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Crusader, Ayyubid and Early Mamluk Shawbak and the History of Medieval South Jordan: The Archaeology and Restoration of the Mamluk Workshop

Crusader, Ayyubid and Early Mamluk Shawbak (GV)

The battle of Ḥiṭṭīn on 4 July 1187 marked the end of an era for Jerusalem and the Jordan valley, especially in our area of interest between the Dead Sea and Red Sea (FIG. 1). Nevertheless, using new technology (FIG. 2), the mediaeval history of southern Transjordan has emerged as one of the most significant architectural and archaeological areas in the eastern Mediterranean. Research by the University of Florence has demonstrated that the castle of Shawbak was the key to a historic frontier, centred on the valley of Petra, which has been brought to light after centuries of obscurity. The role of this border was constantly reinterpreted according to changing local dynamics during the Ayyubid and early Mamluk periods. It is now clear that this entire region shared a common Mediterranean heritage during the 12th to 14th centuries and beyond[1] (FIG. 3).

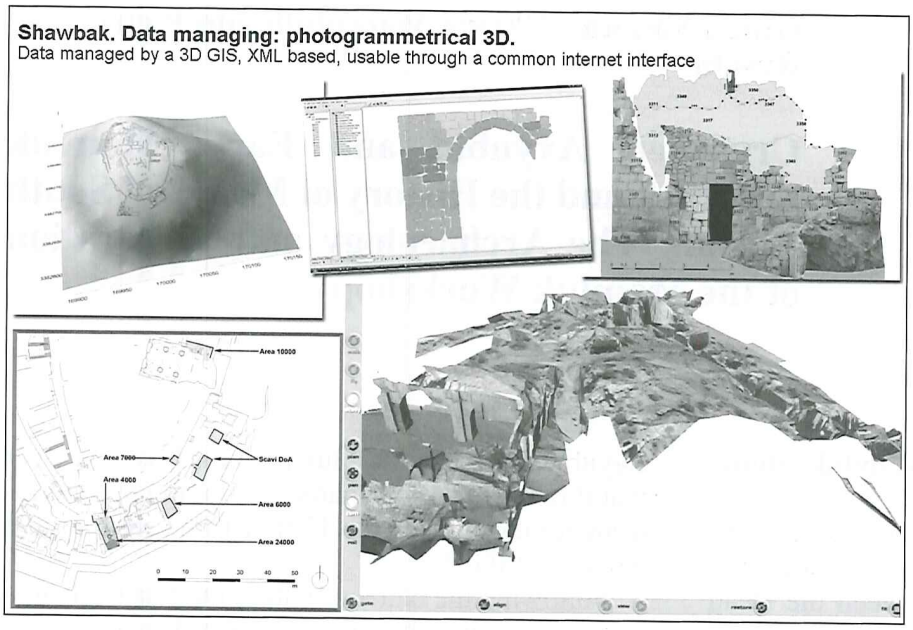
Following the battle of Ḥiṭṭīn, the Shawbak area was freed of its hitherto 'marginal' role and thus acquired a new historical identity. This is well-illustrated by the continuation of independent administrative and military functions at Shawbak (which emerged as the centre of a new 'imperial' Islamic entity in the region) and Karak into the Ayyubid period and beyond. The site of Shawbak, in particular, controlled water sources, fertile land on the desert margins and the great military, commercial and pilgrim roads (FIG. 4)[2].

When Baldwin I hastily erected *Crac de Mon-*

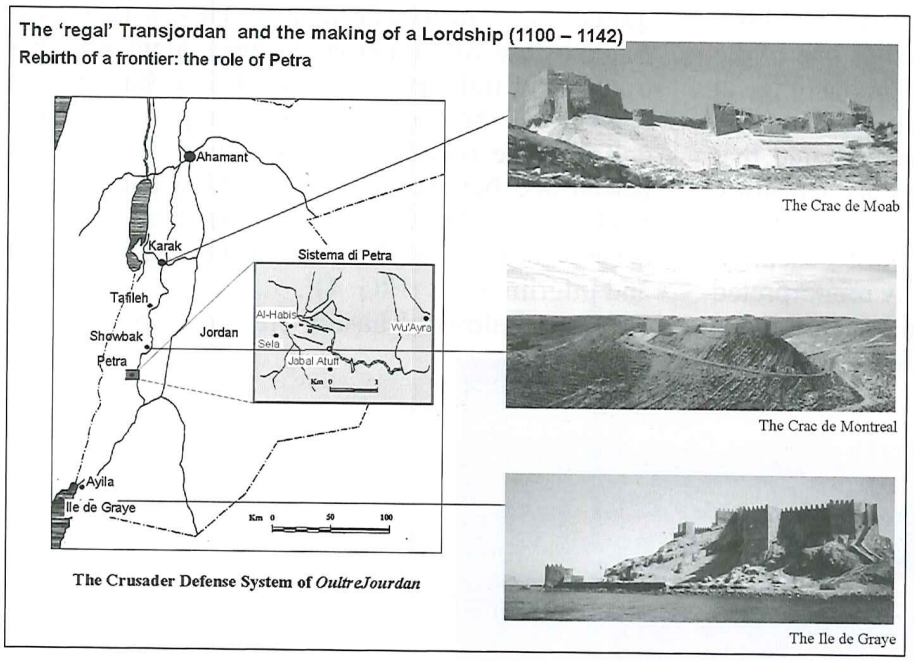
1. Ḥiṭṭīn in 21st century imagination.

[1] For an updated summary of the 'Medieval Petra: Archeology of the Crusader - Ayyubid settlement in Transjordan' project see Vannini 2011b.

[2] An updated study (especially of the written sources) of the political and economic situation in the region during the Ayyubid period is in Milwright 2008 (29-41, 54-77); however, this confirms the traditional view that Karak was the capital of the region.



2. GIS based on 3D photogrammetry.

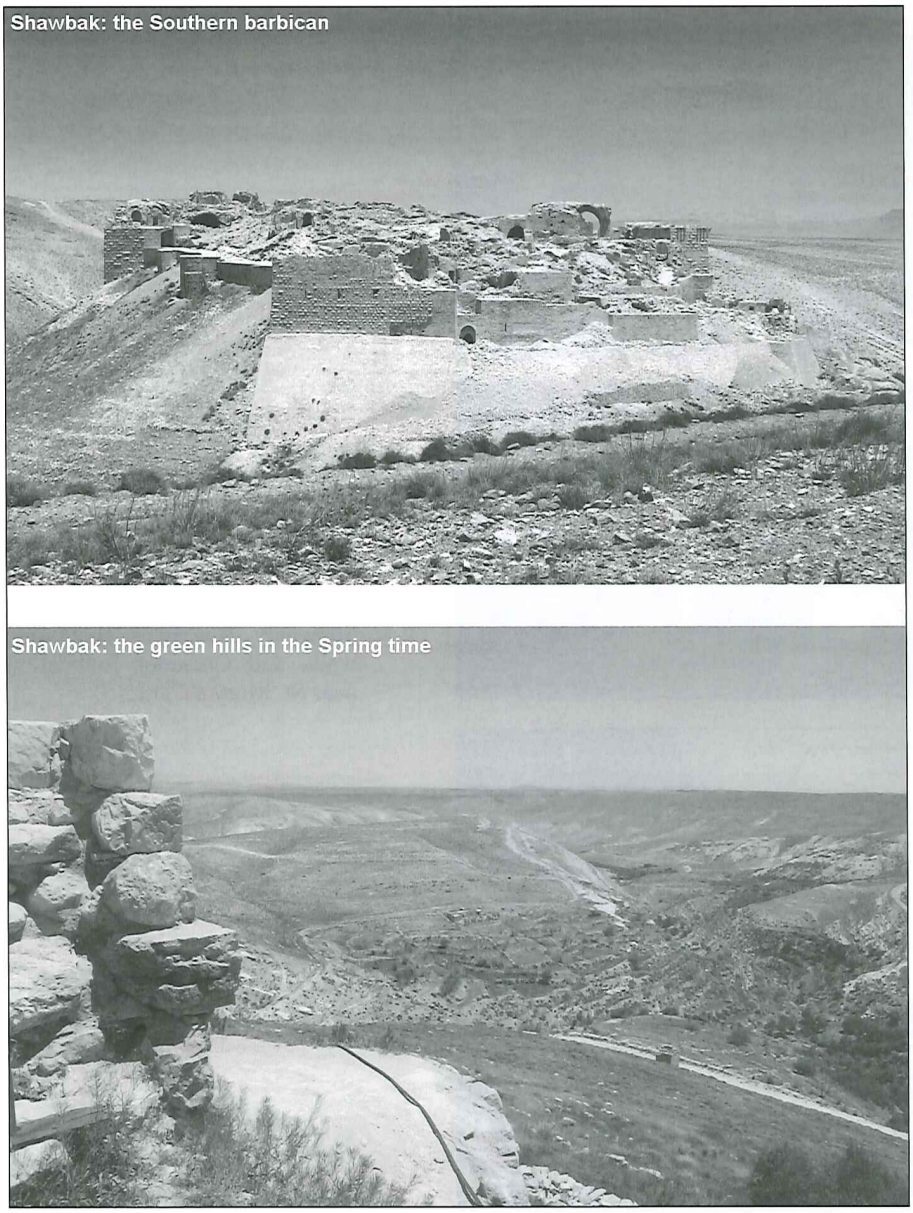


3. Archaeological history of the Mediterranean region.

tréal at Shawbak in AD 1115, he was re-establishing an ancient – though long-abandoned – fortified monumental site that was once part of the Roman - Byzantine *limes Arabicus* (FIG. 5)[3]. This act resulted in a cultural structure that shaped the whole mediaeval period in this region, rather than just generating ephemeral political success. Surprisingly, this settlement and administrative structure of Latin Transjordan has survived to this day, even though it was restructured in the Ayyubid and early Mamluk periods, with more or less the same boundaries. Indeed, it continued to play a frontier role, this time as part of the Muslim world, between Cairo and Damascus (FIG. 6) (Vannini 2007).

The new Ayyubid 'city' that has recently begun to come to light was well-planned and well-

[3] A useful contribution regarding the *Limes Arabicus* in the Petra and Augustopolis areas is in Parker (1990: 117-143). This will be the subject of a study by Michele Nucciotti who, in the Roman structures at Shawbak (i.e. the ruins upon which the Crusaders built their *castrum*), recognised the remains of the border town of Negla, which controlled the junction where the *Via Nova Traiana* split in the directions of Petra and Udruḥ / Augustopolis.



