptian Materials and Technology* (Cambridge, 2000), 169.

[49] http://www.farlang.com/gemstones/biruni-book-gemstones/page_222; R. Darley-Doran, "Tazyīf," in *Encyclopaedia of Islam*, vol. 10 (Leiden, 2000), 409–10.

The movement of water which filled the pool, reinforced this play of light. Such a structure was also cheaper and safer for the health.

In addition, according to the dictionary of E. Lane, the verb زوق ("to decorate," "to embellish"), the verbal noun تزويق ("decoration"), and the participle مزوق ("covered with mercury," especially for dirhams and dinars, which according to Lane, means a coin covered with silver or gold amalgam) originate from the same root as the word for mercury (زووق, زوق ; another variant spelling زئبق).[50] Al-Bīrūnī also mentions fake dirhams covered with mercury.[51]

However, a number of observations still lead us to the conclusion that Khumārawaīh did not follow this safer and more economical way to keep his physician's advice.

Al-Maqrīzī writes in his *Al-Khiṭaī* that after the destruction of the palace people would come to the place where the swimming pool used to be, dig pits, and try to find mercury in the cracks of the pool:

ولقد أقام الناس بعد خراب القصر مدّة يحفرون لأخذ الزئبق من شقوق البركة[52]

Ibn Duqmāq specifies that people were stealing mercury from the pool cracks:

ولما انقضت دولة الطولون وخربت منازلهم كان الناس يخرجون الى الميدان الخراب ويحفرون البركة ويخرجون الزيبق الذى سرقته شقوق البركة[53]

In turn, Isḥāqī writes that people would sell the extracted mercury:

ولقد أقام الناس بعد خراب البركة مدة يحفرون لأجل أخذ الزئنق، من شقوق البركة ، ويبيعونه ،[54]

Such details give greater weight to the testimony of the sources that the pool was actually filled with mercury. Another indirect confirmation is the reference to a mercury pool in al-Bīrūnī's *Mineralogy*. Thus, the scholar writes the following:

كما حكى عن متوكل ان أعضاءه ضعفت عن حركات الرهز ولم يشبع من الجماع فملى له حوض من الزئبق وبسط عليه النطع ليحركه الزئبق من غير ان يتحرك فاستلذه وسأل عن معدنه فأشير الي الشيز[55]

"About (the Abbasid Caliph) al-Mutawwakil, it has been said that constant and unremitting copulation made his body loose and flabby and yet he would not desist. A tank filled with mercury was prepared for him and his bed was laid thereupon in such a way that he would rock upon it without any external source of movement. When he enjoyed this bed, he asked where the mercury mine existed. He was informed that the mercury for his bed came from Shiz in Adharbijan."[56]

Thus, it appears that in the Abbasid period mercury was used for healing both physical exhaustion of the body (or impotence), which, judging from the text, bothered Caliph Mutawakkil, and insomnia which bothered Khumārawaīh.

Avicenna's *Canon of Medicine,* which speaks only about the adverse effects of mercury on the human body, is a collection of rational medical knowledge, but mercury could also be used for healing as a

[50] Edward Lane, *Arabic-English Lexicon*, Book I, Part 3 (New York, 1955–1956), 127.

[51] On the counterfeit coins covered with amalgam, see Darley-Doran, "Tazyīf," 409–10.

[52] Al-Maqrīzī, *Al-Mawaʾiẓ waʾl-iʿtibār fi dhikr al-khiṭaṭ waʾl-āthār* (Cairo, 1270 [1853]), 317.

[53] Ibn Duqmāq, *Kitāb al-intiṣār li-wāsiṭat ʿiqd al-amṣār* (Beirut, 1966), 122.

[54] ʿAbd al-Muʿṭī Isḥāqī, *Akhbār al-uwal fi-man taṣarrafa fī Miṣr min arbāb al-duwal* (al-Manṣūrah, 2000), 244.

[55] Abu l-Rayḥān Al-Bīrūnī, *Kitāb al-jamāhir fī maʿrifat al-jawāhir*, Natural Sciences in Islam, vol. 30. Institute for the History of Arabic-Islamic Science at the Johann Wolfgang Goethe University (Frankfurt am Main, 2001), 15.

[56] http://www.farlang.com/gemstones/biruni-book-gemstones/page_037,accessed 07/06/2013.

magical remedy. It seems that mercury had every reason for that. In alchemy mercury was the most important element. It was considered to be a female principle, just as sulfur was considered a male principle; together they constituted the basis of all kinds of matter. According to the Persian alchemist Ǧābir ibn Haīān (721–815), sulfur is first formed in the bowels of the earth through dry evaporation, while mercury is formed from wet evaporation.

