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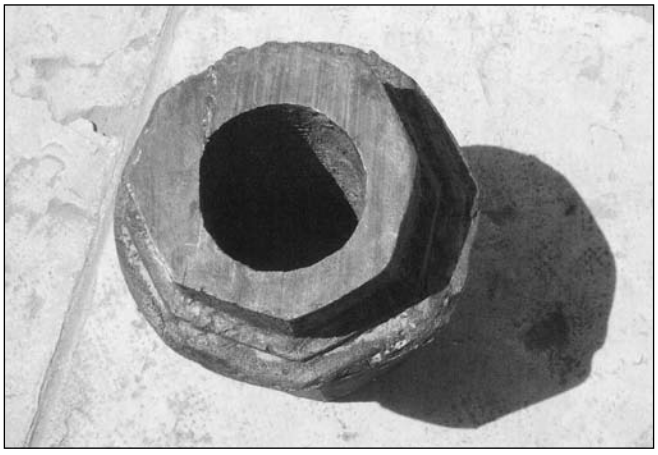
A Bronze Cannon Barrel from ʻAmmān: Physical Evidence for Mamluk Gunnery

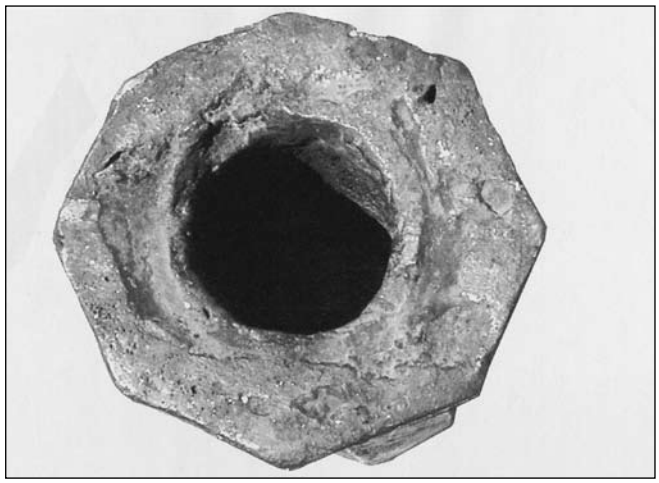
Description

The barrel is made of bronze. The exterior section of the barrel is hexagonal and cylindrically bored from interior. It has been cast in a sand mould, as indicated by the slightly rough feel of the exterior surface: impressions of the sand can still be felt. The thickness of the wall is uneven throughout its length and over the sides of the hexagonal section (FIG. 1). The two ends of the barrel are approximately flat and slightly flanged (FIGS. 2, 3). Two parallels perforated stubs stick out of the body at right angles, one located on each side (FIG. 4). They were cast integrally with the piece and were designed to act as the pivotal points for the cannon, allowing it to be fixed firmly to the base. Usually, when the cannon was fired it recoiled backwards. Without the pivots and if it was not tied down with thick rope it could career violently across the ground. The force of the recoil would have intensified the more the cannon was fired, as the barrel heated up.



1. A cross-section of the body.

2. The front end flange of the cannon.



3. The rear end flange of the cannon.

One longitudinal side of the hexagonal barrel carries an inscription in raised relief written in naskh Arabic, embraced in three oblong frames. Each frame has been dedicated to a phrase (FIG. 4). When the barrel was purchased it had already been cut into three pieces by a modern saw.

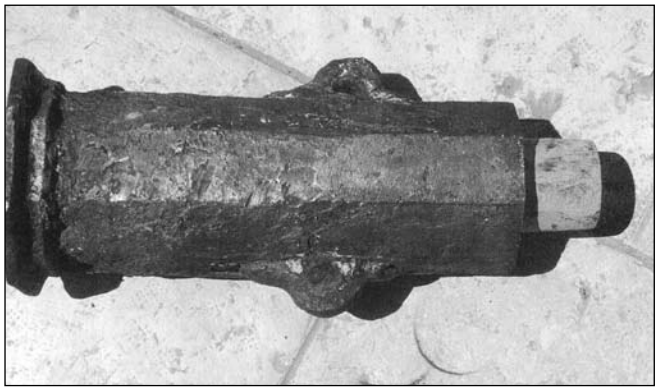
Manufacture of the Cannon

To construct the barrel, the smith probably first made a wooden cylinder, known as a mandrel, of the same length as the desired piece and with the

4. The complete barrel.

same diameter as its bore (FIG. 5). He would then have poured the molten alloy into the sand mould, into which the wooden mandrel would have been fixed. Having taken the shape of the mould, when the alloy cooled then the partly or totally burned wooden mandrel could easily be taken out, leaving a casting with a smooth bore.