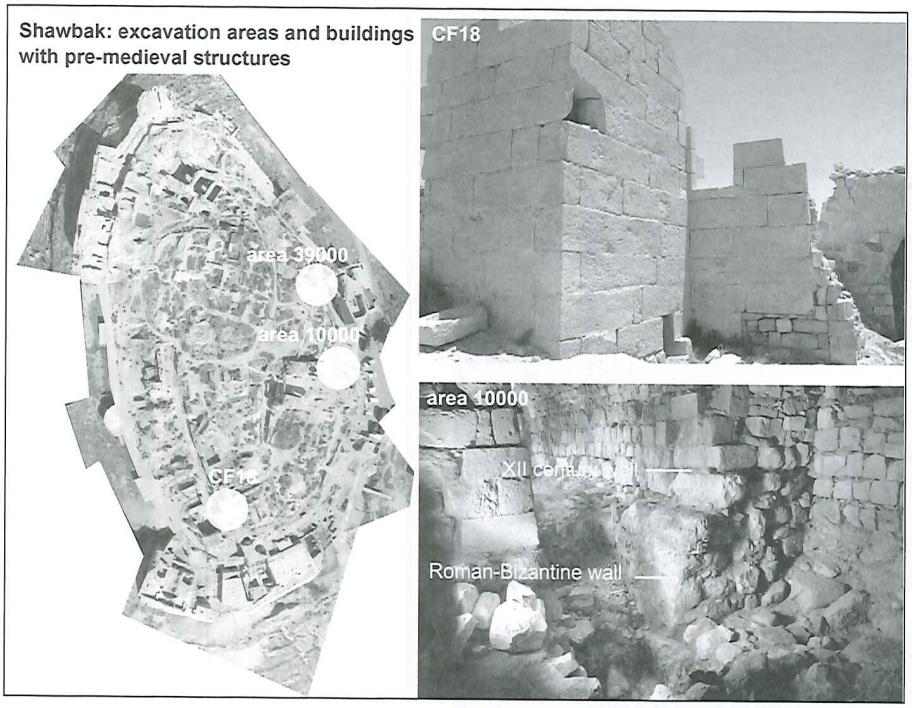
4. Shawbak: view of the southern barbican (above) and control of the desert margins (below).

constructed. The architectural forms and design of Ayyubid Shawbak display clear stratigraphic continuities in relation to the preceding palatial Crusader structures (FIG. 7), whilst being highly innovative at the same time. In particular, the Ayyubid town plan, laid out before the disastrous earthquake of AD 1212 (FIG. 8)[4], includes an urban axis linking the main entrance gate of the first wall (CF3) with the renewed political centre at the far north of the settlement (FIG. 9). This was where the majestic Ayyubid government palace, residence of al-Mu'adham 'Isa (nephew of Salah ad-Din and Sultan of Damascus for 10 years), once stood. With its splendid audience hall, the palace was one of the largest Ayyubid monuments of this type in the Near East (FIG. 10)[5].

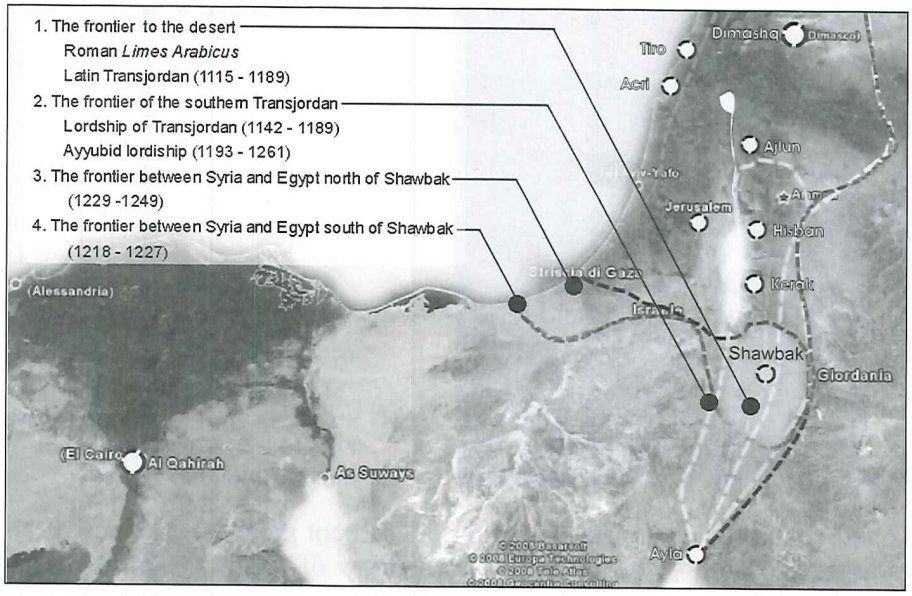
The importance of Shawbak continued until the end of the 14th century, during which time it was progressively divided into functionally specific areas (domestic, manufacturing, military etc.) and

[4] A disastrous earthquake, mentioned in all contemporary eastern and western chronicles, which destroyed many urban centres in the area between Syria and Egypt. The resulting damage, mentioned in the sources relating to Shawbak (Abu Shama and Ibn Shaddad cit. Faucherre 2004: 47-65), has been by confirmed by stratigraphic investigations of the walls (see archaeoseismic analyses in Nucciotti 2007: 36-37).

[5] Various parts of the building were found by Robin Brown in the 80s and later by the Department of Antiquities of Jordan (Brown 1988: 240-242; Nucciotti 2007: 43-45; Vannini 2011a: 159).



5. Shawbak: Roman - Byzantine walls and Crusader foundation near St. Mary's Church.

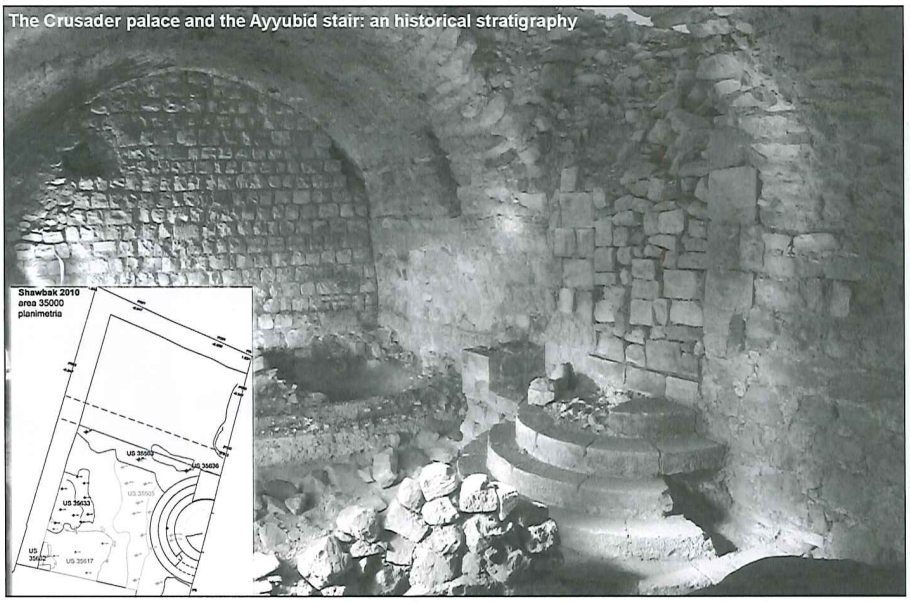


6. Southern Transjordan during the Crusader - Ayyubid period and its 'borders'.

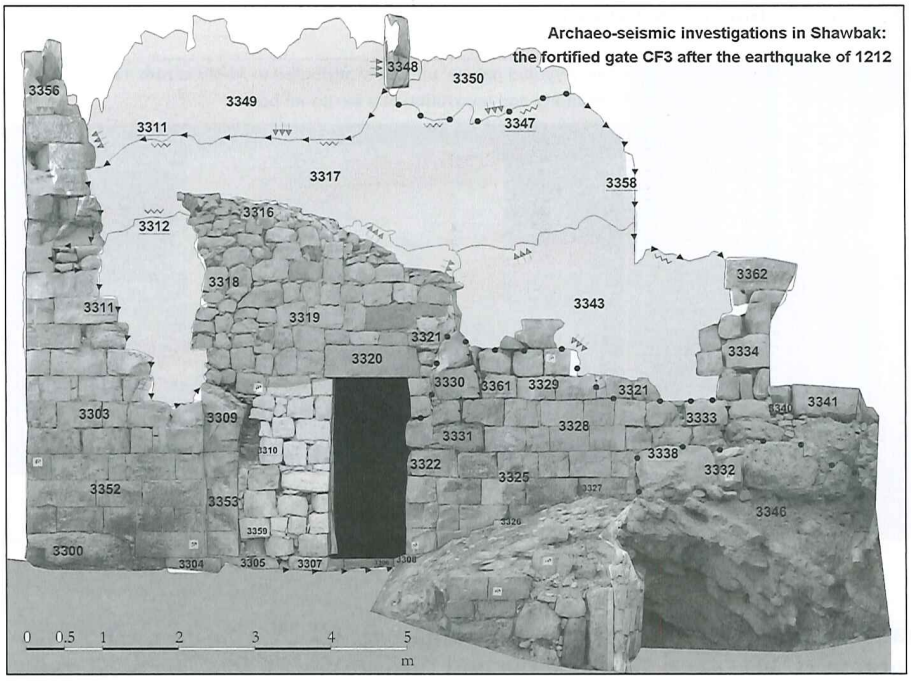
also saw some residential construction (FIG. 11). An extraordinary 'industrial' workshop was created in the Mamluk period between the late 13th and 14th centuries. Situated for the most part in an extension of the old *burgus* of the castle, it was probably a dye-shop. It is an interesting example of industrial archaeology (perhaps the most complete mediaeval dye-shop to be excavated in the Mediterranean region), as well as an explicit indicator of the economic importance achieved by the 'new' Shawbak (FIG. 12)[6]. Production was probably associated with carpets and textiles which, like many other products (e.g. *crancum* sugar of *Montréal*), reached Europe and, along with other agricultural products and handicrafts, brought fame to this ancient frontier land of the eastern Mediterranean[7].

[6] Vannini 2011c; Vannini and Nucciotti 2011; see also Vannini and Nucciotti 2009 and www.frontierarcaeology.eu

[7] A flourishing activity during the Ayyubid period (see Nashef 2011; Milwright 2006: 17, 26), which dated back to the Crusades (Vannini 2005). This topic is currently being investigated by K. Politis (this volume). For a more general view of environmental conditions in the area during the Middle Ages, see Corbino and Mazza (this volume).



7. Crusader palace during excavation; detail of blocked entrance with Ayyubid staircase.



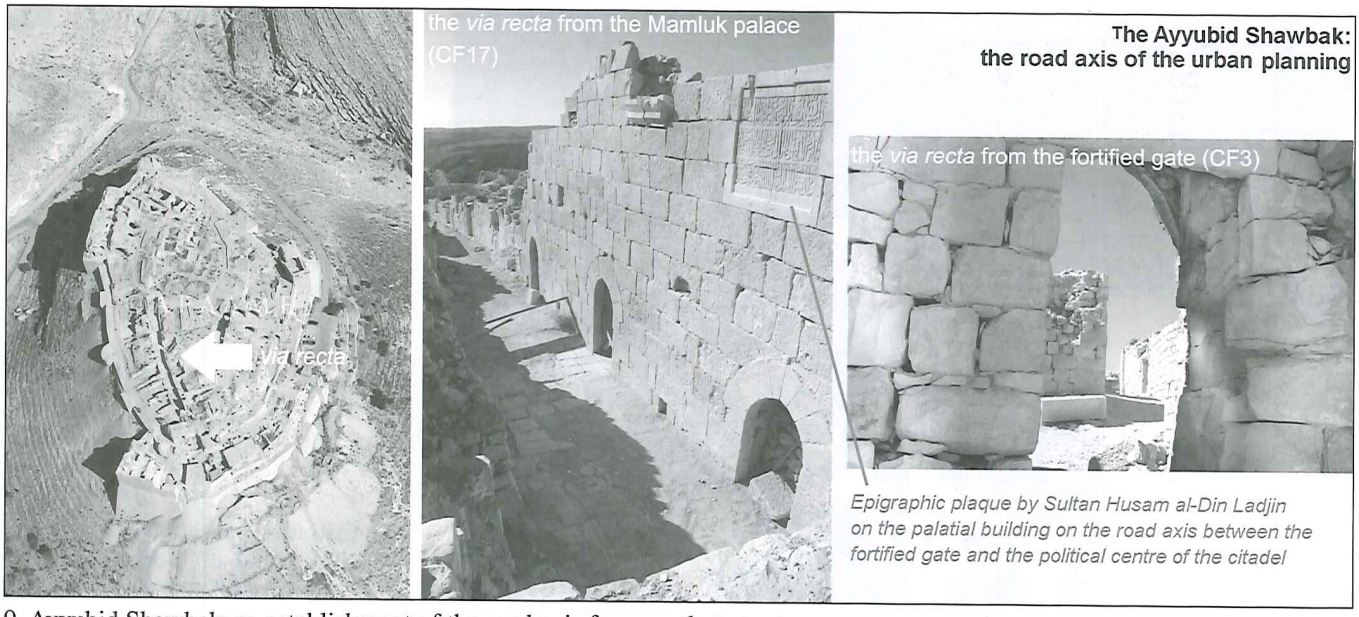
8. Archaeoseismic investigation: reconstruction of fortified gate CF3 following the AD 1212 earthquake (*terminus ante quem* for the establishment of the Ayyubid town; *terminus post quem* is 1189).