Subsequently, seven planetary metals are formed from the compound of sulfur (the father of metals) with mercury (the mother of metals).[57] Gold as a perfect metal is formed only if pure sulfur and mercury are taken in the most favorable proportions. Ibn Haīān also introduced the idea of the philosopher's stone as a certain substance which could change the balance of mercury and sulfur in any metal and turn it into gold, at the same time, being able to heal all diseases and give immortality.[58] In the alchemical writings mercury has a great number of allegorical names: "runner" (الابق), "fugitive" (فرار), "flying, volatile" (طيار). These cryptonyms describe mobility and speed as the main qualities of mercury. In European languages mercury is also called quick silver, Quecksilber, argent vif. The Russian name of mercury ("ртуть") comes from the Proto-Slavic participle *гьтǫть, associated with the Lithuanian *rìsti*, "to roll." The substance with such qualities could be used as "sympathetic treatment"[59] for restoring mobility both of the whole body and of its individual parts. According to the beliefs of the medieval Arabic physicians, mercury could probably also heal insomnia, since mercury as a female principle was associated with the moon. This, perhaps, may explain the description of the merging of moonlight with the light of mercury in all four of the above Arabic texts.

It remains to answer two questions: how the Abbasid Caliph and the ruler of Egypt managed to deliver to Samarra and al-Qaṭāʾiʿ a sufficient amount of mercury to fill the pools, and how they escaped poisoning.

According to the information of historian Isḥāqī cited above, the mercury pool was half the size (20 × 20 cubits) of the pool described in al-Maqrīzī (50 × 50 cubits). In his study on the Tūlūnid period, Z. Hassan wrote that the reservoir filled with mercury had an area of 33 m^2.[60] Thus, if we assume that the pool at the palace of Khumārawaīh had a size of 5.75 m × 5.75 m, it is exactly the area of 33 m^2. If it was filled with mercury, for example, at a depth of 25 cm, this would need over 8,000 liters of mercury, which would have weighed over 112 tons. The production of that amount of mercury and its delivery from Spain to Cairo was clearly possible, given the scale of mercury production due to the demand of gold in the Caliphate. Al-Idrīsī, the Egyptian historian of the thirteenth century, wrote that over a thousand people worked at the Almadén mines, and the depth of the mines reached 120 m.[61] One hundred and twelve tons of mercury, of course, required fabulous expenses of the treasury. This is probably why al-Maqrīzī mentioned that the pool was "more magnificent than any of the king's undertakings," and Ibn Duqmāq wrote that the mercury that filled the pool was of enormous cost.

Apart from the material costs, required by the transportation of one 112 tons of mercury, the whole project represented a complex technical problem. The first question is what kind of containers were used for transporting mercury?

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[57] Ubajdulla Karimov, *Neizvestnoe sochinenie ar-Razi "Kniga tajni tajn" [Unknown Work by Ar-Razi "The Secret of Secrets"]* (Tashkent, 1957), 21.

[58] Apparently, in China people also considered mercury as a panacea for all deseases. According to Sima Qian, Emperor Qin Shi Huang used a variety of remedies trying to gain eternal life, but decided to settle upon pills, which contained mercury, which probably led to his death, see David Wright, T*he History of China* (London, 2001), 49–50.

[59] According to L. Lévy-Bruhl, healing in primitive societies is almost always aimed at "expulser l'influence ou l'esprit dont la présence cause la maladie, soit de faire participer le malade à une vertu constatée ou supposée dans le remède, et qui lui fera surmonter le mal. Dans ce dernier cas, c'est la thérapeutique 'sympathique', qui est universellement répandue, et dont les médecins européens usaient encore il n'y a Pas trois siècles. Ainsi, pour ne prendre qu'un exemple, dans la Colombie britannique, 'on fait boire aux femmes stériles une décoction de nids de guêpes, ou de mouches, parce que ces insectes se reproduisent en quantité'. Les faits de ce genre, comme on sait, sont innombrables," Lucien Lévy-Bruhl, *Les fonctions mentales dans les sociétés inférieures (3e–4e parties)* (Paris, 1910), 43.

[60] Hassan, *Les Tulunides,* 127. Unfortunately, Z. M. Hassan does not specify his source for this information.

[61] A. Al-Hassan and D. Hill, "Maʿdin," in *Encyclopaedia of Islam*, vol. 5 (Leiden, 1986), 967.