As the barrel was built up on a mandrel it was open at both ends. It was probably made as a breech-loader, in which the breech was in the form of a separate chamber, into which the gunpowder charge was loaded, with the open rear end being closed by a wooden plug. The shot would have been loaded into the barrel, with the chamber inserted behind it and kept in place by a wooden wedge. A fresh plug would have been required for each round. This hypothesis is supported by the flatness and flanging at both ends. The stubs of the two ends add to this evidence; they would have fixed the barrel firmly to the base so that it could not move horizontally or vertically unless the base was moved as well.



5. A fragment with a mandrel of the barrel showing body thickness.

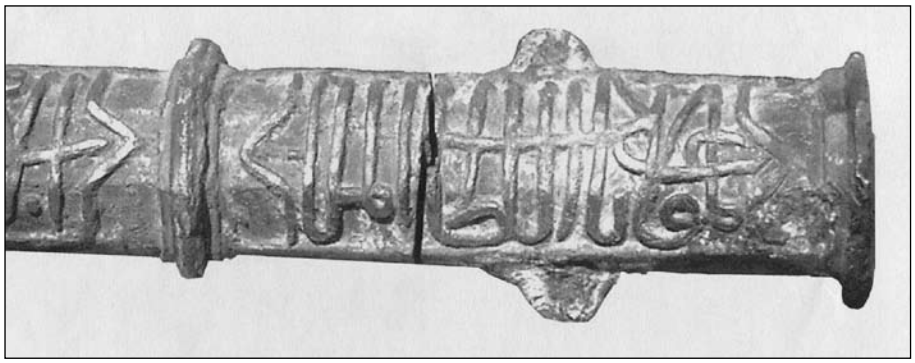
With this mechanism and method of operation, our cannon may have looked like the Alexandrian cannon described by al-Qalqashandi in his encyclopedia Ṣubḥ *al-A'sha* which was made of copper and could fire iron balls ranging in weight from ten Egyptian *Raṭl* (about 4.53kg.) to more than a hundred *Raṭl* (45.3kg.) (al-Qalqashandi 1963: 144-145).

In this case it seems that the smith found that no matter how carefully he shaped or smoothed the end of the chamber and the mouth of the breech into which it fitted, some propellant gas would inevitably escape over or through the breech. This is indicated by the roughness, flanging and flatness of both ends of our barrel.

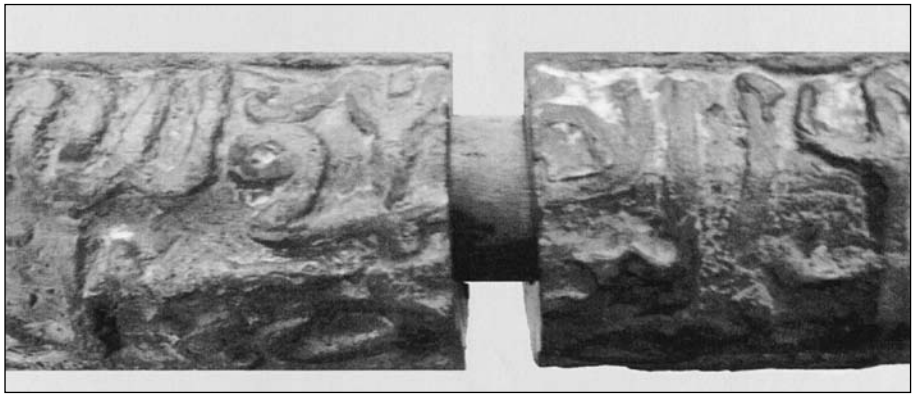
Transliteration of the Inscription (FIGS. 6-9)

1- The first frame reads in naskh Arabic as " *'Izz lemawlana al-sulṭan al-malik"* (FIG. 6).

2- The second frame reads as *"alashraf abu aln(aṣr) inal 'umrahu fi Sabīl Illah"* (FIGS. 7, 8).



6. The right end, inscribed with first phrase.



7. A detail of the middle frame showing the king's name, Inal.

8. The middle phrase included within the middle frame.

3- The third frame reads as *'amal al mu'alem al-sabbak Rajab al-Ḥamawī* (FIG. 9).

Reading the Arabic Inscription and Translation into English

1- The first frame reads translates as "Glory to our Lord the Sultan the King" (عز لمولانا السلطان الملك) (FIG. 6).

