Kate Raphael
The Hebrew University of Jerusalem
Yotam Tepper
Tel Aviv University

The Archaeological Evidence from the Mamluk Siege of Arsūf

During the past five seasons of excavations at the Crusader fortress of Arsūf, over a thousand arrowheads were found along with close to three thousand catapult stones. It is important to note that those numbers will change once the excavation of the moat is completed. The aim of this article is to map the distribution of the arrowheads and catapult stones, and try to determine the location of the Mamluk siege machines and archers that were employed throughout the battle. We shall also discuss some of the problems that Baybars encountered and solved while preparing his siege engines.

Each arrowhead and catapult stone was marked on the map of the site according to where it was found. Due to rain and landslides the original location may have shifted somewhat, so the locations given here are approximate.

As we were mapping out the location of each arrowhead and catapult stone on the map of the fortress of Arsūf, the full scale of the final stage of the Mamluk siege slowly became clear. One can easily imagine the force of the attack, the heavy bombardment and the horrifying sound of *majānīq* stones continually thundering and crashing down on the citadel during the final three days after the city itself had been taken; there would have been scarcely a place within the walls of the citadel that was safe or protected.

1243 Arrowheads and 2748 Catapult Stones

The arrowheads are all of the same design. Made of iron, their average length was 4.5 cm and their width approximately 1 cm. In cross section they are square or diamond shaped. The shaft was secured to the arrowhead with a tang that was driven deep into the wood (Fig. 1). Similar arrowheads were found on various Crusader and Mamluk sites: Montfort (al-Qurayn), Chastel Pèlerin (‘Athlīth), Yoqne’am, Safed, Burj al-Aḥmar, Ḥamāh, Vadum Jacob (Bayt al-Maḥāzin), and Belvoir (Kawkab al-Hawā’).[1] This design seems to have been dominant throughout

[1]D. Bashford, ″A Crusader Fortress in Palestine,″ *The Bulletin of the Metropolitan Museum of Art*, Sept. 1927, pt. 2, Fig. 53:N; C. N. Johns, ″Excavations at Pilgrims Castle ‘Atlit (1932–3):

the twelfth and thirteenth centuries. From the evidence gathered so far, they were used by both Frankish and Muslim archers.[2] They were designed to penetrate armor, and once imbedded in the flesh, pulling them out became a tricky maneuver, since the shaft was more than likely to break, leaving the arrowhead buried deep inside the flesh. The shafts were made out of pine or cedar.[3] Only five arrowheads differ from those described above. Those five are kite shaped and flat (Fig. 2). They were often used for hunting game or for wounding horses in times of battle.[4] Although the Mamluk archers played an important part in the siege, the main role belonged to the teams that operated the siege machines, and the engineers who assembled them. The masons who quarried the stone saw that the weights matched the required order and shaped the stones into suitable projectiles.

Arsūf has so far been the only site within the boundaries of the Crusader kingdom that has yielded such a large number of trebuchet stones. Although many sieges were recorded by both Latin and Muslim sources, very few sites have supplied the archaeological evidence to support the historical sources. While some sites have not yet been excavated, others have simply been resettled and the archaeological evidence lost or scattered. Much has been written on siege warfare in the Latin East, the invention and development of siege engines, and the changes that followed in the field of military architecture. Most of those works rely on the examination of historical sources, some on experimental archaeology, but very few have gathered evidence from the actual fortresses, towns, or cities where those sieges occurred.[5] The importance of Arsūf lies in the fact that in addition to

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Stables at South West Suburb,″ *Quarterly of the Department of Antiquities of Palestine* 5 (1936), fig. 15:2; A. Khamis, ″Chapter 18: The Metal Objects,″ in *Yoqne'am: The Later Periods* (=*Qedem Reports* 3), ed. A. Ben Tor, M. Avisar, and Y. Portugali (Jerusalem, 1996), photo. xviii.4, No. 6; E. Damati, ″Safed Citadel,″ in *Excavations and Survey in Israel 1988–89*, 7–8 (Jerusalem 1988–89),159–60; D. Pringle, *The Red Tower (al-Burj al-Ahmar): Settlement in the Plain of Sharon at the Time of the Crusaders and Mamluks A.D. 1099–1516* (London 1986), fig. 57:21, 22; G. Ploug et al., *Hama, 1932–1938 IV3* (Copenhagen, 1969), fig. 21:1; K. Raphael, ″Archers in the Crusader Period,″ M.A thesis, Hebrew University, 2001; M. Ben Dov, ″Crusader Fortresses in Eretz Israel,″ in *Qadmoniot* 32 (=vol. 8, no. 4) (1975), 102–14 (in Hebrew).