The Crusader - Ayyubid 12th and 13th centuries witnessed, as mentioned above, the rebirth of a frontier that was no longer interpreted as a substantially linear military border (cf. the Imperial Roman *limites*), dependent on an efficient central power. Instead, it was more of a territory which, because it had to be locally sustainable, was soon able to forge an identity based on administrative and economic independence. As such it took on a political dimension, in a manner which recalls similar processes in many regions around the Mediterranean and mediaeval Europe[8].

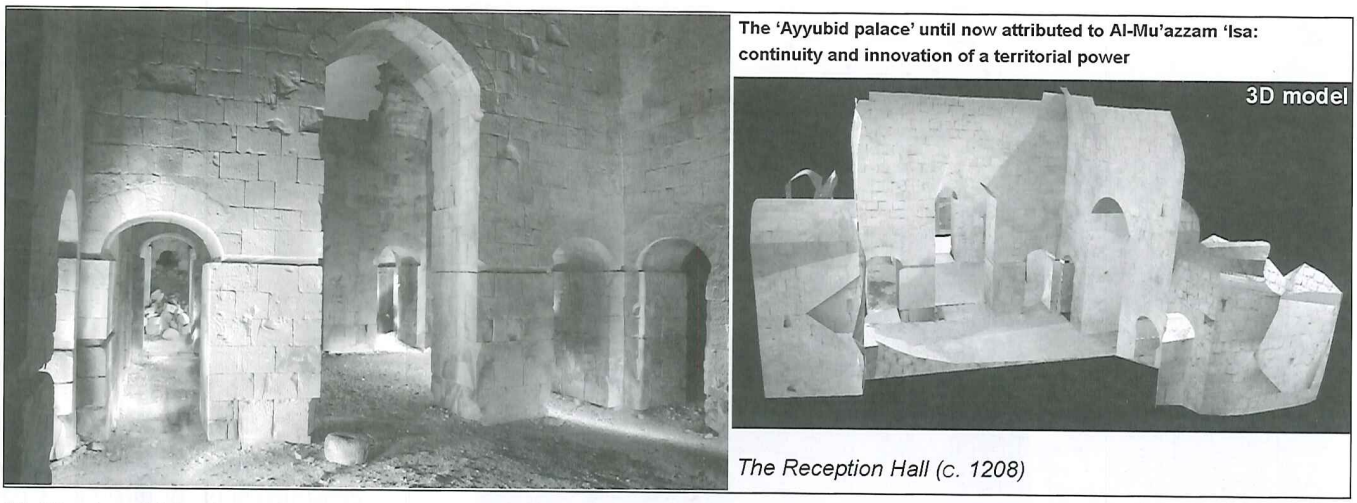
The construction of a sophisticated new Ayyubid 'city' was evidence of Shawbak's importance within the renewed Islamic 'empire', making it the *de facto* mediaeval heir of late Antique Petra. This has now been confirmed by study of written sources, reinterpreted on archaeological basis (FIG. 13)[9].

[8] See Vannini 2011a and 2011c; see also the 'street areas' proposed by Sergi (1996).

[9] Ibn Shaddad wrote: "He (al-Mu'azzam Sharf al-Din 'Isa) fortified and embellished (Shawbak). Trees were planted from countries all over the world, until it equalled Damascus because of its verdant aspect, the abundance of its water and the purity of its air" (quoted by Faucherre 2004: 65).



9. Ayyubid Shawbak: re-establishment of the road axis from castle to town.



10. The Ayyubid palace.

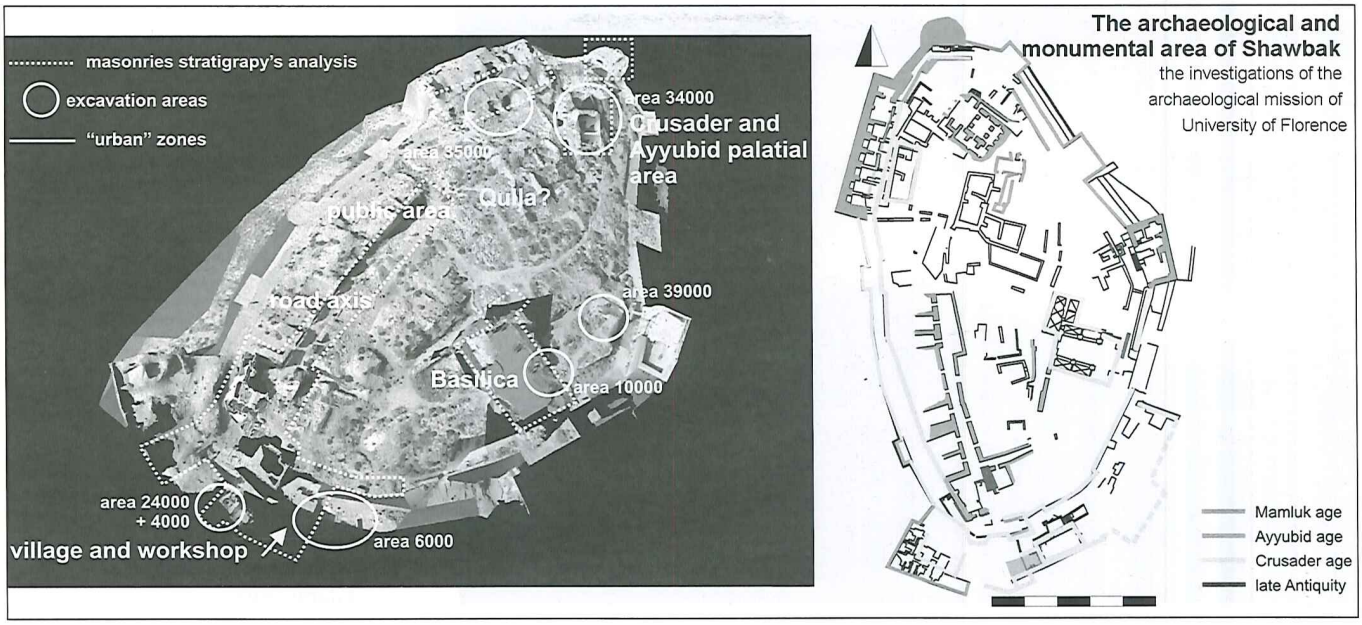
The Mamluk Workshop: an Archaeological Perspective and a Methodological Problem (CM)

When the Italian mission returned to Shawbak in 2002 to start systematic excavations, an unidentified room was visible in front of the lower church, with various basins plastered with *cocciopesto* (Brown 1986: 180-181). New structures, clearly associated with a workshop, have emerged since the first excavation seasons, which were carried out in parallel with restoration work by the Department of Antiquities of Jordan in the same area from 2005 onwards. These structures make up an architectural complex consisting of three rooms in three different buildings, *viz.* CF2[10] (basins), CF32 (cylindrical vat and furnace) and CF24 (furnace room) (FIG. 14).

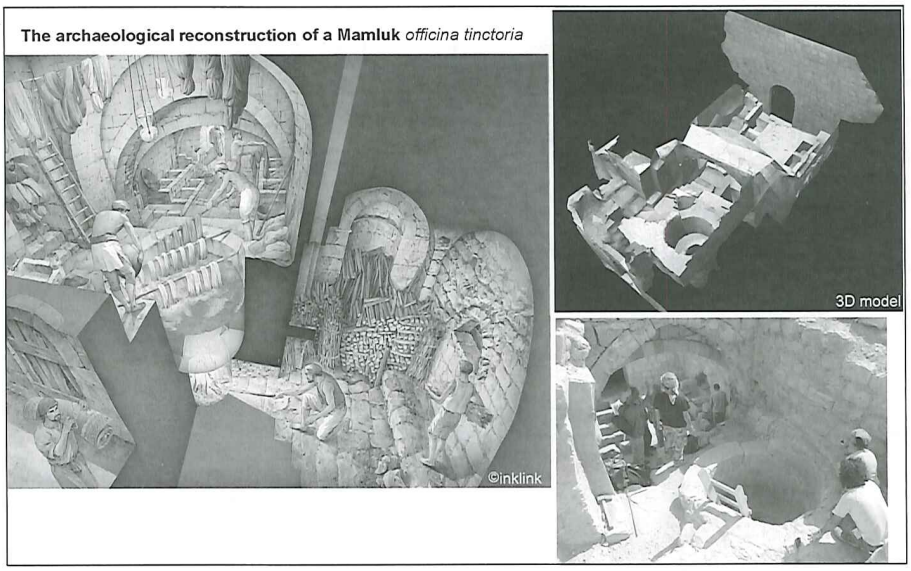
The workshop is located in the village situated south of the 12th century barbican mentioned by William of Tyre (Faucherre 2004: 45; Nucciotti 2007: 27-48), between the second and third curtain walls and next to fortified gate CF5 (FIG. 14). Relative chronology dates the workshop to the Mamluk period; its construction utilised some of the Ayyubid structures erected after the destruction of an important Crusader religious area.

This part of the article presents an archaeologi-

[10] CF = *corpo di fabbrica* (It. "body of factory") (Brogiolo 1988).



11. Archaeological and monumental area of Shawbak; investigated buildings and areas.



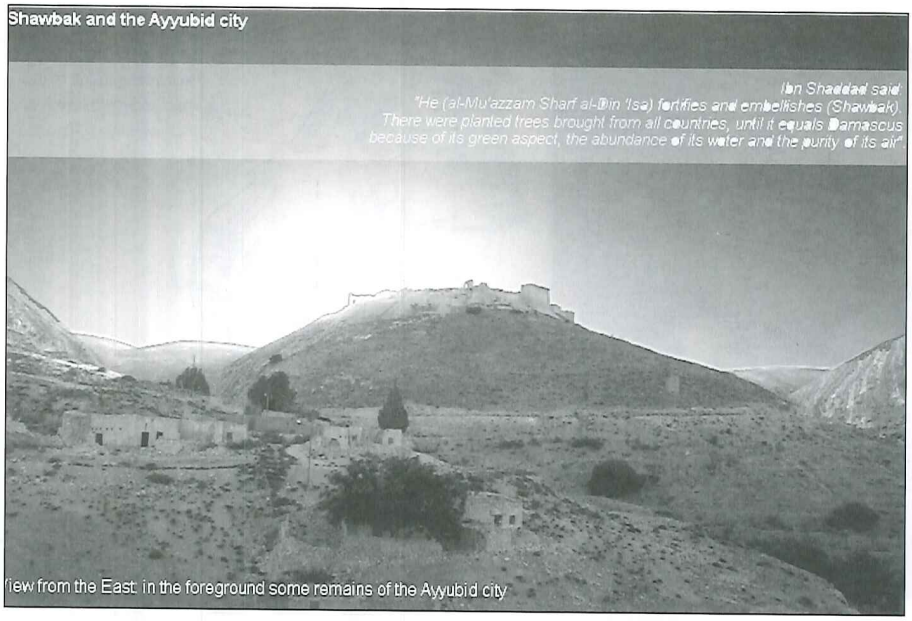
12. Mamluk industrial workshop for textile-dyeing.

cal description of the workshop, focusing on issues related to its interpretation.