2- The second frame translates as "Al-Ashraf Abu Aln(ṣr) Inal created it for the sake of God". The two letters after the letters *aln*, which is part of the second royal nickname (Abu Alnaṣr) are missing owing to the modern saw cut (FIGS. 7, 8) (الاشرف ابو الن(صر) إنال عمره في سبيل الله)

3- The third frame translates as "The work of the expert cast-man Rajab the Ḥamawi", i.e. from the Syrian town of Hama (FIG. 5)
(عمل المعلم السباك رجب الحموي)

9. The left end, inscribed with the name and title of the manufacturer.

In Arabic, the whole inscription reads:
(عز مولانا السلطان الملك، الأشرف أبو الن(صر) إنال عمره في سبيل الله، عمل المعلم السباك رجب الحموي)

The entire translation is therefore "Glory to our Lord the Sultan the King; al-Ashraf Abu Aln(sr) Inal created it for the sake of God; the work of the expert cast-man Rajab the Hamawi".

Dating the cannon

Thanks to the mention of the proper name *Inal*, the nickname *al-Ashraf* and the two ranks of *Sultan* and *King* in the inscription, by referring to the list of Mamluk kings we find the Circassian Mamluk, Sultan the King al-Ashraf Abu Alnasr Inal, who was brought from Caucasia by 'Alaa Eddin and sold to Sultan Barqouk. After a long period, he was promoted to the rank of king for approximately eight years, between 1453 and 1461AD. Then, on account of age of 81 years, he abdicated in favour of his son, al-Shihab Ahmad. In addition to being described as merciful, just, patient and experienced in politics, Inal was familiar with gunnery and artillery, active in the construction of practical buildings and *sabīls*, and keen on the fortification of borders. Thus, our cannon should date to the period 1453-1460AD.

Brief Historical Background

It is not the purpose of this paper to review history and technology of gunpowder or cannon in detail, as this has already been the subject of much discussion and debate. I shall therefore limit myself to points that are relevant to the subject of this paper, *viz*. the development of cannon manufacturing between the 13th and 15th centuries AD, in an attempt to assess the significance of our cannon.

It is well known that cannon has played a leading role in human history over the last seven centuries. Much has been written and reported about the wars of this period and the important role of artillery therein, but there seems to be a gap in modern literature dealing with the Arabic and Islamic world that relates to the history of gunpowder and cannon development in the 13th and 14th centuries AD. This is surprising as the technology is unlikely to have been transferred between China and Europe, without passing through the Arab and Islamic lands which lay between east and west (al-Hassan 2001: 1).

With regard to the propellant, it should be noted that gunpowder is simply a mixture of saltpetre, sulphur and charcoal that is first reduced to fine powder, then granulated, dried and used as a charge in cartridges, shells, firecrackers etc. (Alsiti 1950: 249-250; Webster's Dictionary 1971: 811; Encyclopedia of Islam 1979: 1055-1056). Despite the paucity of available information, it is generally accepted (e.g. al-Obaidi 1988: 152; Kelly 2004: 22) that the Arabs preceded the Europeans in the manufacture and refining of gunpowder and that this occurred sometime in the early 13th century AD, after 1240AD but before 1280AD when Hasan al-Rammah wrote instructions for the manufacture of gunpowder, purification of saltpetre, and descriptions of gunpowder incendiaries in Arabic (Kelly 2004: 22; Partington 1999: 22).

One of the earliest known Arabic and, indeed, world-wide references to the refining of saltpetre appears in the 13th century book *al-Furūsiyya wa al-Manaṣib al-Ḥarbiyya* (Book of Military Horsemanship and Ingenious War Devices) written by Hasan al-Rammah in the 1270s (Kelly 2004: 22). It includes the first instructions for the manufacture of gunpowder that approach the ideal composition for explosive gunpowder used in modern times (*viz*. 75% saltpetre KNO_3, 10% sulphur, 15% carbon), such as the *tayyar* 'rocket' (75 parts saltpetre, 8 sulphur and 15 carbon by weight) and the *ṭayyār buruq* 'lightning rocket' (74 parts saltpetre, 10 sulphur and 15 carbon). He states in his book that many of these instructions were known to his father and grandfather before him (al-Hassan 1998: 130; Encyclopedia of Islam 1979: 1055-1056).

Regarding the cannon as hardware, it can be simply described as a strong cylinder, closed at one end and temporarily blocked by a cannonball at the other end, with a charge between the two. When the charge was ignited through the touch-hole, it quickly exploded, changing to highly compressed gas which expelled the ball to do the terrible service required of it.

