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THE VIEW FROM 'PRE-CRUSADER'
SHAWBAK: TOWARDS A FIRST
CONTEXTUALIZATION THROUGH GIS
VISIBILITY AND SPATIAL ANALYSES

Abstract: The purpose of this study is to provide a first preliminary interpretation of part of the evidence from Shawbak castle which attests to the presence of a 'pre-Crusader, probably Byzantine fort. The strategic features of the location of the fort, in particular a great abundance of water resources, made it indeed strategically advantageous during the Crusader period and in the later Ayyubid and Mamluk periods. Stratigraphic evidence from readings of extant buildings and excavations revealed that the first Crusader foundation of the castle was laid out upon the remains of a Late Roman/Byzantine fortification identified in different parts of the castle. The presence of such fortification should probably be considered contextual to the presence of major forts and potential watchtower sites that have been documented by previous surveys in the area, in particular, a system of strategic locations depending on the castellum of Da'janiya between the Desert highway to the east and the Via Nova Traiana to the west. The need to protect the fertile strip of land east of Shawbak and the natural resources of the area might have required a system of visual control attested to in other nearby regions, which could have involved a signaling network in communication with Shawbak. In this paper, a series of visibility analyses are proposed in order to demonstrate that such system could have worked for Byzantine Shawbak.

Keywords: Jordan; GIS; Byzantine; Shawbak; forts; watchtowers; viewshed

Introduction

The castle of Shawbak in southern Jordan was founded in 1115 AD by King Baldwin I as a stronghold with the role of consolidating the Crusader dominion in the Shara region, between Petra in the south (controlled by the castles of al Habis and Wu'ayra) and Kerak in the north. The castle was erected in the context of a nodal junction of the ancient routes of the King's Highway (then *Via Nova Traiana*) in the inner part of the highlands plateau and the desert route in the eastern desert fringe, probably used by caravans and later by pilgrims for the Hajj after the Islamic conquest of the 7th century (Vannini Nucciotti 2012, 135-144; Nucciotti 2019, 135-138). This is one of the main reasons why its location also continued to be considered strategic during the Ayyubid and Mamluk periods in the 12th to 16th centuries (Nucciotti 2019, 135-138). The archaeological mission led by the University of Florence, represented by the Chair of Medieval Archaeology, has been studying the site since 2002. From 2003 the surveys were accompanied by stratigraphic excavations in potential areas where results from the horizontal deposit could yield promising outcomes (Nucciotti 2007, 27-30). The excavations led to the discovery that Shawbak, similarly to both Wu'ayra and al Habis, was founded by the Crusaders on the remains of an abandoned Late Roman/Byzantine fort or outpost (Pl. 1: 1): soundings opened in correspondence of two buildings and the stratigraphic reading on a third one have revealed at least one Byzantine curtain wall, whose features probably belonged to a fortification (Nucciotti 2007, 35) and which seems to be consistent with the Late Roman-period foundation of sites in the eastern environs of the castle (Vannini and Nucciotti 2003, 520-525; Nucciotti 2019, 131-140). The presence of a ruined fort is mentioned in Early Islamic written sources (Marmadji 1951, 112; Faucherre 2004, 45) as it might explain the short time it took to construct the castle (Vannini Nucciotti 2003, 522-523). These mainly fortified sites have been interpreted in connection with the imperial route system, but their supposed significance varied according to diverse models of interpretation of military sites proposed by different scholars. The present work proposes a series of GIS analyses, based on visibility factors, with the aim of testing the (degree of) validity of a military interpretation of the Shawbak fort and its relationship with the potentially associated sites: possible fortifications and watchtowers. In particular, the aim of this study is to assess the possibility that during the Byzantine period, a system of mutual communication or signaling between major sites could still be an advantageous feature, and to test

the existence of an indirect connection between Shawbak and the major fort of Da'janiya. The Da'janiya *castellum* is located at the easternmost fringe of the arable portion of land before the desert, while below the foothill of Shawbak castle, four freshwater springs allowed cultivation of trees and crops in the wadis below which connect the area with Faynan. Since the presence of a Byzantine fort at Shawbak has not been received by the literature yet (Macdonald 2015, 89-90), the aim of this work is to demonstrate that the site could have been part of a territorial control system, possibly coordinated from the fort of Da'janiya, as it has been shown for the Udruh region (Driessen and Abudanah 2019). The results of these analyses have to be deemed merely preliminary, for they are part of a wider survey endeavor of the rural and agricultural settlements in the environs of the castle, but they are nevertheless indicative as per an attempt to explain the presence of the Shawbak fort and its coexistence with the other fortified sites in the area.

Previous survey work in the Shawbak area

The sites recorded and dated to the Late Roman and Byzantine periods in the area and associated with both service and defensive functions have to be considered as a cumulative result of the surveys carried out in the environs of Shawbak (Pl. 3: 1). In fact, the same importance was not always attributed to some of the sites discussed here which may not have shown clear functional features, but are significant anyway. Survey activity around Shawbak dates back to the explorations carried out by Glueck in the 1930s (1935, 1-202), strongly aimed at discovering the biblical sites of Edom, which provided the fundamentals for future surveys. Research on the Edomite settlement in the highland plateau was then carried out in the 1980s by Hart (Hart and Falkner 1985, 255-277), who also paid some attention to later periods.

Surveys focused on the structures linked to the *Limes Arabicus* have been carried out by Parker, which in the case of Da'janiya, set the foundations for opening excavation trenches inside and outside the fort. Also the surveys led by Zayadine (1992, 228-229), who analyzed road stations linked with the Roman and Byzantine infrastructure system, and then Graf (1995, 278-280), where the author focused on reviewing the evidence of the so-called *Via Militaris* running east of the *Via Nova Traiana* by surveying some of the major sites east of Shawbak castle, pertain to the analysis of fortified sites and their relationship with the route networks.