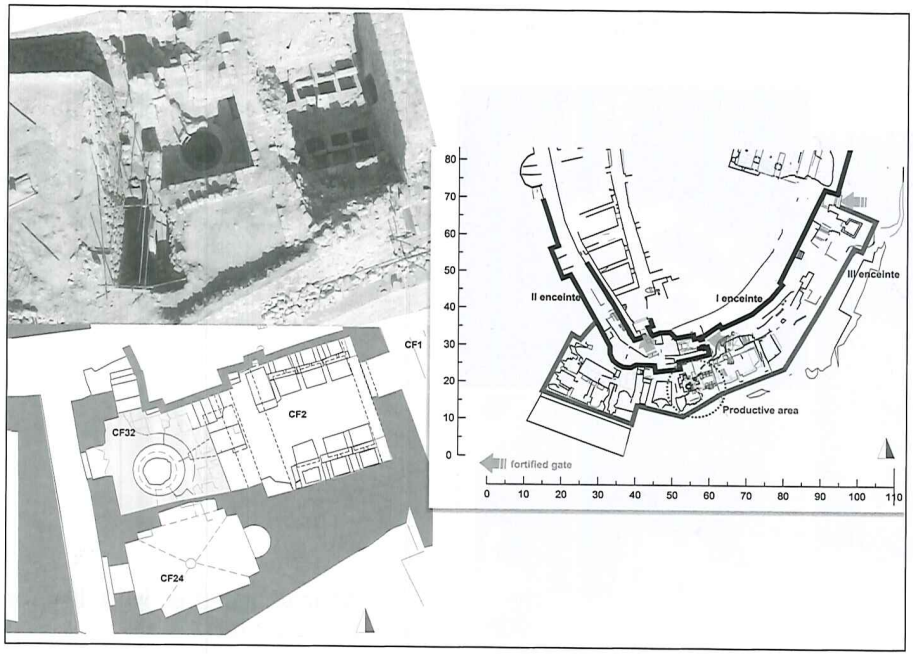
The function of the Shawbak workshop area has been an archaeological conundrum ever since its discovery. It must be acknowledged that, in most cases, the archaeological identification of a workshop area has known limitations. There are no uniform criteria and often finds from the architectural features (e.g. built-in facilities, raw materials, tools and incomplete / finished products) are not particularly common or informative. Proto-industrial workshops in particular are characterised by non-standard infrastructure without specific equipment and tools, such as wooden beams, cooking pots, basins, storage jugs etc. However, no item can be an infallible indicator in isolation, although the combination of a number may increase the chance of a positive identification[11].

In the absence of these clues, as at Shawbak, identification of a workshop is more difficult. In-

[11] On this topic see also research on pre-industrial structures and facilities used for the washing and dyeing of fibres and textiles during the Aegean Bronze Age (Alberti 2007).



13. Shawbak from the east: decline of the feudal castle and rise of an Islamic city.



14. The Shawbak workshop is located south of the castle, between the third and second curtain walls.

deed, its exposure to the elements has rendered identification of raw materials, pigments or unfinished products impossible. These structures are also ambiguous because, in most cases, they reuse architectural elements from pre-existing buildings that were not specifically designed for industrial activity.

Multidisciplinary research is therefore necessary when investigating workshop areas like this. This should involve not only microstratigraphic analysis of both masonry and plaster, but also archaeometric sampling, investigation of iconographic elements and comparison with known workshops elsewhere. Where possible, it is also particularly important to test theories against ethnographic analogies.

Over the past two years, both archaeological data and written sources have supported the identification of the Shawbak factory as a dye-shop. However, this research is still in progress, with many new paths of investigation to come.

Before the Construction of the Workshop: the Crusader and Ayyubid Periods

From start of this research, archaeological investigations have focused on that part of the castle which housed the Knights Hospitaller during the

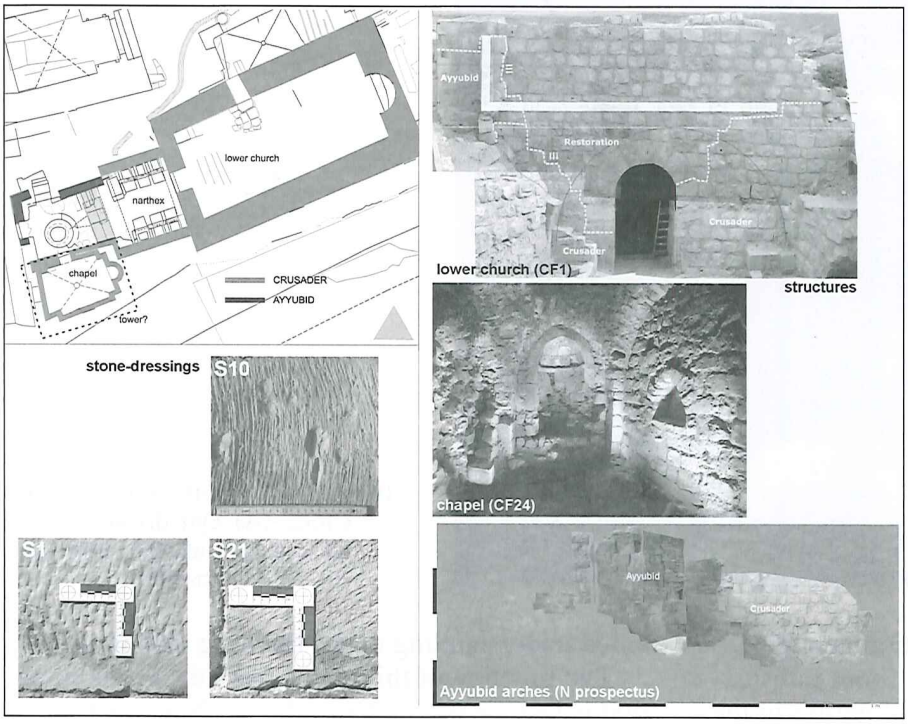
Crusader period[12].

The lower church (CF1), consisting of a single east - west oriented room with an apse and barrel vault, is situated in this area. Access to the church is by means of a door in the north wall and a small entrance in the west façade, PP1[13] (FIG. 15). Here, the upper part of the façade and the arch of the west entrance have recently been restored (USM 1052). The walls of the church are constructed using building techniques typical for Shawbak during the Crusader period[14] (FIG. 15).

South-west of the church is the small Crusader chapel (CF24) with a conch apse in the east wall, characterised by masonry similar to that of the church. A plausible hypothesis is that the chapel stood at the base of a tower – perhaps that given by Maurice de Montreal to the Knights Hospitaller of St. John in AD 1152 (Faucherre 2004: 65) – although the external wall of the building is now almost invisible, hidden by Mamluk restorations and the third curtain wall (FIG. 15). A corner consisting of large ashlars of micritic limestone (USM32146) and a wall of roughly worked blocks of limestone and flint remain today. The present entrance to the chapel is the result of recent restoration; the original possibly stood on the internal north front (CF24; PP2). Examination of the Crusader wall (USM24205; USM24219) has identified a small arch (USM24206), closed at the bottom by a lintel (USM24207)[15] which still hosts a hinge-housing (FIG. 18).

These two religious buildings are linked by a room consisting of two walls built directly onto the church façade. This so-called narthex (CF2) still remains (FIG. 15) and was probably vaulted, as can be seen from the pendentives. Surveys during the autumn 2010 season revealed an offset in the Crusader south wall of the so-called narthex (PP3; USM2300) which supports the narthex masonry and a few centimetres of the external corner of the chapel, thereby confirming that these structures were built in the same period.

A roughly square room (CF32) lies between the narthex and chapel. It is impossible at this stage of the investigation to define its function before it was converted into a factory. However the oldest parts of its structure (USM32200) have been identified in the north-west external corner. In view of



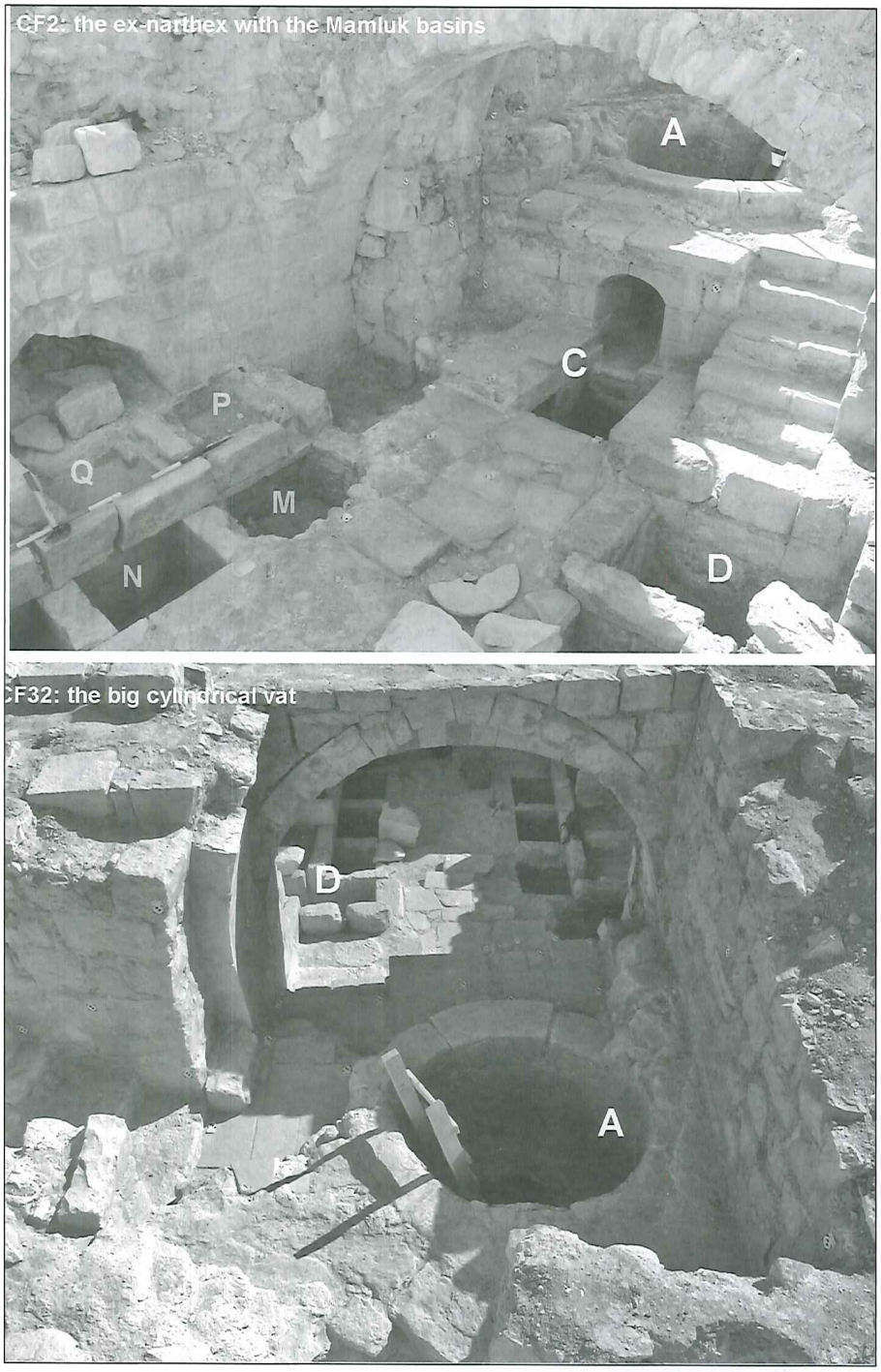
15. Before the construction of the workshop: pre-existing Crusader and Ayyubid structures.