[2]Raphael, ″Archers in the Crusader Period,″ 103–16.

[3]The botanical research was done by Dr. Nili Lifshitz from Tel Aviv University. Among the shafts that were examined there was also a type of coniferous wood that could not be identified with certainty.

[4]W. Swietoslawski, *Arms and Armour of the Nomads of the Great Steppe in the Times of the Mongol Expansion,* trans. M. Abramowicz (Lodz, 1999), 131, plate XIX:4–6.

[5]Christopher Marshall, *Warfare in the Latin East, 1191–1291* (Cambridge, 1996), 212–14; J. Bradbury, *The Medieval Siege* (Suffolk, 1992); P. Chevedden, ″Artillery in Late Antiquity,″ in *The Medieval City under Siege,* ed. I. A. Corfis and M. Wolf (Woodbridge, 1995), 131–73; P. Chevedden, ″Fortifications and the Development of Defensive Planning during the Crusader Period,″ in *The*

the historical references, we can map and analyze the catapult stones and arrowheads that have been left as testimony to the Mamluk siege that took place in the spring of 1265.

Out of the 2747 catapult stones that were found, 800 were measured and weighed (Chart 1). While working on the typology, we noticed that the catapult stones that were found to the north of the gate, among a pile of burnt cedar logs, were larger in diameter and heavier than the stones that were collected from the main area within the citadel walls (Map 1). It is more than likely that the siege engine, which dealt with the Frankish defenders who evidently took refuge under the wooden construction, was of a different type and was capable of hurling stones of greater diameter and weight. The prevalent weights of the catapult stones that were found in the area of the burnt cedar logs were 16 kg, 20 kg, 28 kg, and 35 kg (Chart 2).

Although the majority of catapult stones are carved out of limestone, they vary a great deal in weight, diameter, shape, and quality of the stone dressing. The table below gives the dominant weights and diameters among the catapult stones that were found within the fortress walls.

WEIGHTS AND DIAMETERS OF THE CATAPULT STONES IN ARSŪF

Weight (kg)	Diameter (cm)
8	20
10–11	21–23
16	25
20	27–28
28	30
35	31
40	33–34
41–42	35–37
48	40

The heaviest catapult stone reached 78 kg, but altogether only 11 catapult stones weighed over 70 kg. The lowest weights recorded are 1–3 kg. Almost 50 stones weighed less than 3 kg.[6] While the majority are carved, some are more like huge pebbles (Fig. 3), and appear to have been gathered from the mouth of a riverbed at

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Circle of War in the Middle Ages: Essays on Medieval Military and Naval History, ed. D. J. Kagay and A. J. A. Villalon (Suffolk, 1999), 33–43; K. DeVries, *Medieval Military Technology* (Peterborough, Canada, 1998), 133–40; Swietoslawski, *Arms and Armour,* 70–71.

[6]Some of those stones may have broken and therefore these figures may not represent the original weight.

the foot of the Samarian hills to the east of Arsūf.[7] Among the catapult stones that are dressed, a small percentage has an almost perfect round shape (Fig. 4); most are roughly round and dressed in a coarse manner. Very few are just large stones that have not been dressed and simply left with jagged rough edges (Fig. 5). Five catapult stones were carved out of a marble Roman-Byzantine column (Fig. 6). Two are from flint, and four from kurkar (calcareous sandstone, found along the coast of Israel), which would have left very little impact on the fortress walls.

One of the problems Baybars encountered while laying out the plan and setting up the logistics for the siege of Arsūf would have been finding a nearby quarry that could supply the stone for the making of stone projectiles. The cliffs overlooking the sea are made of kurkar, which was used for the construction of the fortress, but is not quite suitable for the making of catapult stones. Prior to the beginning of the siege and possibly while the fighting was taking place, a group of masons were busy preparing catapult stones at nearby quarries. The stones were probably then loaded on large wagons that were sent off to the Mamluk siege camp. As noted above, the source of the limestone has been identified at the foot of the nearby Samarian hills which lay approximately 15 km to the east of Arsūf.