The most abundant data concerning functional interpretation of single sites come from the Dana Archaeological Survey (DAS), carried out in the 1990s and partially published by Findlater (2004); these survey results and site interpretations are extremely precious for Shawbak, which is located at the center of the area covered by the project. The documented classification of the sites is particularly valuable for understanding how the use of multi-period sites has been evolving over time. During the DAS, 169 of the recorded sites were from the Late Roman/Byzantine period and 81 from the Early Islamic period.

The area of Shawbak was then partially surveyed during the L2HE project (Smith *et al.* 2014), which was carried out as an extension of the ELRAP project on the highlands plateau east of the Faynan area. The survey was in part designed on the baseline provided by Hart's Edom survey and by the DAS and focused on selected sites in the area. Of 48 surveyed sites, 17 were recorded as Roman in their primary occupation, whereas many of them were interpreted as featured by secondary and tertiary dates, although the criteria through which the main occupational phase of the sites was established were not described.

The environs of Da'janiya were the object of reconnaissance activities led by Rucker (2007) with the goal of assessing the role of a fort like that in an apparently 'under-settled' area, with no major towns or villages to defend. Rucker identified a number of potential watchtower sites within the survey region and various water reservoirs that may be ancient in origin.

The Shawbak North Archaeological Project, or SNAP (Yamafuji *et al.* 2015), has provided a remarkable number of sites identified through surveys and pottery collection: for the Roman/Byzantine period, the survey managed to document a great quantity of sites, comprising villages, farmsteads, single structures of variable sizes, clearing mounds, single walls, terraces, and tracks. Being based on the topographical and morphological features of the area, the SNAP survey passed over the lower portions of the slopes east of Shawbak and the highland plateau of the Ifjei plains.

Even though Shawbak was located near an important road junction of the *Via Traiana Nova*, the only possible written evidence of its presence in the pre-Crusader period is its identification as 'town' (?) – *Negla* – in the *Tabula Peutingeriana*, which should probably be identified with the modern settlement of Nijil (Graf 1999, 227; Roll 2007, 123-124; Vannini and Nucciotti 2012, 136).

The last survey, accompanied by surface prospections, is the one carried out by the Jagiellonian University. The project aimed to document

architectural remains of the Da'janiya *castellum* together with their state of preservation and to verify the dating proposed in previous research (Bodzek *et al.* 2018).

From the abovementioned surveys, it is also possible to conclude that until now, no major fortified site has been clearly identified west of the castle.

The sites

The Byzantine fort of Shawbak was located on the top of a conic flinty limestone hill surrounded by four freshwater springs on the northern and southern sides: ain Mgames, ain Al-Raghaya, ain Al-Unsuir, and ain Al-Asi (Pl. 1: 2). The remains of the Byzantine curtain wall have been documented in two buildings, B10 and B39, while the stratigraphic readings of the extant structure in B18 identified an earlier Roman building (2nd-3rd century?) whose function still needs clarification (Vannini and Nucciotti 2012, 136- 137). The curtain wall was built with large blocks of Amman silicified limestone, a material easily found in the surroundings of the castle. Analyses have showed that this building material was not re-employed during the Crusader and Ayyubid periods, while in the Mamluk period, we witness a return of this type of stone, for example in B17 (Nucciotti 2007, 35). Remnants of the wall can be seen on the southern side of the castle between B3 and B11, however, the entrance to the 'pre-Crusader' fort has not been clearly identified, although it may have been located in correspondence of the first entrance of the Crusader wall, B3 (Nucciotti 2007, 34-38).

Located (at almost 5km from the modern settlement of al Hussainiyeh, on the Desert Highway, the *castellum* of Da'janiya has been object of interest of many scholars, of whom Parker (1986), Kennedy (Kennedy and Riley 1990, 170-175), Graf (1995, 278-279), Findlater (2004), Godwin (2006), Rucker (2007), and ultimately a team from the Jagiellonian University (Bodzek *et al.* 2018) have largely contributed to clarify the role of the fort within its territorial context: the conclusions resulting from surface reconnaissance works and excavations point to a probable implementation of the fort between the 3rd and the 4th century, with an occupational timespan that roughly extended beyond the beginning of the 5th century. The *castellum* had walls of an average thickness of 2.25m, with 14 projecting towers to reinforce the curtain, with a height that could easily be 5m from the ground. Among the scholars who surveyed the site, Graf in particular stressed the fact that Da'janiya could have been used also as a road station serving caravans diverging from the Desert Highway or passing near Shawbak from Petra on the way north (Graf 1995, 279).