[12] We would like to thank Michele Nucciotti, Laura Torsellini and Lapo Somigli.

[13] Pp = *prospetto particolare* (It. "front") (Brogiolo 1988).

[14] The lateral façade consists of roughly worked stone blocks (with occasional flints) dressed with stone-dressing S4 and arranged in courses with very large joints and beds full of wedges. On the façade, but especially in the apse, there are ashlars of micritc limestone arranged in courses and dressed with a stone-axe (S10). S = *superficie* (It. "surface").

[15] The lintel is still visible in the external wall (south façade of CF32), though partly obscured by the great Mamluk vat.



16. Mamluk workshop CF2 and CF32: (A) cylindrical vat, (C) rectangular tank, (D) cistern and (E - P) small basins.

the stone-dressing[16] and construction techniques used for the masonry and mortar (both substantially different to that of the Ayyubid period in the same structure), we believe that this lower part of the wall dates to the Crusader period, even though USM32200 is probably too small to provide an detailed understanding of the building techniques.

The function of this area during the Ayyubid period is less clear. The Crusader narthex was used in some way with the addition of two large pointed-arches that seem to connect the two rooms CF32 and CF2. These arches, characterised by large ashlars in

[16] This lower part of the masonry is characterised by stone-dressing S10; there is also one block dressed with a pointed chisel (*gradine*), which may be similar - but more eroded - to another block in USM2301 on the south wall of the 'narthex' (CF2; PP3).

micritic limestone with stone-dressings S1 and S21 (FIG. 15) – distinguishing features in many of the Ayyubid castle walls built after the 1212 earthquake (Nucciotti 2007: 44) – are built against the previously described external corner of the chapel on the south side and an Ayyubid-period corner on the north side, the latter dated on the basis of building technique and stone-dressing (FIG. 15).

It is plausible that the narthex was still covered at this time, given the presence of an Ayyubid phase in the church façade, consisting of the partial reconstruction of the left corner (USM1056) with stone-dressing S1 and a doorway (USM1058) indicating the existence of a room on the top floor of the narthex (FIG. 15).

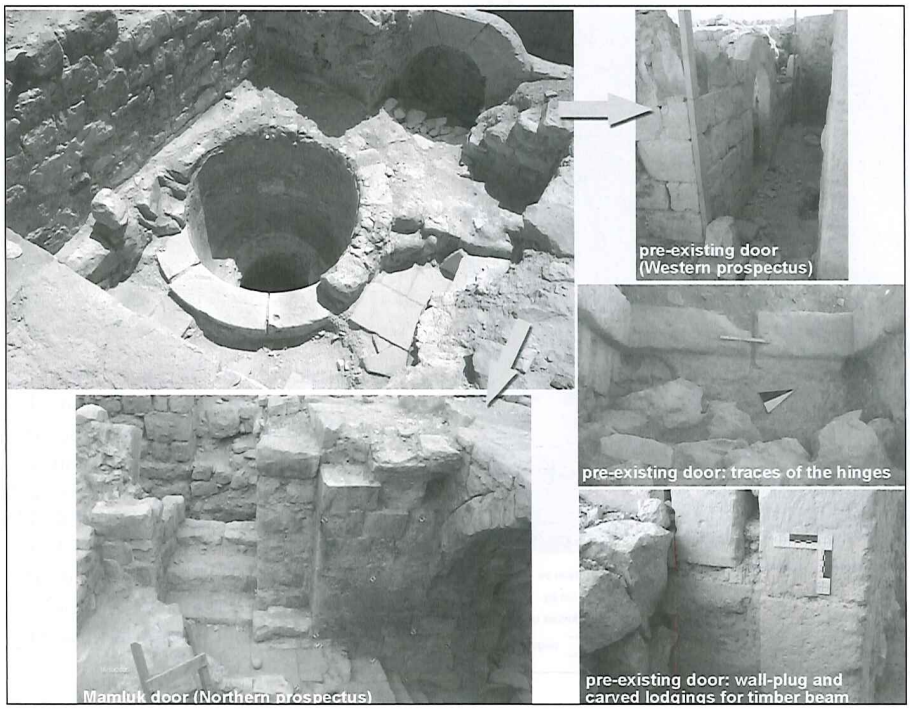
The north and west walls of CF32 were raised again in the Ayyubid period; the construction or reconstruction of the door in CF32 can be dated to a later period. It is not easy to establish exactly when this event took place, whether later in the Ayyubid period or early in the Mamluk period (FIG. 17).

Construction of the Workshop Reusing Older Structures: the Mamluk Period

Later, the entire area was transformed into a workshop. Stratigraphic analyses of the masonry and microstratigraphic analyses of plaster sampled during the 2006 - 2008 archaeological seasons indicate that this complex structure was planned in the Mamluk period and that considerable architectural changes were required in order to carry it out. In brief, these changes comprise two major structural modifications which may be ascribed to the same construction phase, *viz.* (1) the placement of twelve basins and a tank in the narthex of the lower church CF2 and (2) the construction in CF32 of a huge building containing a furnace surmounted by a large cylindrical vat (FIG. 16). The workshop must have seen intensive activity, including continuous use of water and perhaps chemicals, as indicated by the many layers and patches of *cocciopesto* that cover all structures.

Structures of the Mamluk Workshop: the Furnace and Vat

The construction of large cylindrical vat 'A'[17] (using large, slightly curved ashlars of micritic limestone, lined with several layers of *cocciopesto*) resulted in the 'filling-in' of CF32 in its entirety and, more specifically, the construction of a raised floor and blocking of the west door. The latter was probably associated with the Ayyubid room, as shown by the traces left by the hinges (FIG. 17 [detail]).



17. Workshop construction: blocking of pre-existing door and opening of a new one.

[17] From a methodological point of view, during microstratigraphic analysis we decided to treat the blocks used for the vats as a series of single stratigraphic units in order to maintain 'visibility' of the construction method of the vats. At the same time, we also identified each vat with its own letter ('A', 'B' etc.).

Placements were cut into the jambs when the door was blocked in the Mamluk period, in order to fit timber beams across the entrance that could bear the vat structure (FIG. 17 [detail]). As a result, a new door was created on the north side (FIG. 17).

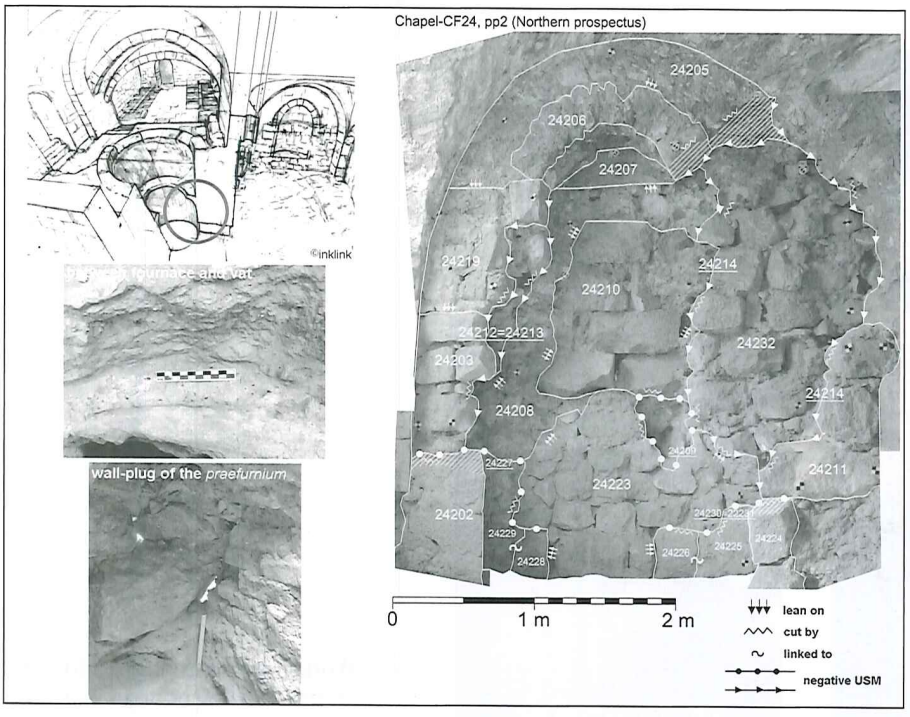
Stratigraphic analysis revealed four different pavements that overlap each other; these can be ascribed to the different stages in the building and restoration of the vat. Three of them are layers of mortar plastered with *cocciopesto* (I - III), while the last one is of limestone slabs (IV).

The water in the cylindrical vat was heated by furnace 'B', which was partly dug into the sloping ground and partly exploited the chapel and CF32 walls. The furnace was rounded in shape with an ogival ceiling, and was built of fire bricks. A metal screen, now absent but evidenced by some traces visible in the section, probably separated the cylindrical vat and furnace. It is thought that the Islamic bath at Tall Ḥisbān (De Vries 1986: 227; Walker and La Bianca 2007) had this type of partition between the furnace and vat (FIG. 18 [detail]).

We can see the cuts (USM24212 = USM24213 and USM24214) made in the Crusader masonry that indicate the position of the vat's rounded structure (USM24210), the furnace and the furnace room jambs (USM24228; USM24226) in the interior of the chapel on the north front (PP2; FIG. 18). The furnace room, which may have been topped by an arch / *arcosolium* (USM24202; USM24224), was associated with the limestone paving slabs (US24616) exposed during excavation of the chapel (Area 24000). The interior of the Crusader chapel was then transformed into a room used for storing firewood and stoking the furnace. A thick layer of ash-grey burnt clay and fire-cracked bricks can still be seen at the bottom of the furnace.

Stratigraphic analysis of PP2 resulted in the identification of a final stage, during which the structures of both the furnace and furnace room (USM24230 = USM242315 and USM24227) were probably removed (or collapsed). The furnace room *intrados* was then blocked with large, roughly worked stones (USM24223) held together with lime mixed with earth (FIG. 18).

Stratigraphic analysis of the chapel walls, along with a study of sherds from the area 24000 excavations, has enabled the abandonment of the workshop (i.e. the collapse of the furnace room) to be dated to around the late 15th century. All excavated



18. Structure of furnace and vat; stratigraphic analyses and details. See introduction of the new masonry for the cylindrical vat (USM24210; USM24208) cut into Crusader walls (USM24232; USM24211; USM24203; USM24219) and closure of the furnace room (USM24223) (PP2 photogrammetric image by Francesca Cheli).

[18] We did not find a Crusder-period floor during excavation of the chapel (Area 24000). This (and the fact that all deposits are quite recent) favours the hypothesis that the original pavement of the chapel was dug up and re-utilised elsewhere in the workshop. The later removal of older strata in order to reutilise rooms is has been documented elsewhere in the castle (e.g. Areas 35000 and 6000).