In order to try to calculate the location of the Mamluk archers and siege machines, each arrowhead and catapult stone was marked on the map of the fortress. Both maps show a similar distribution. The majority of the arrowheads, 812 (65%), were found between the two towers of the main gate (Map 1). This correlates with 1112 (40%) catapult stones that were gathered from around and between the walls of the gate (Map 2). The majority of the catapult stones in the region of the main gate fell somewhat closer to the northeastern gate tower. This may indicate that a siege machine was stationed almost opposite, at an angle of fire that gave a clear view and turned the northern gate tower into a relatively easy target. On the other hand, the southern gate tower yielded less than 75 catapult stones. The front wall of the southern tower is slightly damaged on the side facing the northeast (Fig. 7), giving a clear idea of the angle of fire. As noted above, one of the larger or stronger siege engines was positioned directly in front of the wooden construction. The markings left on the southeastern peripheral wall (Fig. 7) indicate that at least one of the siege engines must have been carried through the town after it fell and stationed on the southeast edge of the fortress moat.

[7]According to the geological survey conducted by Ram Ben-David.

In an analysis of the siege given by Meron Benvenisti it is proposed that Baybars opened his attack from the south.[8] This view seems quite unlikely, as the distribution of catapult stones is mainly in the northern section of the fortress.[9]

The land to the north and the northeast of the fortress is slightly elevated, so that the Mamluk siege engines may have gained sufficient advantage, until the city wall was breached. It seems, though, that the Mamluk force concentrated most of its efforts opposite the main gate. From the archaeological evidence it appears that a fierce attack was carried out by both siege engines and a strong group of archers that was stationed almost opposite the gate. The following description may indicate that a great crossbow was used in the attempt to break through the main gate.

Among the arrowheads that were found between the gate towers was a huge bolt made of iron (Fig. 8a–b).[10] While cleaning the bolt under a magnifying glass strands of rope could be seen. The rope had been tightly tied around the bolt and one of the knots is still quite visible.[11] The size and weight of the bolt present the possibility that it was shot out of a large crossbow that was probably mounted on a wooden frame. As the bolt is covered with burnt fragments of wood it is possible that it served as a torch and the rope secured a thick piece of cloth that was lit and aimed at the wooden doors that secured the main entrance to the fortress.

The southwest corner of the fortress yielded 187 arrowheads. There are a number of explanations that may be given in order to understand this scattered distribution. It could indicate that those arrows were shot once the fortress was entered and close combat took place within the fortress walls. Or, they may have been shot by a group of archers that made its way through the city and stood south of the fortress moat.

When it comes to establishing the type of siege engines that Baybars used, the task becomes rather difficult. Although the weight of the catapult stones varies a great deal, most stones could be lifted by one man, while the heavier stones required two people, who could handle each stone without much strain. This does not fit the descriptions of weights given by some of the Latin and Muslim chronicles and the modern historians that have dealt with the subject of early medieval siege warfare.

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[8]M. Benvenisti, *The Crusaders in the Holy Land* (Jerusalem, 1976), 133. It is not clear if this refers to the attack on the town or the fortress.

[9]For the development of the siege, see the article by R. Amitai in this volume.

[10]With it were two fragments that seem to belong to bolts of a similar size and design.

[11]We would like to thank Mimi Lavi, who heads the conservation laboratory in the Institute of Archaeology of the Hebrew University, for pointing out this incredible find to us.

Paul Chevedden states that the hybrid trebuchet that the Franks operated during the siege of Damietta launched projectiles that weighed 185 kg. The counterweight trebuchet launched projectiles that probably reached a common maximum of 300 kg, while the counterweight trebuchet used at the siege of Ḥimṣ (1248–49) threw projectiles weighing 259 kg. At the siege of Acre (1291) the large Frankish trebuchet employed by the Mamluks threw stone projectiles that weighed 185 kg. The only weights that are close to those measured in Arsūf are the weights of stone projectiles from Qal'at Sahyūn,[12] and even those are heaver than the average weight found in Arsūf. Donald P. Little quotes al-Yūnīnī, who reports—evidently on the authority of an eyewitness at the siege of Acre—that the Frankish mangonels employed by the Mamluks could fire a shot of 45 kg and more.[13] Christopher Marshall quotes a modern experiment in which a model of a counterweight trebuchet hurled stone projectiles that weighed 100 to 150 kg to a distance of 150 m.[14] The siege engines used by Baybars at Arsūf were probably not quite as powerful as those described above. Very few of the stone projectiles that were found at Arsūf reach those weights. The majority weigh well under 45 kg. And yet the damage that those siege engines caused was encountered throughout the excavation.