Philologically, the word 'cannon' comes from its essential component, the cylindrical bore or barrel, probably from the Latin *canna*, which in turn originated from the Greek *kanna* — cane or reed — with an Italian suffix - *one*, giving us *cannone* or large tube (Webster's Dictionary 1971: 264).

The contribution of the Arabic and Islamic world to the development of the cannon can be clearly noticed from the number of Islamic artillery historians who compiled documents, which told the story of its evolution and usage. These documents

have for centuries been considered the main references for the European artillery and war historians who translated those documents into their own languages. Of the Arab historians, Commander Najm al-Din Hassan al-Rammah (died 1294), who compiled *al-Furūsiyya wa al-Manaṣib al-Ḥarbiyya* and *Ghayat al-Maqṣūd min al-'Elm wal 'Amal bihi*, deserves special recognition, as does the Andalusian cannon manufacturing expert Commander Ibrahim bin Ahmad bin Mohammad bin Ghanem bin Zakaria, who compiled a book in Spanish in 1631 which was translated into Arabic in 1639 in Morocco. It was entitled *al 'Iz wal-Rif'a wal-Manafi' lil-Mujahidīn fi sabīl Illah bil-Madafi'* and described 32 sorts of cannon; Ibrahim is thought to have gained his experience from his father and grandfather (Zaki 1973: 108-109). Other Arab historians include al-Qalqashandi (1365), Ahmad bin Fadl al-Umari (1340), Ibnu Iyas (1352), Salih bin Yahya (1342), Ibn Khaldoun (1332-1406), Ibn Mankali (1370) and Shams al-Din Muhammad al-Ansari al-Dimashqi (died 1327) (Zaki 1973: 111-115).

With regard to the manufacture and widespread adoption of cannon as a main machine of war, we find historians referring to the Mamluk Sultan al-Ashraf Qayetbay (1492) as the first king who adopted artillery on a wide scale. He established a specialised cannon force and fortified all borders and castles with cannon. His Alexandria and Rashid castles in Egypt were specially designed for this type of heavy weapon. We should also note the Mamluk cannons, including those of Qayetbay (1492) and al-Ghouri (1501AD), on display at the Topkapi Palace Museum in Istanbul; these were siezed by Ottoman forces when they defeated the Mamluks (Abu Ghaneemah 1983: 245).

In the early stages of the cannon's development, they were made in two separate parts — the barrel and chamber — which were wedged or screwed together for firing. Sometimes the breech of the gun was an open box, with the chamber wedged into it. The best cannon were cast in bronze alloy and were bored so that the stone, iron or lead cannonballs were a close fit. They were provided with trunions, or at least with rings for attaching ropes, so that they could be accurately fixed and elevated when fixed on bases or mounted on strong wooden carriages (Calvert 2008: 8-9).

Cast iron, when it became available, was a much cheaper material than bronze. It was used both for cannonballs, completely superceding stone by the end of the 16th century, and for the cannon themselves. Cast iron cannon were favored by warlords because they were cheaper, but not by the gunners who were the ones who suffered when they burst without warning, often with fatal results. Failure of bronze guns could usually be predicted in advance by the development of a bulge. Furthermore, bronze cannon were usually indicative of high rank (Calvert 2008: 8-9).

What Can We Learn from Our Cannon?

1- Our cannon would have been a physical manifestation of the status of the Mamluk king, owing to the expense involved in casting in bronze.
2- Rajab al-Hamawi, whether as a person or a workshop, would probably have been a famous smith who specialised in cannon casting. Has fame was sufficient for him to inscribe his proper name and title on the cannon.
3- Our cannon suggests that the casting and use of cannons was widespread in the Arabic or Islamic world, possibly from the beginning of the Mamluk period, which predates their introduction to Europe in the 14th century (Encyclopedia of Islam 1979: 1058).
4- Our cannon manufactured in the Syrian part of the Mamluk Sultanate.
5- We learn from the inscription that the cannon had been manufactured by casting.
6- The mention of the king's name alongside the titles and nickname of the Mamluk sultan provides a firm date for the cannon itself and for the development of gunnery in the Arabic and Islamic world.
7- The mention of the phrase *fi sabeel illah* ("For the sake of God") clearly indicates the function of Arabic / Islamic.