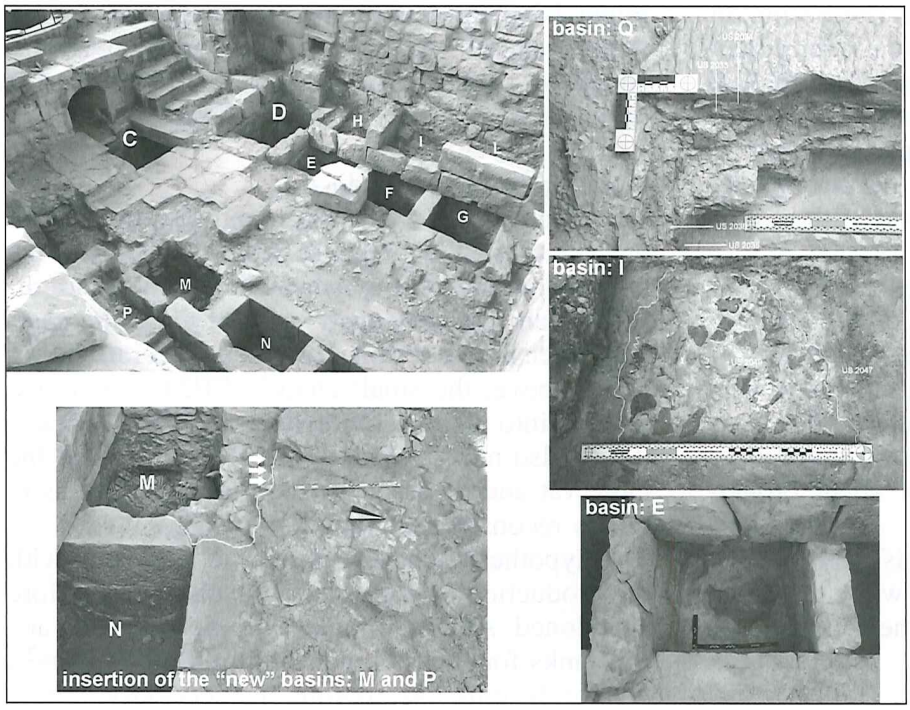
layers overlaid Crusader-period masonry[18] and the furnace room wall-blocking, *viz.* layers US24609[19] (compact, dark brown with charcoal fragments, burnt pottery and animal bones) and US24614 (collapse deposit of large stones and block fragments with animal bones, charcoal fragments, glazed pottery sherds[20] and fritware[21]).

Mamluk Workshop Structures: the Basins

A round hole in the bottom of the cylindrical vat led to a large, deep rectangular vat / tank 'C', which was plastered with *cocciopesto* and did not have a drainage hole.

Twelve basins on two levels stood close to the two walls of the narthex and were connected two-by-two ('E - R') on the same level as the rectangular vat. A large cistern 'D' at the north-west corner collected clean water from a stone channel (USM2000; USM2041) (FIG. 19). This channel was built on the rubble of the vault of the narthex (USM2043) (FIG. 20 [detail]). The basins did not have any drainage holes.

Stratigraphic and microstratigraphic examination of horizontal surface PP1 enabled some of the building techniques used for the vats and several layers of earthenware (FIG. 19 [detail]) to be identified, confirming that workshop CF2 was a contemporary structure. The basins all have similar features, in that they were all built of *calcarenite* (dune limestone) ashlars dressed with stone-dressing S2[22] and are all of the same size (*ca.* 26.5 - 28cm in height and *ca.* 67 - 69 m in length). All the vats are plastered with earthenware; the basins on the upper level were made smaller by setting some stones and mortar between the first and the second layers[23]. The microstratigraphic analyses have shown the necessity of allocating a US number to the different preparatory layers of mortar between the many layers of earthenware, in order to distinguish the various stages and plastering techniques[24]. The lower vats are not usually covered with a preparatory layer containing potsherds; instead, this is a characteristic of the upper vats and the large cistern in CF32 (FIG. 19 [detail]).



19. General view of basins and details: microstratigraphic plaster analyses (basin Q and I), basin filled with lime (basin E) and insertion of two 'new' basins (basins M and P).

[19] In US24609 we found a rim fragment of a green-glazed slipware bowl (Sciortino 2010: 52 and catalogue: Type DB a, n. 82, Type CB d *s*, n. 214, Type CB e, n. 221 and Type DB b, n. 133)

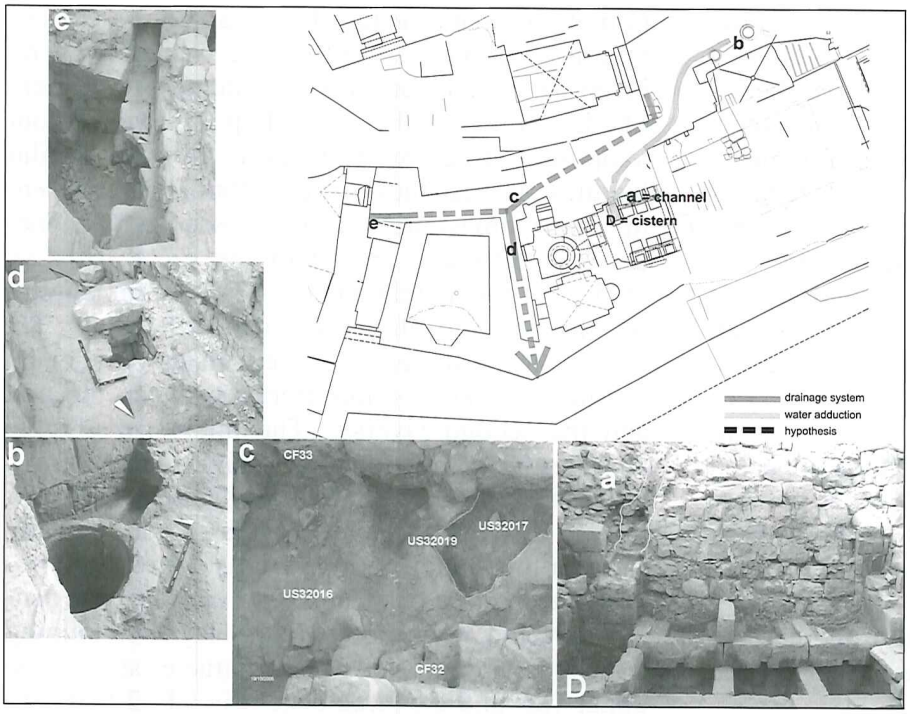
[20] Sciortino 2010: 52 and catalogue: Type CB c 14, n. 159, Type CB d *s*, n. 215, Type CB e, n. 216, Type CB c 14, n. 231. N 159 is a green-glazed slipware.

[21] Sciortino 2010: 47-54; see Type FB a, n. 6 and Type FB h, n. 41, blue-and-white decorated fritware from Egypt.

[22] Stone-dressing made with a small pickaxe and draft-line made with a chisel or pointed chisel (*gradine*).

[23] The reason for this reduction in the size of the upper basins has not yet been identified.

[24] This also makes it possible to give individual reference numbers to archaeometric samples of the different layers of earthenware (*infra* and Mazza *et al.* 2009: 174-175).



20. Workshop water and drainage system.

Examination of the plaster also gives us an idea of the original volume of the vats. The basins on the lower level were much deeper (*ca.* 64cm) than those above (*ca.* 30cm), notwithstanding the fact the original height of the latter has not been preserved. We can assume that the upper vats were at least *ca.* 48 - 49cm deep although we are unable, owing to erosion of the plaster, to say if this coincided with a larger volume.

The floor of the room comprises two different layers of *cocciopesto*: the first (USM2022) is contemporary with the basins; the second (USM2025) was cut to hold two new basins in the south-west corner. The upper basin, 'P', is similar to the other basins but with ashlars of slightly different size. The lower basin, 'M', is made of small broken stones laid flat (FIG. 19).

The second layer of *cocciopesto* is covered with a third 'pavement' of small stones, while the other layer consists of large micritic limestone paving slabs (USM2023).

Theories About the Shawbak Workshop

The archaeological results of the 2002 season suggested that the structure was a dye-shop[25], although later hypotheses considered the possibility that it might have been used for the production of oil, wine or sugar[26]. At that time the workshop, as noted above, consisted of just one room with twelve basins placed on two levels, *viz.* CF2.

Sugar or Olive Oil Production

The discovery of the furnace and cistern in 2005 opened up new avenues of research, because the production area was evidently larger and more diverse than had previously seemed to be the case, with three rooms devoted to specific operations. As noted above, the small chapel (CF24) was transformed into a room used for stoking the furnace; it was also necessary to define the function of the large vat and its associated features, as well as to totally reconsider the function of CF2.

The hypothesis that associated the workshop with the production of wine and olive oil was therefore abandoned. Although these activities require various tanks for filtering and refining the products[27], neither heating nor boiling is necessary. These types of production, especially of olive oil, also necessitate pressing in mill structures.

Written sources describe Shawbak as an important

[25] The surveys were conducted by Monica Cortelletti.

[26] Dario Rose is interested in these later hypotheses.

[27] Pre-industrial evidence attests to different methods of filtering olive oil, with regional diversity in methods of separation (Frankel 1999: 48). Many Palestinian wine installations, carved into bedrock, have two tanks set on two levels, with the first serving as a filter (Brun 1993: 527).

centre for the production and export of sugar derived from sugar cane[28]. Sugar refineries require the same facilities, e.g. a crushing basin and vertical circular stone, as olive presses. Water or animal power may have been used, as in the olive oil industry. Further excavation in the area surrounding the workshop, with targeted stratigraphic sampling, allowed the pre-industrial sugar production hypothesis to be discounted. Only one small stone channel leads into a cistern in the Shawbak workshop and, even though a furnace exists, mill stones, traces of wooden presses or large quantities of sugar pot fragments were not found[29].

The Main Hypothesis: a Mamluk Dye-Shop

The furnace, a number of earthenware-lined vats and basins, the water-supply and the drainage system (as well as comparisons with similar structures and some written sources) suggest that the Shawbak workshop may have been a dye-shop, probably related to carpet manufacture.

The lists of the Haram Documents refer to remarkable numbers of carpets from Shawbak between AD 1379 and the last decade of the 14th century. In an endowment, we find a woman giving various pieces of furniture to Madrasa al-Barudiyya, including no fewer than 15 *buṣuṭ*, "a pair of five-span Shawbak carpets", "a pair of Shawbak carpets" and "five single Shawbaks"[30]. Another list of items, donated by a certain Shaykh ʿAbid al-Wāḥid to Madrasat at-Taziyya, includes "two Karak carpets" and "four Shawbak carpets"[31].

A second group of documents (numbering about 450 in all [including wills, estate inventories and records of the sales of estates]) relates to members of the lower and middle classes who died in Jerusalem during the last decade of the 14th century. Here we find one *sajjāda*[32], 23 *buṣuṭ* (out of a total of 168) and three pairs of *buṣuṭ* from Shawbak. Some documents associate the term *buṣuṭ* with *maqāʿid* (Ar. "cushion"); four (out of a total of 23) are from Shawbak (Little 1986: 88-89).

These documents make it clear that there was a carpet industry in at least two areas of Palestine in the late 14th century, both of them associated with Crusader castles, *viz.* Karak and Shawbak (Little 1986: 87).