Khirbet Qannas, 9.5km east from Shawbak castle, is located on a flat ridge flanking the southern side of the easternmost portion of the Wadi Nijil, along the modern road from Shawbak to the Desert Highway. It has been surveyed by Zayadine (1992, 229), Graf (1995, 279), Kennedy (2000, 172-174) Findlater (2004, 197) and Rucker (2007, 21-23). The site consists of a building of rectangular layout, occupying an area of 112×45m, mainly built with limestone and black basalt blocks. Many interpretations of the site have been proposed by different surveyors; some emphasized its nature as a station along a possible route between the Shawbak area and Da'janiya, while others focused on its military features (Findlater 2004, 116-117), including potential projecting towers on the western and northern sides of the structure; a third interpretation takes into account both the defensive features of the complex (the projecting towers and the thickness of the walls of 1.25m) and its service station nature consistent with the evidence from at least two structural phases, involving the construction of a *quadriburgium* with towers projecting to the west followed by an addition of a caravanserai building attached to the eastern side of the former fort (Kennedy 2004, 172-174). Along the north-western boundary of the site, 32 wells/improved cisterns – some still in use – are located in proximity of the shallow wadi, which points to the need for a reliable source of water for the site. South of Qannas, a system of field plots is still recognizable. Despite its possible military and defensive nature, no milestones are associated with Khirbet Qannas (Graf 1995, 279), which is, by the way, located on the course of the Khatt Shebib south of Jebel Da'janiya (Findlater 2004, Map V). Apart from the absence of milestones, no road track has been identified passing nearby the building (Graf 1995, 279).

Along the track of the Trajanic road, 9km north-east from Shawbak castle, another large site, called Khirbet Samra, is located on a gentle slope of a small wadi which runs on the northern boundary down the Baddah area. The site was visited by Rucker (2007) and Findlater (2004, 116-117, 185-186) but neglected by other scholars who worked in the area to investigate Roman and Byzantine sites. The seemingly fortified complex has been mainly dated to the Byzantine period, with substantial reuse during the Middle Islamic period and with a probable earlier phase in the Nabatean period. It is a square building, c. 65×65m, with outer perimeter walls 1m thick and internal walls of 0.80m. South of the main building, a smaller single structure, 9.5×7m, has been described only by Rucker (2007, 51-52). On the basis of surface collection, the surveyors have come to slightly different conclusions. The interpretation of the site and its dating differ according to the two

surveyors: for Findlater, the foundation of the site can be dated to the Nabataean/Early Roman period, with an occupational gap until the Late Byzantine period, to continue well into the Islamic period (Findlater 2004, table 14); for Rucker, the occupational periods of the site are Early Roman, Late Roman and Late Islamic (Rucker 2007, 62).

The last major site is the building, also excavated by Petersen, that might represent the classical phase of the Ottoman Hajj station of Unayzah (Petersen *et al.* 2002, 49; Al Shqour 2015, 197-198); in Findlater's opinion, this caravanserai should be put in relation with Da'janiya and the other sites discussed here as its presence is a confirmation of the route of the Desert Highway which would reach Ma'an to the south coming from Jurf Ed-Durawish in the north (Graf 1995, 278; Findlater 2004, 194-196).

The potential or probable watchtower sites have been reviewed and recorded by different surveys. The nearest to Shawbak castle (1.9km) is the tower identified south of Muthallath, at Khirbat Wamiya (Smith *et al.* 2014, 255), an Iron Age II site reoccupied during the Late Roman and Byzantine periods. Along the track of the *Via Nova Traiana*, near the edge of the plateau, lies a single building recognized by Findlater (2004, 187, 427), who dated it from the Nabataean to the Late Byzantine period, and by Rucker (2007, 48-49), who did not record pottery later than Early Byzantine. The third site is the structure directly south of the main building of Khirbet Samra. Even though Findlater did not describe it and Rucker (2007, 51-52) did not provide any interpretation, this structure might have well fit the topographic position of the fort/road station, which is lightly embedded in the wadi running north of it; furthermore, the thickness of the walls, 1.25m, would support the interpretation of a watchtower. 3.7km north-east of Qannas, overlooking a modern dammed reservoir at the center of the Ifjei plain, a basalt ashlar structure was surveyed by Findlater (2004, Table 45) and Rucker (2007, 33-34), where the former did not report any surface pottery, while the latter managed to document an occupation from the Iron Age II to the Byzantine period.

The last two potential tower sites are located in topographically dominant positions, on the top of two basaltic cones north and east of the region studied here. On the top of Jabal Da'janiya, a possible watchtower was surveyed by Graf (1995, 278), Findlater (2004, Tables 29-30), and Rucker (2007, 31-32). The conclusion about this site is that it might have been an Iron Age II watchtower probably reused during the Nabataean/Early Roman, Late Roman, and Byzantine periods. The final structure is located on the top of Jabal Unayzah, which –even though not proved to have been used during

the period of interest through surface collecting of pottery – would have been an effective way for possible caravanserais of Unayzah to maintain a visual contact with the rest of the sites, given its position behind the hill (Findlater 2004, 195; Bodzek *et al.* 2018, Fig. 14).

Methodology

This study was inspired by recent research on the surveillance systems in the Roman and Byzantine periods in different regions (Williams 2017; Turchetto and Salemi 2017) and on the visibility between fortified sites in the Petra area (Kennedy 2019; Kennedy 2013) and its hinterland (Driessen and Abudanah 2019), with a methodological basis in the synthesis presented by Wheatley and Gillings (Wheatley and Gillings 2000) and Ogburn (2006). The analyses were performed using the ALOS World 3D (3.1 version) elevation model, with a resolution of 30m, which has proved to have a better vertical accuracy with respect to other free 30m DEMs (Digital Elevation Models) such as ASTER and SRTM (Alganci *et al.* 2018). The software used is QGIS 3.10, whose toolbox lists the algorithms developed by Cuckovič for fast viewshed analysis (Cuckovič 2016).