The funds and exhibits of many museums contain so-called spheroconical vessels, "mysterious" ceramic containers, described in many archaeological studies.[62] The spheroconical vessels have spherical upper parts and conical lower parts. The body ends with a short neck with a small head. The hole in the head varies from 2 to 5 mm in diameter. The outer surface of the vessels was treated in different ways. The surface was often polished or coated with colored glazing. In most cases, the surface of the vessels was decorated with various decoration patters, imprinted on raw clay. According to the statistics in the study of R. Dzhanpoladyan, the average size of the vessels ranges from 9.5 × 7 cm to 14 × 11 cm. The vessels were made of very dense, hard, calcitrant clay. The walls of the vessels are thick and are close to stoneware.[63] Galiyeva believes that clinker burning was used in the manufacturing of the vessels.[64] According to Dzhanpoladyan, spheroconical vessels were not cheap products and they cannot be put at the same level with simple unglazed ceramics;[65] she also writes that vessels of such form were common in Central Asia and Eastern Europe from the ninth through fourteenth centuries.[66] The most intriguing mystery, associated with spheroconical vessels, is their function. Very often on the labels of museum collections they are described as "hand grenades."[67] It is suggested in a number of studies on spheroconical vessels that they were used for transporting and storing mercury, since at various sites archaeologists have found sealed vessels with traces of mercury.[68] The most recent archaeological findings in the article of Galiyeva leave no doubts in that.[69] However, as follows from field materials, the spheroconical vessels were not exclusively made for transporting and storing mercury. According to Galiyeva, the spheroconical vessels were a successful invention of medieval potters. They were specifically designed as convenient and unbreakable containers for transporting expensive oils, liquids, and medicines, as well as chemical ware over long distances.[70]

However, it is unlikely that the thick-walled vessels of not more than 20 cm in height were used for transporting such a large amount of mercury. If our hypothesis that the pool was really filled with mercury is correct, the transportation of mercury from Spain would have needed a much larger container than spheroconical vessels. However, such vessels are not known.

As far as the adverse effects of mercury on the human body are concerned, it is likely that a short period close to mercury does not lead to disastrous consequences, and mercury may be excreted from the body. Thus, for example, in 1937, at the International Exhibition in Paris, the Republican government of Spain showed the fountain of mercury created by American artist and sculptor Alexander Calder. It was exhibited in the Spanish national pavilion along with *Guernica* of Picasso and Miró's works. The work of Calder was dedicated to the siege of the town of Almadén by Franco's troops, and Almadén, as already mentioned, was the place of world's largest deposits of mercury. The moving parts of the fountain were made of steel for the reason that mercury does not amalgamate steel. The container for mercury was made of concrete and was coated with resin. Its dimensions were 114 × 293 × 196 cm. The

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[62] Zamira Galiyeva, "Sferokonicheskie sosudi Srednej Azii: K voprosu o tipologii I chronologii" [Spherical-conic vessels from the Middle Asia: typology and chronology], T*he Middle Asia: Archaeology, History, Culture. Proceedings of the International Conference Devoted to the 50th Anniversary of the Scientific Activity of Galina Shishkina* (Moscow, 2000), 54–57. Ripsime Janpoladyan,"Sferokonicheskie sosudi iz Dwina I Ani" [Spherical-conic vessels from Dwin and Ani], *Soetskaja archeologija [Soviet Archaeology]* 1 (1958), 201–13; Emily Lenz, "O glinjanich sosudach s konicheskim dnom nachodimich v predelach musulmanskogo vostoka" [Clay Vessels with a Conical Bottom from the Muslim Orient], *Zapiski vostochnogo otdelenija russkogo archeologicheskogo obshestva [Proceedings of the Oriental Department of the Russian Archaeological Society]*, 15 (1904), 0101–0112. For a detailed typology of the speroconical vessels, see Galiyeva, "Sferokonicheskie sosudi Srednej Azii," 53.

[63] Janpoladyan, "Sferokonicheskie sosudi," 202.

[64] Galiyeva, "Sferokonicheskie sosudi Srednej Azii," 53.

[65] Janpoladyan, "Sferokonicheskie sosudi," 202.

[66] Janpoladyan, "Sferokonicheskie sosudi," 213.

[67] For example, exhibits no. 101, 102, and 104 at the Museum of Islamic Ceramics in Zamalek in Cairo (http://icm.gov.eg/E_fatemi.html, accessed 07/06/2013). This is an unconvincing hypothesis which currently is not considered serious by scholars.

[68] Janpoladyan, "Sferokonicheskie sosudi," 209.

[69] Galiyeva, "Sferokonicheskie sosudi Srednej Azii," 56–57.

[70] Janpoladyan, "Sferokonicheskie sosudi," 213; Galiyeva, "Sferokonicheskie sosudi Srednej Azii," 57.

fountain used 150 liters of mercury.[71] Currently the fountain is on display at the Joan Miró Foundation in Barcelona inside a sealed glass case that protects the viewers from malicious mercury vapors. However, at the Exhibition, the fountain obviously was open, since according to Calder's memories, the crowd in front of the unusual construction was most amused by the fact that the coins thrown into the mercury did not sink.[72]

In conclusion, I would like to make one more hypothesis that may solve all the problems related to the construction of an open-air pool filled with mercury, namely, transporting a large volume of liquid metal over a long distance and its fatal effects on the human body. It is possible that only the bottom of the pool was filled with mercury. On top, the mercury was covered with water, which prevented the evaporation of the liquid metal. Such a pool would fully comply with its main purpose: to draw moonlight, intended to heal the ruler from the torment of his insomnia.

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[71] Joan Marter, *Alexander Calder* (Cambridge, 1991), 191–92.
[72] Marter, *Alexander Calder*, 191–92.