There are still quite a few enigmas left. No evidence has been found of the Mamluk sappers´ tunnels described by Ibn 'Abd al-Ẓāhir. There are very few clues as to the methods the Hospitaller garrison used in order to defend the fortress. Could they have possibly mounted artillery on the citadel´s towers or roofs? And what was the exact nature of the wooden construction, the pile of burnt cedar logs on the northeastern side of the citadel? We may find some of the answers to those questions as the excavation continues in the grounds around the fortress and once the moat is cleared.

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[12]Chevedden, ″Fortifications and the Development of Defensive Planning ,″ 37–38.

[13]D. P. Little, ″The Fall of Akkā in 690/1291: The Muslim Version,″ in *Studies in Islamic History and Civilization in Honour of Professor David Ayalon,* ed. M. Sharon (Jerusalem, 1986), 171, citing Quṭb al-Dīn al-Yūnīnī, in A. Melkonian, *Die Jahre 1287–1291 in der Chronik al-Yūnīnīs* (Freiburg, 1975), 86.

[14]Marshall, *Warfare in the Latin East,* 213.

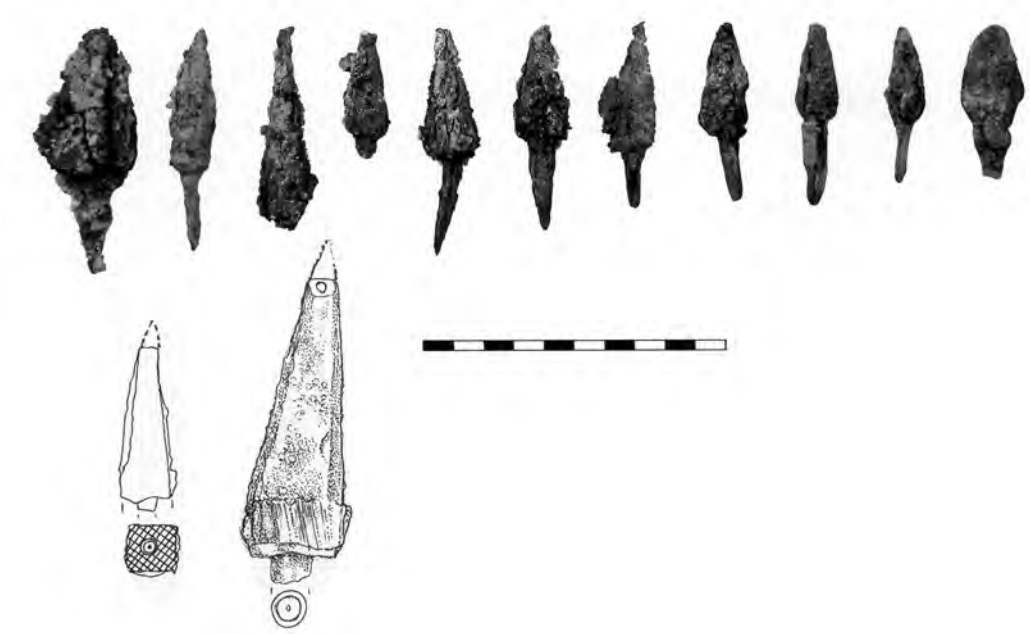


Figure 1. Arrowheads made to penetrate armor (photograph: Yotam Tepper).

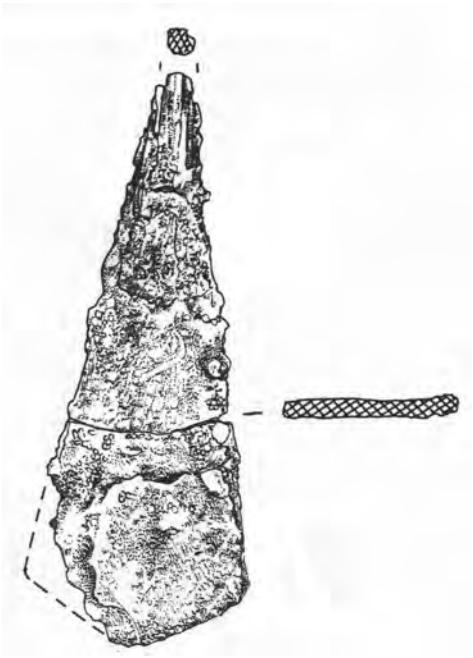


Figure 2. Arrowheads meant to wound horses.

Figure 3. On the right, a large pebble. On the left, a catapult stone that had been dressed (photograph: Yotam Tepper).

Figure 4. Well-dressed catapult stones (photograph: Yotam Tepper).