Instead of performing a traditional viewshed analysis, it was decided to carry out a ‘reverse’ viewshed by using the ‘depth below horizon’ algorithm in the processing toolbox. Instead of calculating binary results for visible/non-visible cells, the algorithm provides values indicating which height is required for a certain location to be seen from an observation point, providing clues on the minimum elevation that could grant visual contact from one site to another. The second step was recalculating raster values in order to isolate the heights of interest. Since the location of Shawbak castle is tactically advantageous, while its visual dominance is not immediately obvious with an empirical on-field examination, the Depth Below Horizon was first calculated with a virtual height of 0m for both observer and targets with the aim of assessing the visual capability from Shawbak hill at ground level; the values were then isolated to identify location from which virtually no elevation from the ground is required to see Shawbak. The step was repeated assigning to Shawbak a height of 5m. This value was arrived at by considering the extant walls of other fortifications in Jordan and noticing that a two-story building might well have exceeded this height, especially with the aid of corner and interval towers like in the case of Da’janiya itself (Bodzek *et al.* 2018, 53). Given the absence of complete data from the architectural evidence of the Shawbak fort, it was decided to set this value as a good

parameter to assess the visual field from its location. Another important aspect was evaluating the actual surface observed in correspondence of the major sites distributed in the landscape: to this end, a traditional viewshed was performed from Shawbak at 1.75m and 5m in order to compute the angle of the line of sight at ground level directed to the nearest lower sites, the VNT tower and the possible tower at Samra.

The viewshed layer was thus reclassified taking into account the $\times 60$ and $\times 1100$ factors theorized by Higuchi (1983) for the perception of objects in the landscape: a short range between the point of origin of the viewshed and the observer height (or the height of the observing structure) multiplied by 60; a middle range value comprised between the short range radius and the observer height multiplied in this case by 1100; a long range beyond the last value. Within the short range, the clarity is assumed to be perfect and therefore the visual control can be considered optimal; within the middle range, clarity decreases as the perception of the landscape shifts from single objects to groups of objects; in the long range, clarity significantly decreases and the potential visual control depends mainly on other factors, such as the observer’s sight and atmospheric conditions. Supposing the height of the structures of Shawbak hill at 5m, the short distance viewshed would be from 0 to 300m, the middle distance between 300 and 5500m, and the long distance beyond 5500m. In the second step, a middle range buffer of 5500m was applied to all the sites considered here (Fig. 1).

Shawbak	Da’janiya	19430 m
Shawbak	Qannas	10560 m
Shawbak	Samra	9320 m
Shawbak	Samra tower	9275 m
Shawbak	VNT tower	6340 m
Shawbak	Jabal Da’janiya tower	15170 m
Shawbak	Unayzah	23030 m
Shawbak	Unayzah tower	21450 m
Shawbak	Muthallath tower	1900 m
Shawbak	Ifjej tower	13830 m

Fig. 1. Table reporting distances from the Shawbak fort to the other sites in meters

Results

With a hypothesized height of 5m for the observer, and the target object being set at ground level, the visibility assessment carried out on

the Shawbak fort has showed that an observer could establish visual contact from this point with all the other sites considered in this study, except the possible road station identified at Unayzah. On the other hand, at the height of an average individual (1.75m), the virtual ground visibility from the top of the hill was limited, even if provided by the resulting value as not possible for small elevations (Pl. 2: 2, 3: 1). The viewshed results, even if probably disturbed by errors in the DEM surface (Caglar *et al.* 2018, 697-615), suggest that the Shawbak fort would be in visual contact with the watchtower on the *Via Nova Traiana* (VNT tower) and Samra (Samra and Samra tower), but not with the track of the Roman road. This is shown by the angle of incidence of the line of sight from Shawbak, which at 5m of height, falls on the VNT tower and the Samra tower at nearly 90°, almost straight towards the edge of the Ifjiej plateau (Pl. 3: 2, 4: 1). This suggest that the visual link from the fort would have been solely dependent on the architectural prominence of the watchtowers above the ground. The VNT tower establishes an indirect communication link with both Khirbet Qannas and Da'janiya (the latter through the second tower north-east of Qannas) and possibly with Samra. The use of a height of 5m both for observers and targets yielded an intervisibility network for virtually all sites except Unayzah (Pl. 4: 2, 5: 1). As for the distances between sites, only the possible tower at Muthallath falls within the computed range of medium distance in Higuchi's classification (300 to 5500m). The role of this tower, if occupied simultaneously with the Shawbak fort, should probably be interpreted in relation with the territory south of Shawbak.

Discussion

The archaeological (and historical) interpretation of the sites and infrastructures of the Roman and Byzantine frontier has changed during the past two decades, shifting from an idea of the *limes* intended as a military road or a mere frontier area to a broader concept in which more elements are considered: first, the interpretation of the main routes within a wider network of secondary and tertiary roads; second, the landscape connectivity deriving from this network, which allowed links between fortified sites, hamlets and villages, farmsteads and field systems; third, the general reconsidering of the strategic location of the main fortified sites, which rather than being oriented by the terrain morphology, was strictly bound to the presence of water and agricultural resources (Graf 1995, 280-281; Findlater 2004, 267-279). The latter aspect seems to be most conspicuous for the Byzantine period