A survey of the archaeology of dyeing processes yielded some suggestions about how to identify a dye-shop. The absence of special facilities for water supply and the characteristic fulling tubs – the only reliable criteria for identifying a fullery (Flohr 2008) – identify the Shawbak workshop as a dye-shop instead[33]. Dyeing and fulling were however often carried out close to each other, as at the Jarash hippodrome[34] and – more frequently – at Roman cities like Pompeii (Pietrogrande 1976), ancient Ostia (Uscatescu 1994), Barcino[35] and Florentia (De Marinis 1997; Pagni 2010: 176-178)[36].

The presence of a workshop like this inside the castle is hardly surprising. In Roman cities, such facilities were typically placed near the gates, close to the main roads yet within the city walls. This was the case at Barcino (Beltran de Heredia Bercero 2000: 254); the location of the Shawbak workshop seems to follow a similar tradition.

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[28] The fertility of the Jordan valley area evidently encouraged the Frankish sugar industry in the area. A special kind of smooth, white sugar was produced, known as 'sugar of Montreal', i.e. sugar of ash-Shawbak (Nashef 2011). Later, between 1310 and 1340, this sugar was sold in the markets of Florence (Nashef 2011). See also K. Politis (this volume).

[29] Apropos we recall the pottery analysis from the 2010 excavated assemblage. See also Nashef (2011), Politis (2007) and Politis (2005).

[30] Document no. 76 dated 790 / 1388 (Little 1986: 85-86). *Buṣuṭ* or *bisāṭ*: "a generic term for carpet and, more specifically, one of fairly large dimensions" (Serjeant 1972: 205). Little concludes that the word *busuṭ* refers instead to woollen carpets, which should not be confused with prayer carpets (Little 1986: 89).

[31] This is the first mention of carpets from Shawbak: document no. 595, dated 781 / 1379 (Little 1986: 87).

[32] It is a prayer rug. We have also information about the colours and materials: the 68 references to *sajjāda* include 20 wool rugs (*viz.* five white, two green, one black, one honey-coloured with a white fringe, one red-and-white and one with a red border); ten were cotton rugs (of which three were white) and one was a heavy hair rug (black). The colours do not appear to be associated with particular areas of origin (Little 1986: 88-89).

[33] See *supra*: owing to erosion of the *cocciopesto* in the CF2 basins, we are unable to say whether the upper vats were originally much deeper than 49 cm, or whether this height coincided with a larger volume. It is possible that only the lateral walls of the vats were higher, rather like typical *salti fullonici*.

[34] Fulling tubs were not identified at the Jarash hippodrome laundries, but washing activity is intuitively indicated by the worktops set on top of some tanks (Bessard, Callot and al-'Tum 2008: 173). For the latest information on this area see F. Bessard (this volume).

[35] The structures, a *fullonica* and *tinctoria* of the 2nd century AD, can be found in the Museo de la Historia de la Ciudad de Barcelona. They are the first recognized examples of *fullonicae* in Spain (Tarragona, Màlaga and Mérida have yet to be confirmed). Remains of blue pigment have been found in some of the tanks, *viz.* Egyptian or Pompeian blue (Beltran de Heredia Bercero 2000).

[36] For a catalogue of Roman fulleries see http://www.mikoflohr.nl/archaeology/ and the 'Cleaning the Laundries' project.

The existence of a furnace in CF32 would make the Shawbak workshop a fairly rare example of a dye-shop. Some scholars argue that hot dyeing was unusual in the Middle East, as very few furnaces have been found[37], and that a distinction should be made between simple cold dye-shops, e.g. the Hellenistic workshop at Sardis (Crawford 1991: 15-17), the Byzantine ones at Athribis (Petrie 1908: plate XXXV) and Gaza (Ovadiah 1969: 197), and the Umayyad workshops at the Jarash hippodrome, and dye-shops proper, e.g. the Byzantine workshop at the Jarash *macellum* (Uscatescu and Martín-Bueno 1997). In connection with this, we think that the furnace in *taberna* 11 in the *macellum* was only partially made of bricks and perhaps supported a mobile, metallic vat like the example depicted in *L'arte della seta*, vol. II: 27. The large cylindrical vat and furnace at Shawbak demonstrate that the workshop was evidently able to support a substantial dyeing bath[38], confirming that it was an important production centre, as suggested by written sources. However, we believe that this kind of distinction can only be confirmed by widespread archaeometric analyses and investigations of other dye-shops.

As already noted, the difficulty in identifying an industrial structure, especially one associated with the washing or dyeing of textiles, means that the determining factor almost always relies on the discovery of traces of pigment. Examples include the tubs containing traces of pink in *taberna* 11 at the Jarash *macellum* (Uscatescu and Martín-Bueno 1997: 78), of Pompeian blue at the dye-shop at Barcino (Beltran de Heredia Bercero 2000: 257) and of blue and red at the hippodrome workshop (Bessard, Callot and al-'Tum 2008: 176). There is some controversy regarding the identification of workshops at Tell Beit Misrim (Albright 1943) and the Rachi settlement at Isthima (Kardara 1961), both recently identified as structures for olive oil production (Anderson-Stojanović 1996: 91-92).

The plaster used in the dye-shop at Shawbak has unfortunately been exposed to the elements for so long that any visible traces of pigment have almost entirely disappeared. Archaeometric analyses on the earthenware of the basins, cistern and vat have demonstrated the presence of potassium nitrates. Also, organic fibres (perhaps flax) were found on the surface of samples taken from the different layers of *cocciopesto* on the basins and vats; microanalysis has shown that they contain traces of nitrogen and sulphide (FIG. 21). Finally, the composition of the plaster found in the workshop was completely homogeneous, suggested that the dye-shop was – broadly speaking – of one date[39].

Theories on the Dyeing process in the Upper (CF32) and Lower (CF2) Rooms

As the great cylindrical vat 'A' is the largest and the only one that was heated, it was probably used either to mordant (dye in cold baths) textiles or skeins[40], or to hot dye large quantities of material. We do know that some colours were chemically prepared in a hot dyeing vat, e.g. kermes for reds and woad for blues (Robinson 1969: 28-29; *L'arte della seta*, vol. I: 31-35, 48). The same hot vat could be used for the mordanting process, which made use of various elements: e.g. urine, alum and ashes (*L'arte della seta*, vol. I). Several batches of hot water were used to prepare skeins of silk before the actual dyeing process (*L'arte della seta*, vol. I).

The very small drainage hole that runs into rectangular vat 'C' may be there because the cylindrical vat was only part-emptied after dyeing. It is possible that the chemicals in the dyeing vat did not produce debris which could block the drainage hole. Written sources mention some chemicals that produce only a little scum on the surface of the dyeing bath (*L'arte della seta*, vol. I).

Presumably the basins on the upper level were used for draining the dyed textiles or skeins, which would have been hung out on timber beams as shown in illustrations (*L'arte della seta*, vol. II: 25). Excess liquid could be collected in the basins on the lower level without a drainage system. Written sources tell us that a colour bath could be reused to get softer colours. It is also possible that

[37] For the distinction between the dye-shops with (i.e. in western Europe) and without (i.e. in the Middle East) furnaces, see Pietrogrande (1976) and Uscatescu and Martín-Bueno (1997: 77). The dye-shops at Jarash are considered the earliest examples of dye-shops with furnaces in the Middle East.

[38] See, for example, various large vats in *L'arte della seta*, vol. II or the 18th century Diderot dye works in Gillispie (1959 vol. II).

[39] For the results of the archaeometric analyses on the Shawbak workshop, see 'Archaeometric studies on *cocciopesto* mortars from the workshop' by R. Franchi, L. Gobbi and G. Raffaelli in Mazza *et al.* (2009: 174-175).

[40] If the Shawbak workshop were used for production of carpets, as suggested by the written sources, it is likely that they were made mainly with skeins or tissues.

some of the basins on the lower level were used for cold dyeing (for example indigo)[41]. It is therefore interesting to note that one of the basins on the lower level was half-filled with white lime; quick lime alone could be used as a poor quality mordant for cold dyeing (*L'arte della seta*, vol. I), as proposed for the Jarash hippodrome dye-workshops[42]. It is also likely that some basins were used for washing and rinsing. Excess liquid was probably collected in specifically shaped paving slabs in the largest rectangular vat 'C'.

Clean water arrived from the level of the street above by means of a stone channel built on the collapsed northern wall of the narthex. There are also a series of carved stone water channels that run between the second and third curtain walls; two of them seem to be related to one of the big silos in the small vaulted building adjacent to the lower church (FIG. 21 [detail])[43].

There was no drainage system in the workshop but presumably ceramic or metal containers were used, as suggested for the Byzantine dye-shop at the Jarash *macellum* (Uscatescu and Martín-Bueno 1997: 78) and some of the Umayyad workshops at the Jarash hippodrome (Bessard, Callot and al-'Tum 2008: 176).

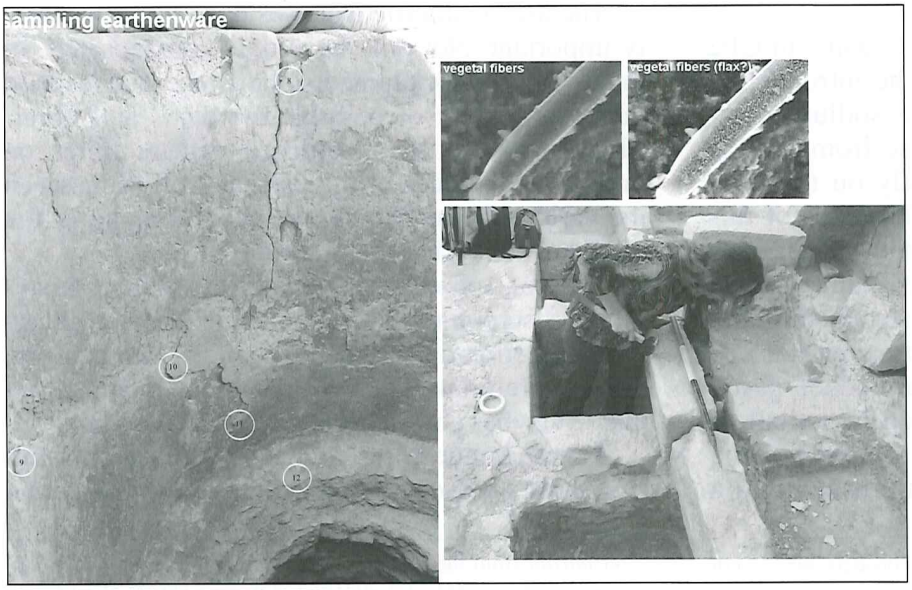
A complex system of channels, exposed during the 2006 season, was probably used as for drainage, exploiting the slope of the ground that ran towards the castle walls (FIG. 20). We should also mention the channel of stone slabs in the south-west part of the village, which was brought to light during the 2005 season. It is interesting to see how the construction of this channel seems to be related to the drainage system of the workshop (FIG. 20).

The workshop drainage system and water channels are still under study, being an important part of the industrial activities carried out there. They have the potential not only to yield information about the Shawbak dye-shop, but also about the wider changes which took place in the village located within the third curtain wall between the Crusader and Mamluk periods.

Suggestions for Further Research: a Soap Factory?

Pictorial comparisons suggest that there may be similarities between the Shawbak workshop and the structures preserved at the Soap Museum in Sidon, Lebanon.