Comparative Analysis

Consulting the Arabic sources we note that:

1- The first portable hand cannons to appear were those used by the Egyptian Mamluks to repel the Mongols in 1260 at the battle of 'Ayn Jālūt (St Petersburgh ms. 1963: 160).
2- Ibn Khaldoun (1332-1406), in his history *Kitab al-'Ibar*, how the King of Morocco, Sultan al-Marinid Abu Yousuf "used machines of besiege some of which could blow in a combustion and heated balls of stone and iron balls were projected, with a huge recoil" (al-Zahar 1982: 6; Ibn Khaldun: 188*)* when he besieged the town of Si-

jilmasa, on the desert fringes in North Africa, in the year 1273AD.

3- In 1340AD, the historian Fadl Allah al-'Umari described the cannon that were used in the attack of walled cities in his handbook for government officials: "They throw balls that batter the tops of parapets and break the columns of arches"('Umari 1894: 208).

4- The historian Salih ibn Yahya (1342AD) mentions that "the besieged people in al-Karak mounted on its walls together with five trebuchets" (Ibn Yahya 1969: 105).

5- It is also reported that in 1352AD the governor of Damascus fortified the citadel by mounting gunpowder cannon upon it (Ibn Yahya 1969: 105).

6- Ibn Mankali, in one of his military reports of the Crusades, written sometime between 1362 and 1370AD, wrote: "If the Franks who are facing us are cavalry then we shoot at them with incendiary arrows and cannon since their horses will be frightened away and when their mobilization is in disarray then they will be chased" (Ibn Mankali 1988: 19).

7- In 1365AD, al-Qalqashandi described the siege engines then in use in his encyclopedia *Subh al-A'sha*. Concerning cannon, he writes: "Among them (i.e. the siege engines) is the gunpowder cannon (*makahil al-barud*). These are the cannon (*madafi'*) that use gunpowder. They are of different types. Some throw iron balls weighing from ten Egyptian *Raṭl*(s) (about 4.53kg.) up to more than one hundred (45.3kg.)". He also reported that "I saw in Alexandria during the Ashrafiyya State, (of Sultan) Sha'ban bin Husayn, when Prince Salah al-Din bin 'Arram, God have mercy on him, was governor, I saw a cannon made of copper and lead and bound by iron ends. A huge heated iron ball was projected from it in the *maydan* (parade square or hippodrome), and it fell into the Silsila Sea outside Bab al-Bahr (Sea Gate), which is a faraway distance" (al-Qalqashandi 1963: 144-145).

8- The St Petersburgh Manuscript, which is attributed to Shams al-Din Muhammad al-Ansari al-Dimashqi, who died in 1327, is well known. In this manuscript a cannon is described thus: "Description of the drug (*dawā'*) that you put in the cannon (*midfa'*) — its composition (*'iyāruhu*) is potassium nitrate (*bārūd*) ten, charcoal (*faḥm*) two dirhams and sulphur (*kibrīt*) one and a half dirhams. Grind it finely and fill one third of the cannon (*midfa'*). Do not fill more otherwise it will split. Then let the wood turner make a wooden plug (*midfa'*) of the same size as the mouth of the cannon (*midfa'*). Ram (the gunpowder) tightly and place on it the ball (*bunduqa*) or the arrow, and give it fire at the ammunition (*al-dhakhira*). Measure the cannon (*midfa'*) at the hole; if it (i.e. the *midfa'*) is deeper than the hole then it is defective and it will punch the gunner (*al-rami*), so understand this" (St Petersburgh ms.1963: 160).

9- It is said that many cannon cast in Egypt and inscribed with the names and titles of Mamluk kings, including Qayetbay (1492 AD) and al-Ghouri (1501 AD), are displayed at the Topkapi Palace Museum in Istanbul because they were taken there from Egypt by Ottoman forces after they defeated the Mamluks (Abu Ghaneemah 1983: 245).

10- It is said that al-Ashraf Qayetbay established a cannon force to defend the Egyptian borders and fortifications, especially at the Alexandria and Rashid fortresses. His son Mohamad devoted further attention to this type of weapon (Abu Ghaneemah 1983: 245).

Where Does the Cannon of 'Ammān Fit?

Two parallels for the Mamluk cannon can be considered. First, the bronze cannon reported by al-Qalqashandi in 1365 AD and, second, the cannon cast in Egypt and inscribed with the names and titles of Mamluk kings, including Qayetbay (1492 AD) and al-Ghouri (1501 AD), which are displayed at the Topkapi Palace Museum in Istanbul.

In this case, our cannon is known to be cast in bronze alloy and inscribed with name and title of the Mamluk king who ordered its manufacture in the middle of the 15th century. It therefore predates the Qayetbay and al-Ghouri cannon described above.

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