in the Petra area, during which a shift of settlement concentration took place in the direction of Udruh; this shift was accompanied by an intensification of agricultural activities and possibly a concentration of land properties to fewer hands (Kouki 2012, 129-133; Driessen and Abudanah 2019, 470- 471). The reinterpretation proposed by Findlater (2004) makes clear that there is strong topographic correlation between military sites, production centers and imperial estates and has been recognized as valid for the Udruh region (Abudanah 2006, 36). This model, proposed for the Petra hinterland, corroborates the surveillance system that was probably implemented around Udruh, now shown as possible also for the area east of Shawbak castle, with some clarifications. Previous surveys recorded a certain level of agricultural exploitation both in the wadis north-east of Shawbak castle and in the highland plains of Ifjei in the Roman and Byzantine periods, suggesting that a network of surveillance structures might have been used for ensuring control over the fertile lands of the region (Pl. 5: 2). Even if the shortest 'visual path' between Shawbak and Da'janiya might be identified, since the distances between Shawbak, the VNT tower, the tower north-east of Qannas ('Ifjei tower') and Da'janiya all exceed the 5500m and fall within Higuchi's long-range distances (Pl. 6: 1), the ongoing survey has contributed to propose additional locations within the 5500m radius from Shawbak castle that may have been used as watchtowers and outlooks: a possible round tower on the hill immediately south of Shawbak castle (Jayyah tower) and a mound at the summit of Tur Abu Ras Hill, located north-east of the castle and overlooking the Tartar and Bustan wadis. The first site did not show any surface material, while the second site was featured by great quantities of Late Roman, Byzantine, and Middle Islamic pottery sherds and traces of quarrying activity on the eastern slope of the hill (Pl. 6: 2). Despite this evidence, it must be noticed that the 'VNT tower' falls only almost 1km outside the middle range buffer zone, suggesting that a height of 6.5m – quite realistic for a watchtower – would have sufficed to establish a good visual link; the same considerations can be made about the tower north-east of Qannas (Ifjei tower) and its visibility towards Da'janiya. The mutual distance between the VNT tower and the Ifjei tower, roughly 7500m, could be achieved with a height of 7.5m.

Conclusion

The logic of the Shawbak fort was most probably that of protecting the precious water resources at the foot of the hill itself, the potentially

cultivable areas in the wadis below (Kennedy and Bewley 2010, 523; Smith *et al.* 2014, 253-256), and the segment of the *Via Nova Traiana* which ran nearby. Comparing it with the other sites discussed here, one could say that the fort of Shawbak protected the most strategic location of the area in terms of water availability. This provides an explanation to the need of establishing a visual link with the other main sites related both to the route system and to the control of the fertile strip of land of the Ifej plains, which was maintained through a connection with the chief fortification of the area, the *castellum* of Da'janiya. Shawbak is thus positioned at the end of two road segments, the one of the *Via Nova Traiana* before turning south in the direction of Petra and a possible track that would have linked the Desert Highway with Shawbak leading from Da'janiya and Qannas. A potential control of the traffic along these routes would have been indirect, mediated by the watchtowers distributed on their course. A direct visual control could have been necessary on the hypothesized segment of the *Via Nova Traiana* that would have slightly diverted west from Samra to descend into the Tartar Wadi down to Abu Maqhtooob in the direction of Shawbak castle (Pl. 7), as kindly communicated by Fawzi Abudanah (Abudanah *et al.* forthcoming).

Even if the surface evidence of a reoccupation of potential outlooks and possible watchtowers is not overwhelming, it has been acknowledged that a certain level of reuse of these structures, predominantly Iron Age and Nabataean in their primary date, took place between the Late Roman and the Byzantine periods (Graf 1995, 277-278; Rucker 2007, 55; Bodzek *et al.* 2018, 65). The existence of a relatively widespread communication system in this portion of land gains further significance by interpreting the Shawbak fort in the light of Findlater's conclusion, where he identifies the Shawbak area as probably belonging to the territorial pertinences of an imperial estate (Mayer 1990, 41; Graf 1995, 281; Findlater 2004, 237-265). As it was shown in the case of Udruh (Driessen and Abudanah 2019, 470-472), a system of communication between viewpoints would have served to protect and control agricultural properties, even if a comprehensive and focused study for evaluating the intensity of land exploitation in the Byzantine period is still missing for the Shawbak area.

As a preliminary work, this study demonstrates that a system like the one attested for the Udruh region potentially fits the case of Shawbak. Considering the lack of excavations in the majority of the sites discussed here (excluding Shawbak, where the study of materials and stratigraphic data is still ongoing, and Da'janiya, where the trenches only partially sounded the deposit of the fort), GIS visibility analyses have shown some

potential in verifying models proposed in nearby areas and could be used as a foundation to understand the role of those sites that were reoccupied during the Middle Islamic period (e.g. Samra and Qannas), when Shawbak castle would have become the center of a possible control system on that portion of land, starting with the Crusader settlers.

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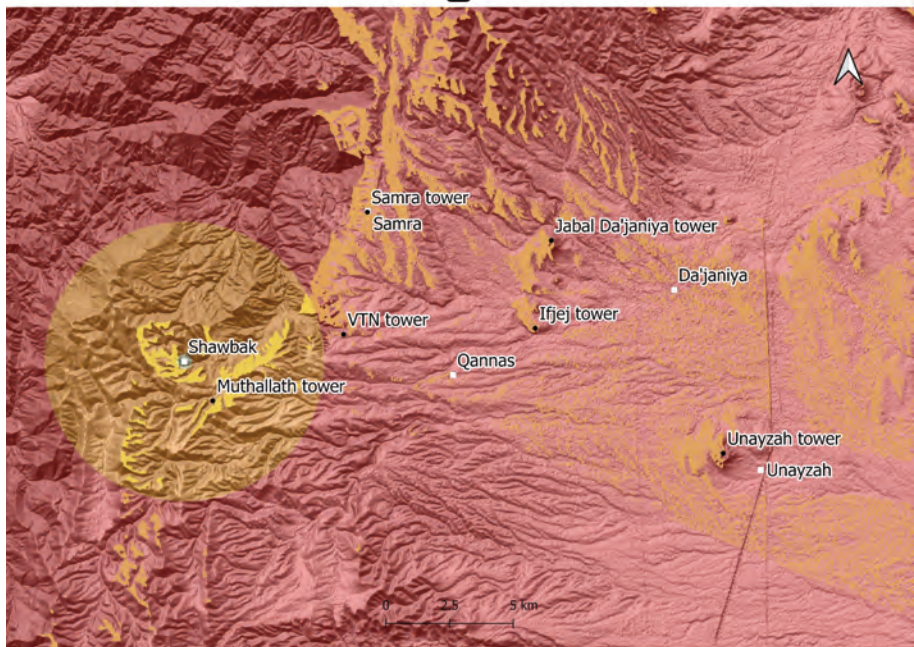