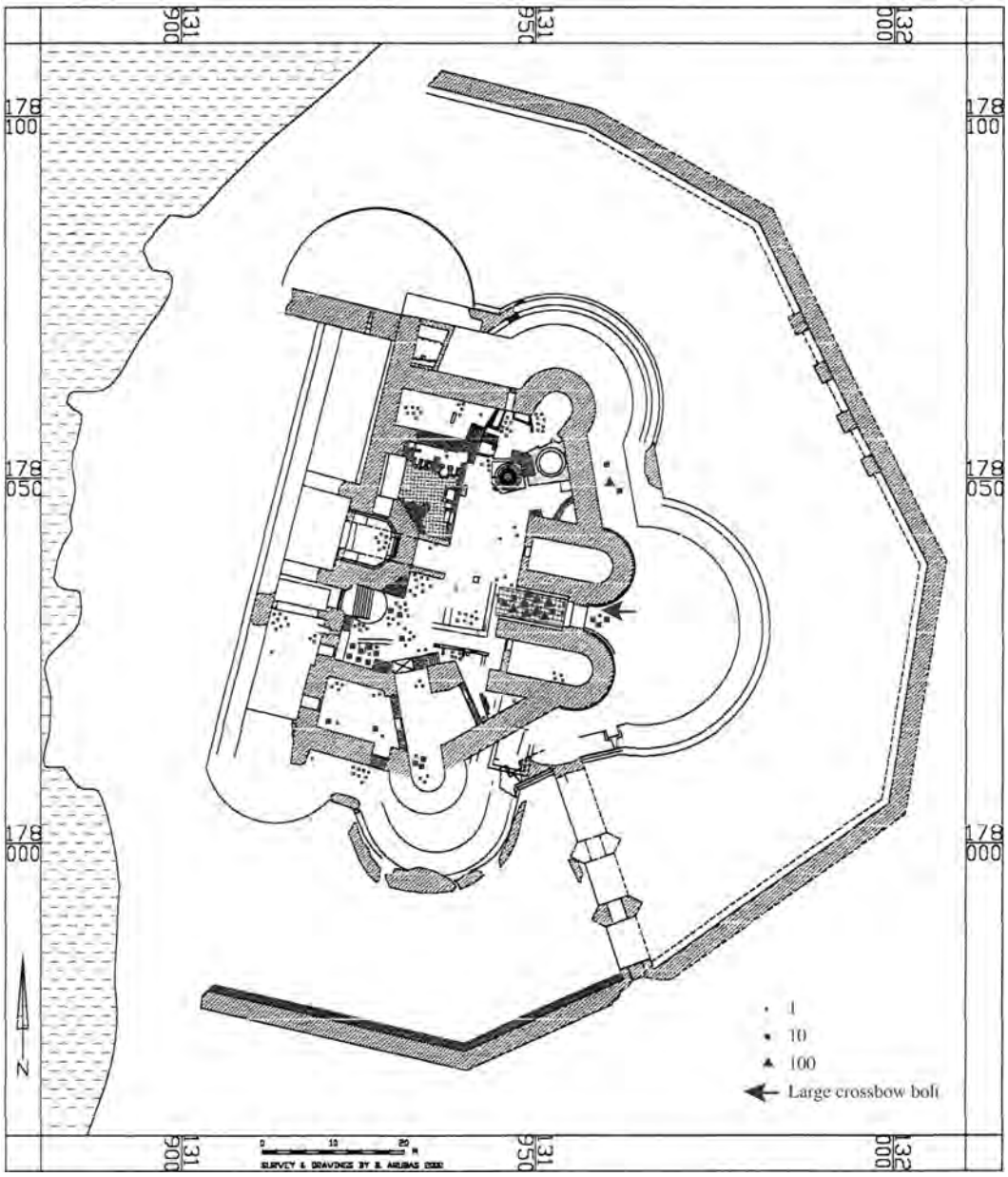
Figure 5. Far right: a catapult stone that has not been dressed and simply left with rough edges (photograph: Yotam Tepper).

Figure 6. A catapult stone cut out of a Roman marble column (photograph: Yotam Tepper).