The soap museum is housed within the old and recently restored soap factory of the Audi family, in which the principal elements of soap manufac-



21. Archaeometric analyses of plasters: sampling of earthenware in cylindrical vat, basins and traces of organic fibres (thanks to specialists from University of Urbino and Centre for Archaeometric Studies [see R. Franchi in Mazza *et al.* 2009: 175]).

[41] For a general history of indigo, see Balfour-Paul (1996) and (for indigo dye-baths) Robinson (1969: 23-24). Rectangular basins on two levels, similar to those at Shawbak, were found during the excavation of the so-called 'Boatswain's house' at the Santa Severa castle in Rome. Their stratigraphic context dates them to the 15th century; their identification as dyeing structures comes from the discovery of traces of red pigment (Enei 2006: 11-12).

[42] Given the absence of a furnace, it is thought that the use of lime would serve to increase the temperature of the dye bath (Bessard, Callot and al-'Tum 2008: 176).

[43] It might be interesting to study the features of this channel system (building techniques and stone-dressings) and its stratigraphic relationship with the Crusader structure and Mamluk workshop.

turing are preserved *in situ*. Analysis of the building shows that the oldest part of the soap factory, where the soap basins are located, dates back to the 17th century[44]. The production of virgin olive oil soap was carried out in the Sidon workshop using the 'hot' process, as in the traditional and historical soap factories of Palestine and Syria[45].

According to written sources and ethnographic documentation, the traditional 'hot' process for soap-making, which is still used in Aleppo, required several different stages and took over a week. The first step in saponification was the pasting process: olive oil was boiled with soda and the resulting mixture blended in a large cauldron. The saponification reaction produces soap and glycerine; the two products were then separated and the glycerine removed. Boiling marks the next stage; the soap 'dough' was heated to a high temperature for several hours with an excess of alkali to ensure the total transformation of the greasy material into soap. After leaving the soap to rest, the water was removed from cauldron. The excess soda remaining in the soap dough was eliminated at the end of this process by boiling the soda with water, which was afterwards removed. This process might explain furnace 'B', large cylindrical vat 'A' and rectangular tank 'C', connected by a small drainage hole, in the Shawbak workshop.

It is also possible that the small basins in CF2 were used for lixiviation. Before the introduction of caustic soda in the 1860s, the sodium compound used for saponification came from the *barilla* plant, which grows abundantly on the eastern banks of the Jordan river[46]. The ashes of this plant were pounded into a fine, natural, alkaline soda powder called *qilw* or *qili*. Today *qilw* is still combined with lime to make a soda solution. The *barilla* ashes are placed in a stone mortar and pounded into a fine powder with a wooden pestle to produce *qilw*. The lime is spread in a shallow pit and soaked with water until it evaporates; the dry substance that remains is then crushed into a powder. The two powders (*qilw* and lime) are combined with hot water in fermentation pits. The hot water absorbs the chemical content and seeps into identical, deeper pits below the fermentation pits situated above ground[47].

This new hypothesis is, at a first glance, intriguing but – at the current stage of research – we do not have any written sources that mention soap production at Shawbak, nor are there supporting archaeometric data, notwithstanding the fact that the 'Ammān and as-Salṭ areas are known for their production of soda ash.

The Mamluk Economy at Shawbak

In conclusion, research undertaken at the Shawbak workshop over the past two years has led us to provisionally identify it as a dye-shop or - more recently – a soap factory.

Stratigraphic analysis of both the masonry and the plaster, along with preliminary results from the chapel / furnace excavations, suggest that the structures were built in the Mamluk period, with production ending some time in the late 15th century.

Ethnographic and pictorial analogies support the archaeological data, which suggest a close similarity with dye-shops elsewhere or – more recently – with the soap factory at Sidon.

The archaeometric analyses have been extremely important. Not only have they compensated for the lack of visible pigments, they have also resulted in the discovery of possible mordants and fibres. These analyses also identified vegetal fibres on the plaster surfaces of the vats, as well as between the various layers of plaster linked to repair of the earthenware during historic times.

Written sources, specifically the Haram Documents, also point to Shawbak being a centre of carpet production during the last half of 14th century; there are references from Jerusalem which suggest that 'Shawbaki' rugs were extremely popular.

A new avenue of research derives from apparent similarities between the Shawbak workshop and a

44 http://fondationaudi.org/English/MuseeSavon.aspx?id=7. For discoveries and descriptions of soap factories in Jerusalem, along with details of the production process, see Warren (1876: 500-508).

45 Two main types of traditional soap made with olive oil and alkali can be distinguished: Nablusi and Aleppo soaps differ slightly because of the use of certain ingredients (e.g. the Aleppo soap also includes laurel oil).

46 *Barilla* refers to several species of local plant containing a high content of alkaline salts. Large numbers of *bedouin* used to gather *barilla* from the valleys around Salt and Tadmur (Palmyra); see Doumani (1995: 203-204) and Molyneux (1848: 119-120). In the late 10th century the Jerusalem physician al-Tamini described the presence of large quantities of these plants in the 'Ammān area and also wrote about the *qilw* that reached Palestine, Egypt and other countries from the 'Ammān area (Amar 1998: 8, 12).

47 See chapter 280 of the *Mappae Clavicula*, 'How soap is made from olive oil and tallow', in Smith and Hawthorne (1974: 70). See the model in the Salt ethnographic museum for other soap factory processes.

soap factory. This is something we intend to pursue by searching for other archaeological and textual *comparanda*, as well as by means of new archaeometric analyses.

The discovery of the workshop at Shawbak introduces several new elements for which there are few *comparanda*, whether in Transjordan or in the Middle East as a whole. The workshop is relatively complete, with a furnace, a cistern and various earthenware-lined basins and vats.

Textile industries, such as the weaving and dyeing of fabrics, and associated activities, e.g. cultivation of vegetal fibres and trading of dyes, played an important role in the economy of the Middle East (Robinson 1969; Balfour-Paul 1996; Mackie 1984; Frantz-Murphy 1981). However soap – if this hypothesis proves viable – was also a luxury product that was marketed from the Arab world, including the Jordan valley, to neighbouring regions and Europe (Le Strange 1890: 513; Richards 1999).

Mamluk Shawbak thus emerges as a commercial crossroads of great strategic importance, as attested in textual and archaeological sources of the 14th century.

The Workshop Restoration Project (P. R.)

The restoration of Shawbak castle presents complex problems of analysis, methodology and planning owing to the presence of varied structural features dating to different periods, *viz.* Roman - Byzantine, Crusader, Ayyubid, Mamluk and Ottoman. This is a very rare situation amongst the Crusader castles of the Middle East. It requires accurate preliminary investigations and a large-scale and well-planned (whilst conservative) restoration project. Regular checks must be carried out during reconstruction, with constant reference to the archaeological evidence.

Having been abandoned for fifty years, the Jordanian authorities have carried out some restoration work at Shawbak castle in recent years in order to improve the state of the masonry, though without following any plan based on reliable historical data. We do not always agree with some of the methods used in this reconstruction. However, in view of the complex historical stratigraphy of the castle – relating to the use of different building techniques (e.g. stone-working, the arrangement of blocks and types of mortar) – we accept that it is extremely difficult to choose the right methods and techniques of consolidation.

The current project, although it involves only a small part of the castle complex, *viz.* the workshop, is nevertheless of great historical and documentary value, and will hopefully inform a larger restoration project involving the entire castle. The primary objective has been to use methodologies that respect and, where appropriate, highlight the various construction stages of the castle complex, using modern reconstruction only when necessary.

The project to restore and consolidate the Mamluk dye-shop will concentrate mainly on the great architectural *lacuna* caused by the collapse of the Crusader vault, as well as on some of the caved-in structures. Lightweight materials will be employed (e.g. light concrete, resins and steel) in order to provide structural continuity and to protect the architecture (e.g. construction of new roof-coverings). Selective restoration, consolidation and protection will be carried out on damaged stonework with minimal use of additions and replacements. The various stages of construction will be differentiated using different types of masonry and stone-dressing technique (FIG. 22).

Lastly, the project tackles the theme of tourist routes and utilisation of the monument by proposing illustrated itineraries and offering different viewing points that focus on historical, archaeological and architectural aspects of Shawbak castle, including maps and virtual reconstructions to be displayed in the newly completed visitors' centre.

In conclusion, the aim is to adopt conceptual and methodological principles based on respect for and conservation of existing architectural evidence, rather than on reconstruction. This will allow for the preservation of the monument with full respect for its historical identity and material integrity. We believe that careful observation of the monument is the best way for the observer to understand it and its history, along with the traces that history has left on the structure itself.

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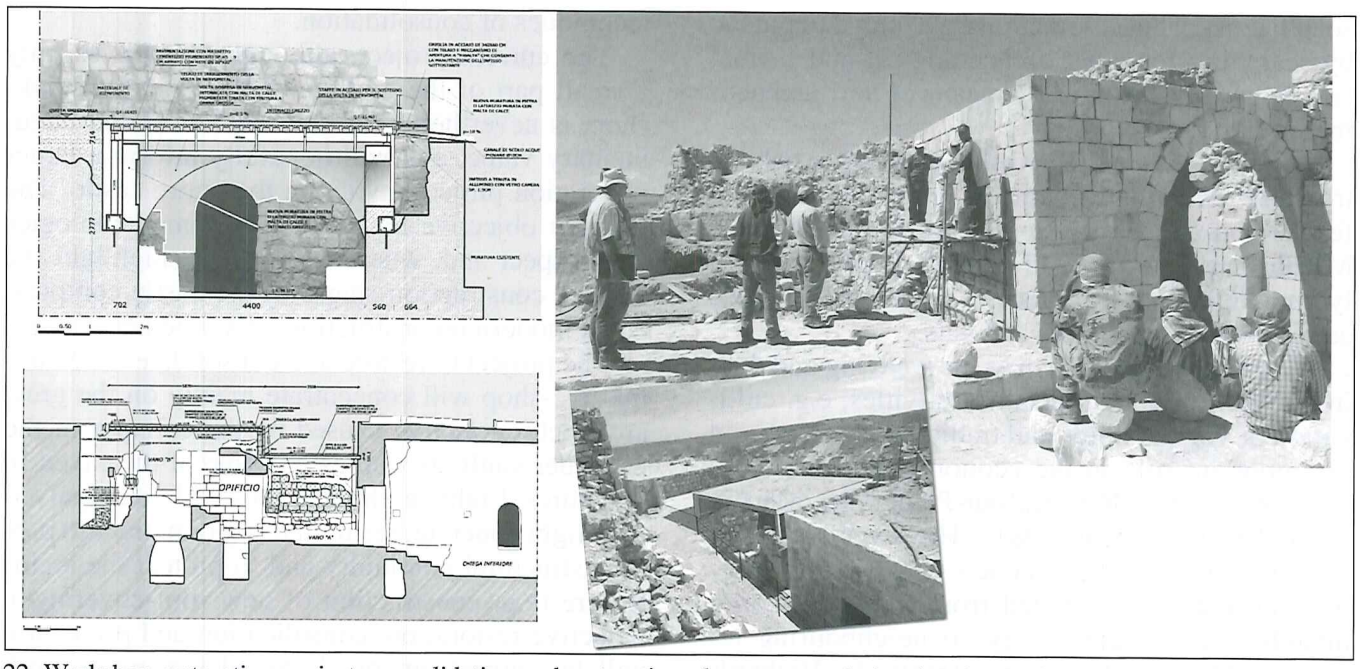

22. Workshop restoration project; consolidation and restoration plan: structural planning for roofing (left), test to fill masonry joins in CF5 (top right) and view of proposed roofing (bottom right).

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