Pl. 1: 1. Orthophoto and plan of Shawbak with buildings where 'pre-Crusader' structures have been identified (in red)

Pl. 1: 2. Map showing Shawbak castle, the springs at the foot of the hill, and part of the cultivated wadis east of it



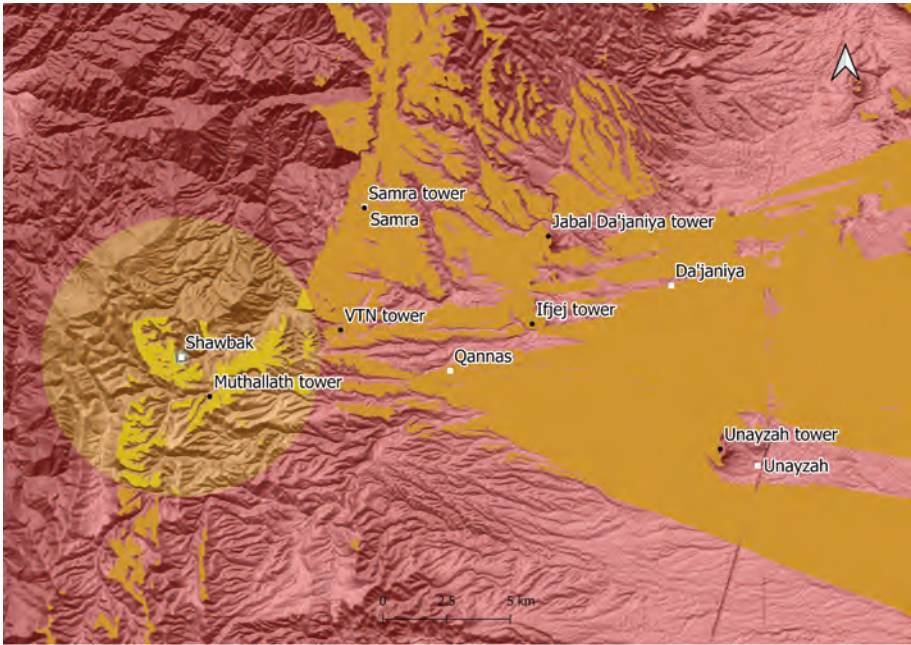
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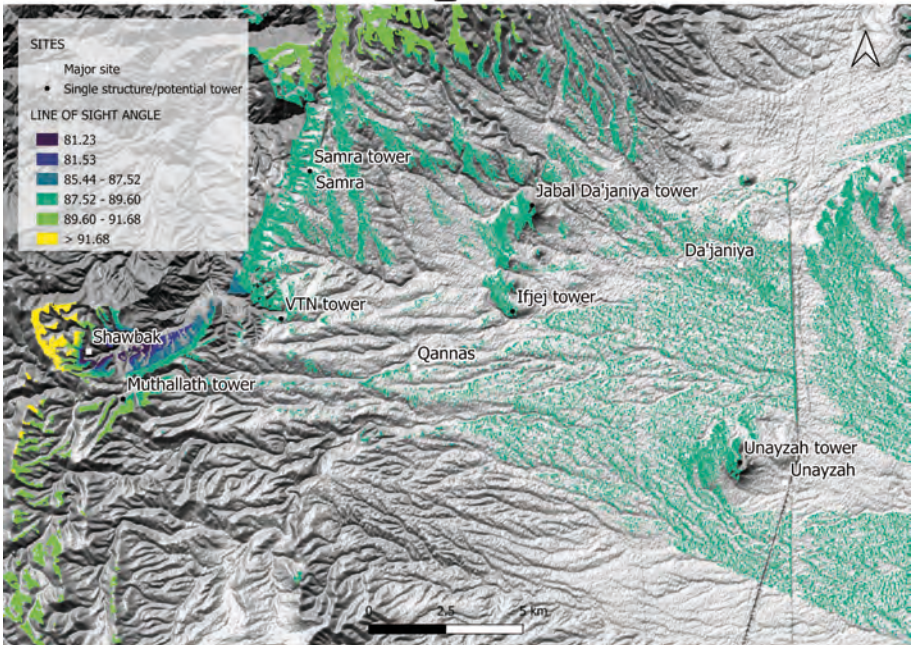
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Pl. 2: 1. Map showing the sites studied and the main routes in the portion of territory east of Shawbak castle

Pl. 2: 2. Depth below horizon viewshed, with middle range buffer zone at 5500m showing which locations at 0m are visible from Shawbak at 0m