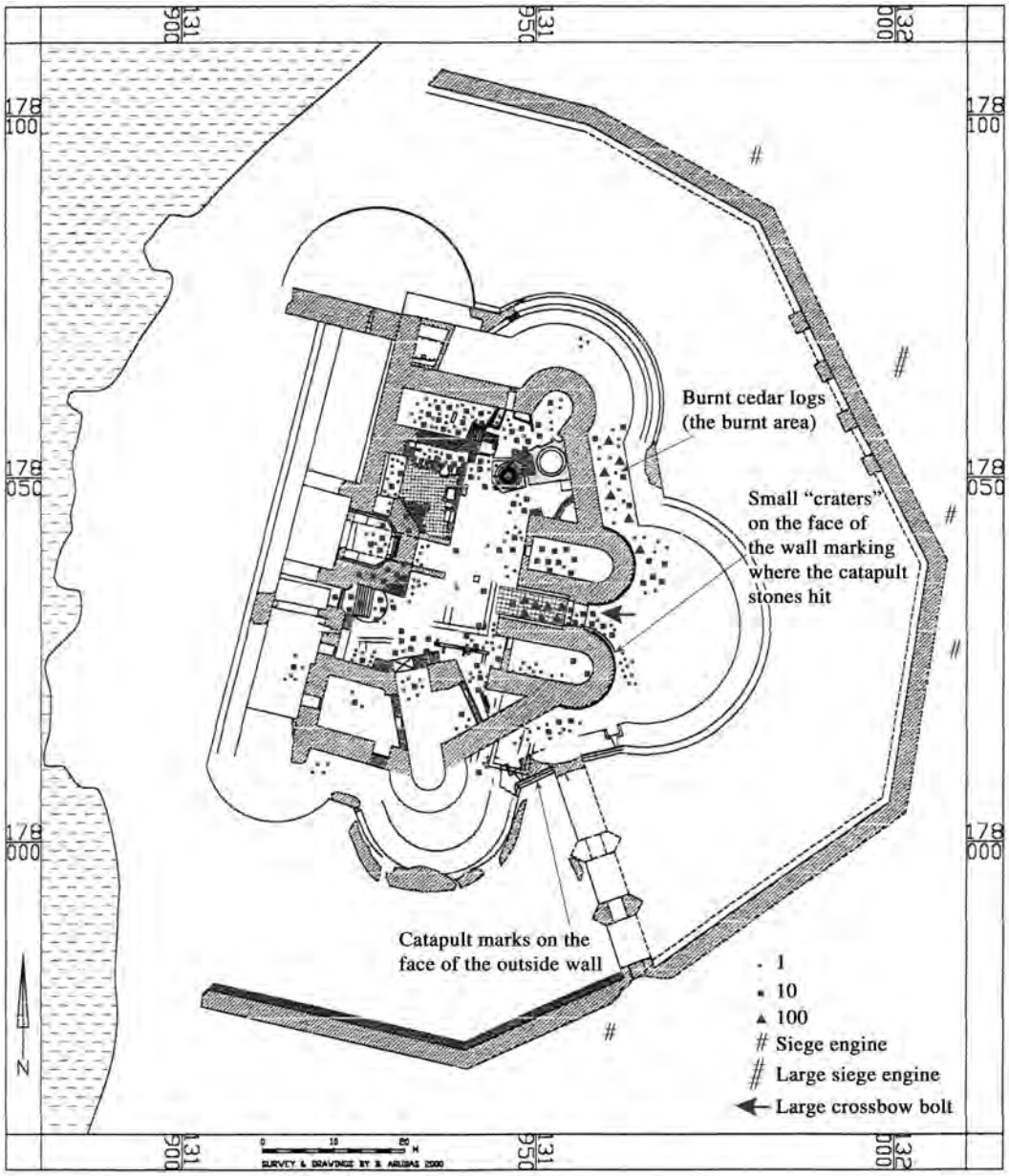
Figure 7. "Craters" from direct catapult hits on the face of the southern gate tower (photograph: Yotam Tepper).

Figure 8A. Iron crossbow bolt (photograph: Gabi Laron).

Figures 8B and 8C. Close-ups of the iron crossbow bolt, remains of rope tightly tied round the bolt (photograph: Gabi Laron).



Map 1. Distribution of arrowheads.



Map 2. Distribution of catapult stones.