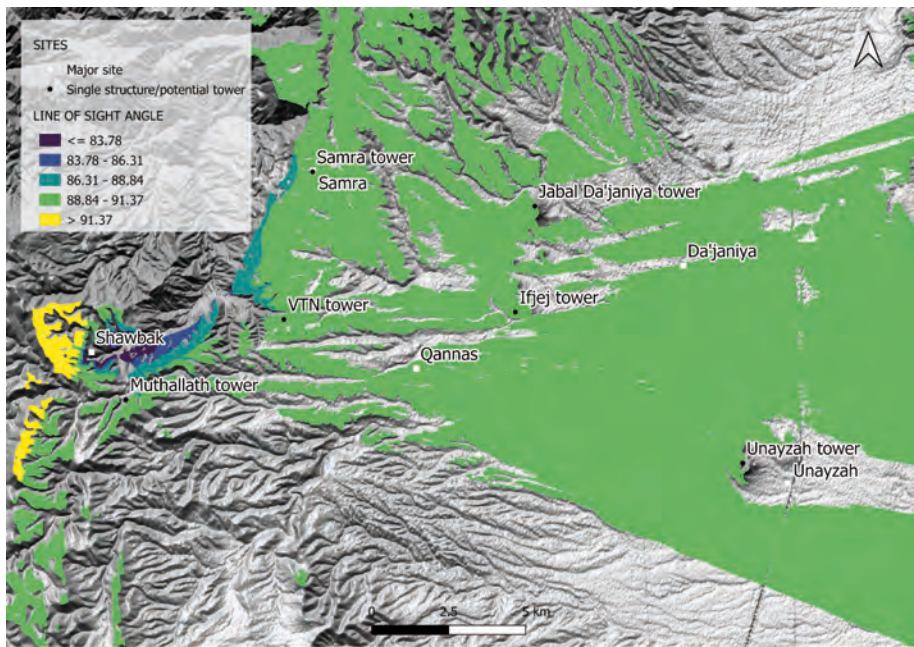


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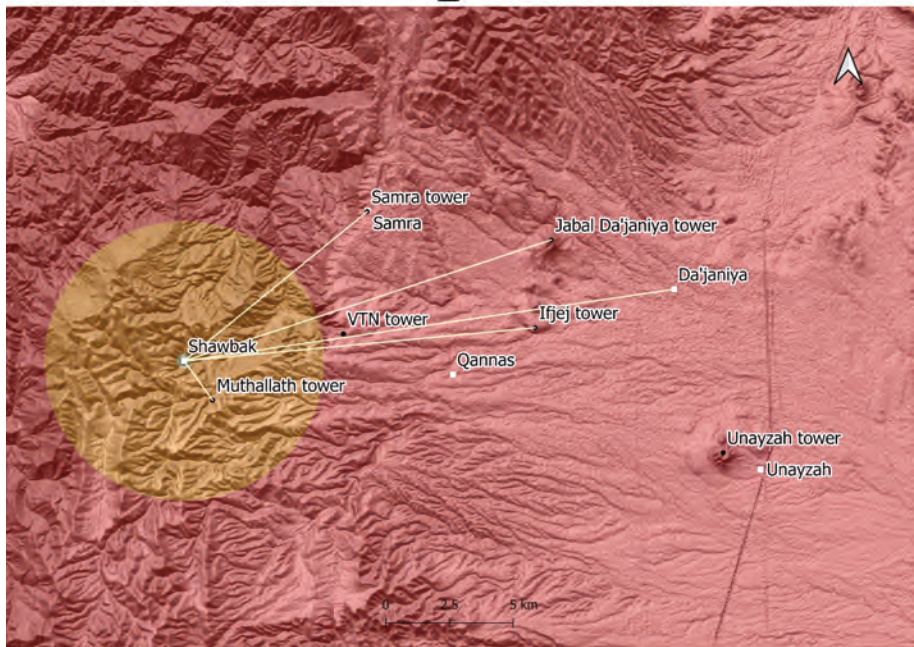


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Pl. 3: 1. Depth below horizon viewshed, with middle range buffer zone at 5500m showing which locations at 5m are visible from Shawbak at 0m
Pl. 3: 2. Viewshed from Shawbak at an observer height of 1.75m to ground level targets, indicating the line of sight angle, from yellow (more than 90°) to dark blue (less than 90°)

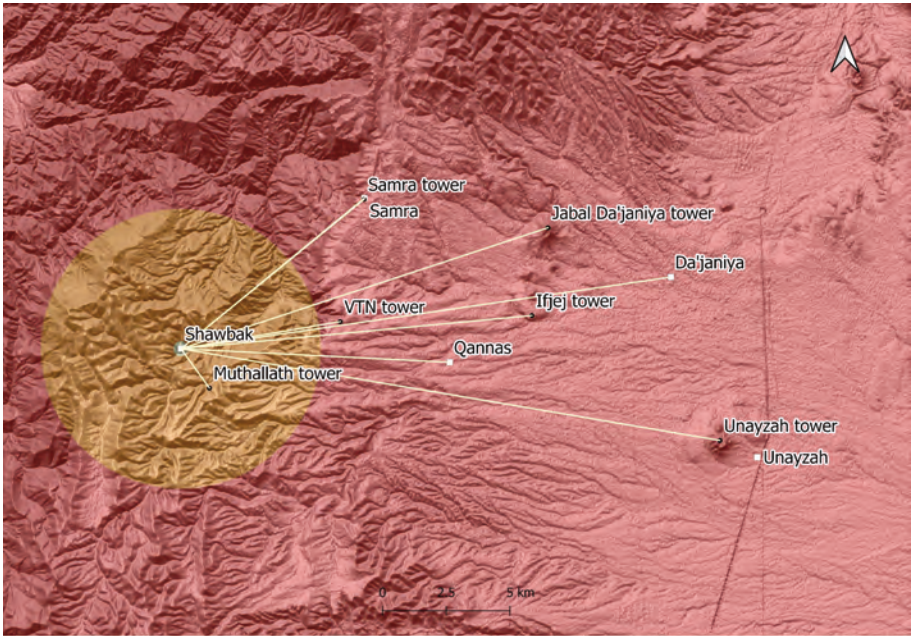


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Pl. 4: 1. Viewshed from Shawbak at an observer height of 1.75m to 5m high targets, indicating the line of sight angle, from yellow (more than 90°) to dark blue (less than 90°)
Pl. 4: 2. Lines of sight from Shawbak at a height of 5m directed to targets at ground level