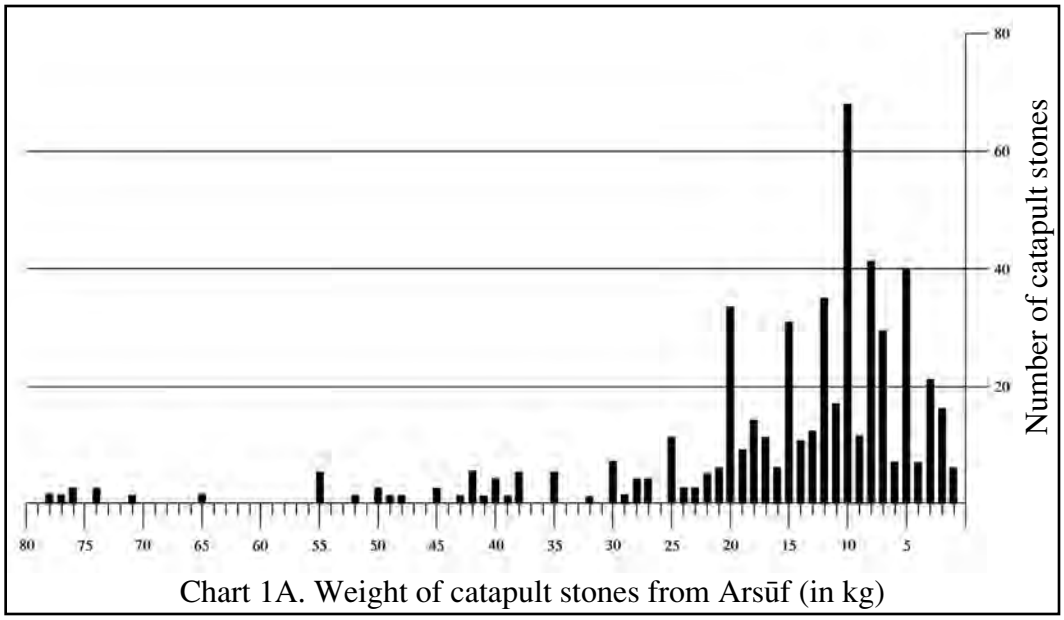


Chart 1A. Weight of catapult stones from Arsūf (in kg)

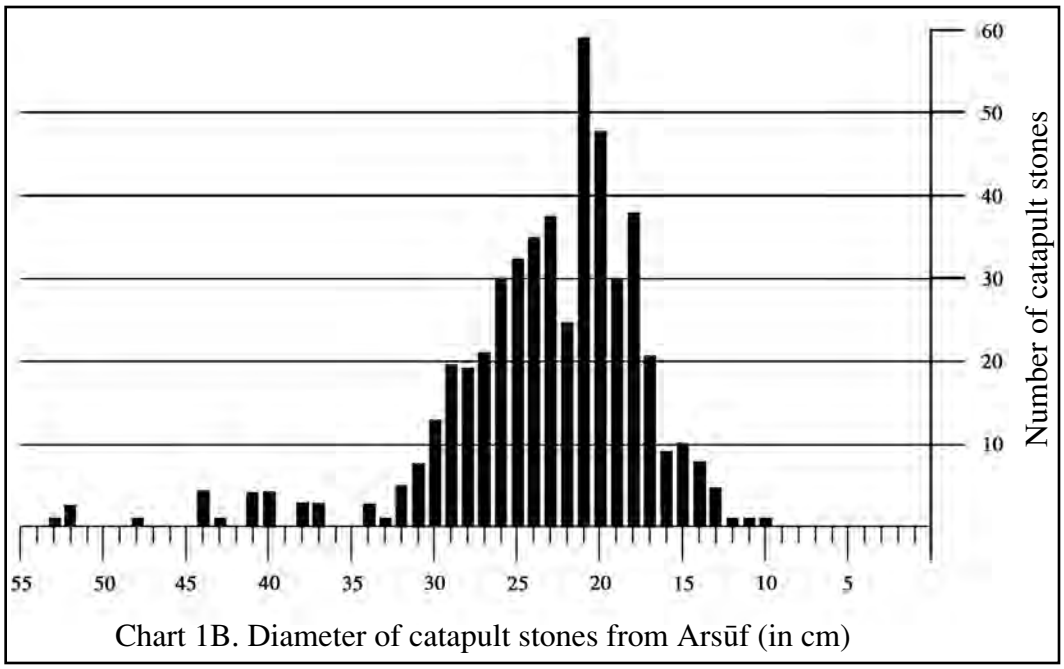


Chart 1B. Diameter of catapult stones from Arsūf (in cm)

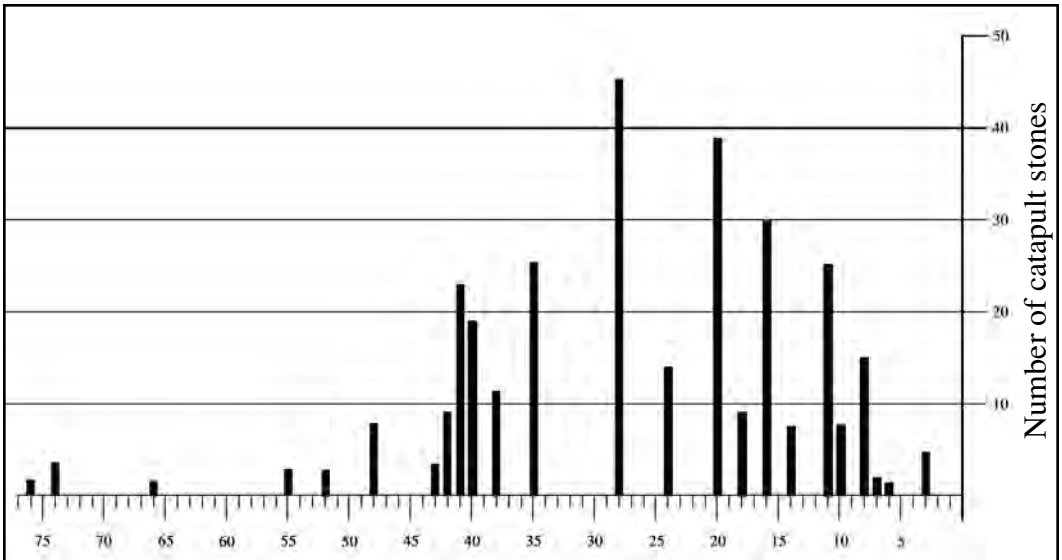


Chart 2A. Weight of catapult stones from the burnt area (in kg)

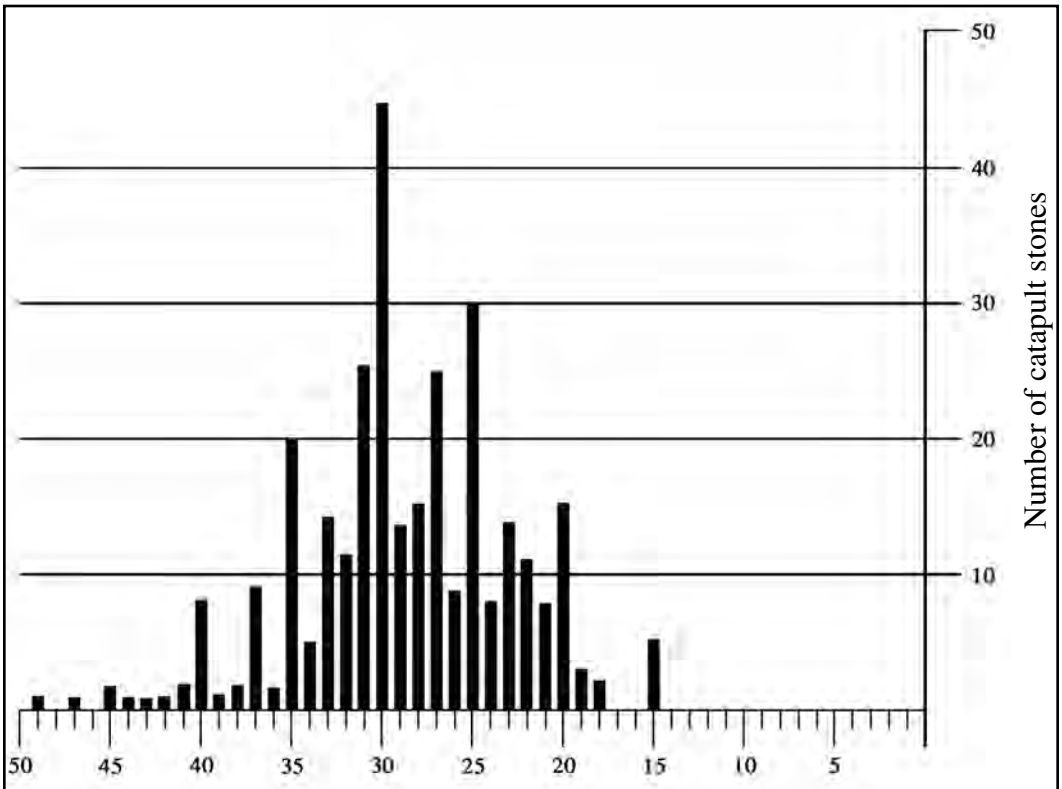


Chart 2B. Diameter of catapult stones from the burnt area (in kg)