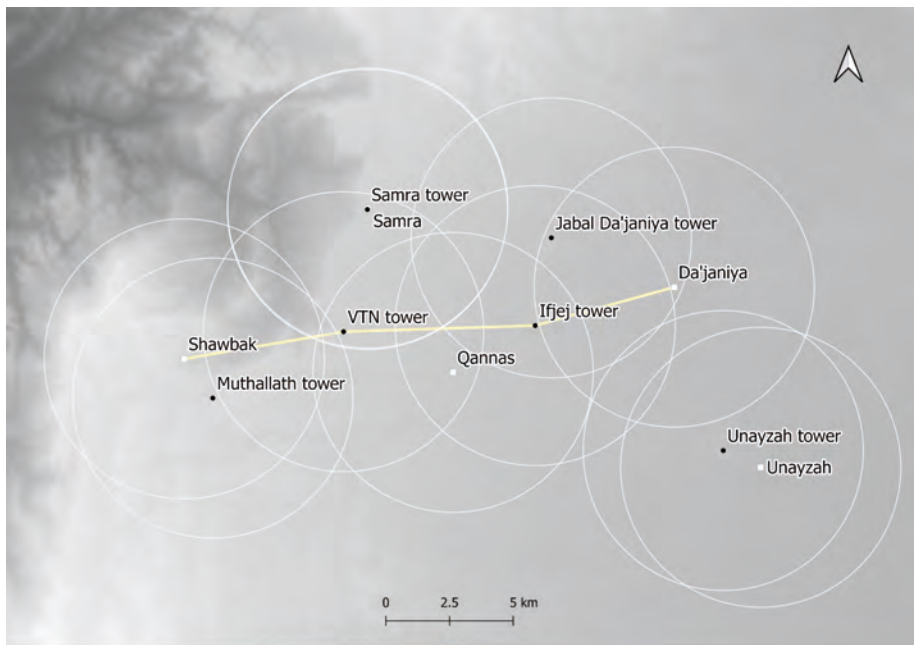


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Pl. 5: 1. Lines of sight from Shawbak at a height of 5m directed to targets 5m high
Pl. 5: 2. Map showing the approximate boundary of the cultivated strip of land east of Shawbak

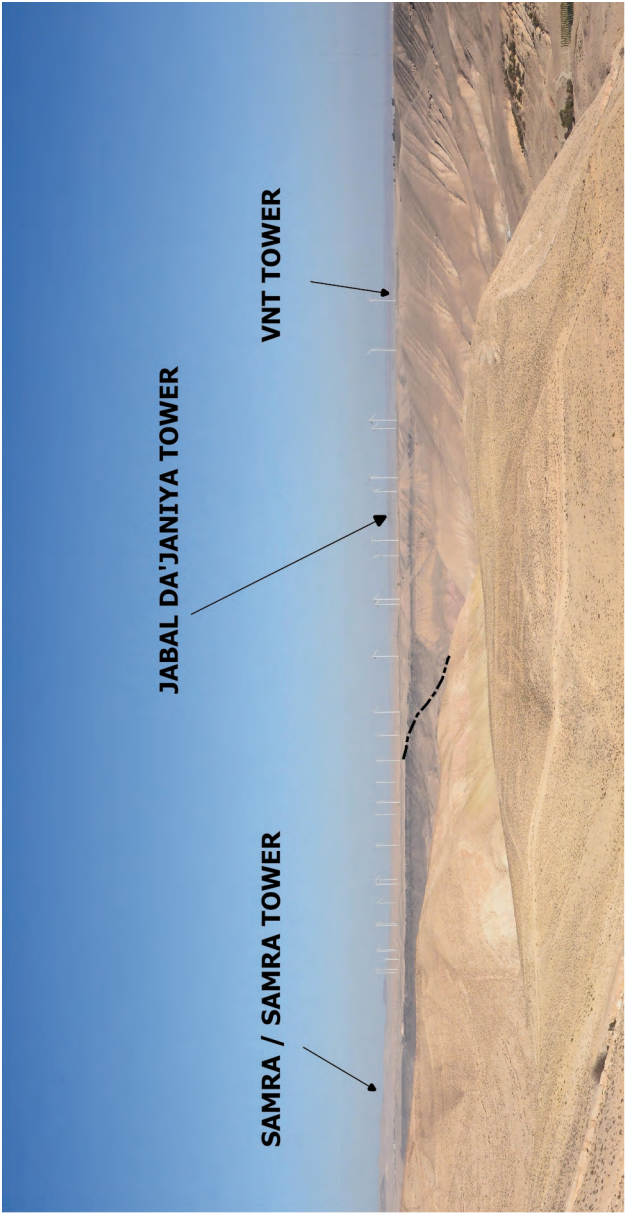


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Pl. 6: 1. The reconstructed communication link between Shawbak and Da'janiya with a 5500m middle range buffer from each site
Pl. 6: 2. Map showing the two possible locations within the radius of 5500m from Shawbak castle



Pl. 7. View from Shawbak castle showing the sites of Samra, VNT tower, and Jabal Da’janiya tower. The dotted line represents a possible segment of *Via Nova Traiana* in the direction of Shawbak castle