

# CULTURAL HERITAGE DAMAGE ASSESSMENT AT KHIRBET AL-KHALDE IN A *LONGUE DURÉE* PERSPECTIVE

## Multiscalar Methodologies and Survey Results

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### ABSTRACT

Fieldwork projects in the Middle East and North Africa are increasingly integrating a wide variety of methodologies, and often such rapidly developing approaches are results of the fragile situation in the region. While this trend, moving away from purely traditional approaches, is welcome and promises to open new avenues of investigation, the utilization of legacy data, which holds a vast trove of information, is often overlooked in the process of publishing results. Such legacy data can help us understand the sites in a more holistic way both before, during, and after fieldwork. This contribution advocates for the inclusion of legacy data as preparation for survey and fieldwork and shows in which ways the analysis of such data can aid the understanding of a site in its *longue durée* perspective, especially when integrated with other research approaches.

**KEYWORDS:** Khirbet al-Khalde, fieldwork, legacy data, multiscalar survey, cultural heritage protection and preservation

### Situating the Khirbet al-Khalde Archaeological Project within the Discussions of Cultural Heritage Preservation and Management in the MENA Region

Cultural heritage in the Middle East and North Africa (MENA) region is rich and varied. It is, however, also under threat in numerous places, and not only when situated in a conflict zone. Much public attention has recently focused on the devastating consequences of the wars in Syria and Iraq and on the cultural heritage of those countries, while less attention, outside of academic discourse, has been paid to the cultural heritage of Jordan, modern Israel, the West Bank and Gaza Strip, and Lebanon. Nevertheless, even in MENA countries with stable political conditions, cultural heritage in many places is under threat from rapid urban expansion, lack of resources for cultural heritage protection and monitoring, as well as modern looting and destruction. While it is impossible to resolve this situation without means that are not always available to projects working in these regions, the situation on a local level and a smaller scale might be changed step-by-step through the implementation of new and more holistic strategies in fieldwork projects. Such a development is already used by missions working in Jordan (see, e.g., Contreras and Brodie 2010; Tuttle 2013; Kersel, Hill, and Chesson 2014; Kersel and Hill 2016; Kopij et al. 2023, to name but a few). Overall, there is high awareness



of cultural heritage preservation and restoration as well as the importance of building collaborations with local communities (see, e.g., Corbett and Ronza 2022; de Vries 2022; and the webpages of the foreign schools and institutes in Jordan, e.g., the American Center of Research's [ACOR] Sustainable Cultural Heritage through Engagement of Local Communities Project [SCHEP], <https://acorjordan.org>; <https://usaidscshep.org>). While field archaeology has developed rapidly in the last decades and data-sharing as well as publication speed have been improving, archaeologists are often still struggling with how to include legacy data in the best possible way into their projects, both in the preparation of fieldwork and during fieldwork. Definitions of legacy data are broad and numerous and most often refer to data that has been accumulated in the past and which might not be stored in an easily accessible way and, therefore, does not easily enter scholarship. Legacy data can include data that has been organized or not been organized, and it can include data accumulated by humans as well as system-generated data. Legacy data often proves crucial, however, to the understanding of the development of sites and the ways in which archaeological sites have been previously excavated or shaped by nature or other human actions. Gaining access to, managing, as well as analyzing and incorporating legacy data into new fieldwork projects can be challenging and sometimes impossible, particularly when the data comes from earlier and nonconnected projects. The use of legacy data, however, is increasingly becoming something that is discussed in archaeology on a variety of levels and includes both field archaeology as well as the study of collections (Raja 2023; Frey and Raja, forthcoming). Recent research has shown the potential impact of such incorporation of legacy data and the entirely new perspectives on sites that it can bring to the forefront (Brughmans et al. 2021; Lichtenberger, Raja, and Stott 2019; Stott et al. 2018), including how it can contribute to a deeper knowledge of archaeology already undertaken at sites (e.g., Bobou, Miranda, and Raja 2022a; Bobou et al. 2023; Raja 2023). Such data can also include documentation of earlier visits to the site by travelers (Sartre-Fauriat 2021; Bobou, Miranda, and Raja 2022b), in the shape of travel accounts or personal diaries (Raja, Steding, and Yon 2021), correspondence between travelers and their relations or between agents and collectors (Miranda and Raja 2022), earlier maps, aerial photographs,

and even historical satellite imagery, which preserve, like aerial photography, a frozen moment in time (Contreras and Brodie 2010; Stott et al. 2018; Lichtenberger, Raja, and Stott 2019; Brughmans et al. 2021; Kopij et al. 2023). Legacy data is, so to speak, a very broad category of material. However, while much research has been done on legacy data in general, it is most often treated separately from ongoing fieldwork, as a field of its own within the genre of historiography, history of the region, gender history (when women traveled), or political and military history. Nonetheless, there is a large, untapped potential in incorporating such data both in preparation for fieldwork and surveys as well as during the fieldwork in order to understand a site or region as holistically as possible (Mortensen 2018; Lichtenberger and Raja 2018). While surveying can be used as a fieldwork tool to monitor the state and preservation of sites, legacy data can complement on-the-ground survey work by bringing into the picture more knowledge about the chronological development and state of sites—sometimes at various points over several centuries. The complementarity of such data and fieldwork is the focus of this contribution.

Archaeological sites usually comprise a variety of periods, some covering several thousand years; however, most often, archaeologists have a particular period of interest or expertise, which can skew the overall picture by emphasizing one cultural period over others. Fortunately, over time it has become common to engage also with the periods outside of one's own expertise, and so the *longue durée* perspective has become more pronounced in archaeological research. However, taking a *longue durée* perspective does not only apply to archaeological evidence from the premodern past but just as much to the postantique and postmedieval heritage. This means that the history of research also ideally should constitute an embedded part of the way in which fieldwork is undertaken, although we are well aware that access to legacy data might not always be as easy as one would like it to be. In this article the *longue durée* perspective includes the accessible legacy data from the postantique and postmedieval periods as well.

The aim of this contribution is twofold. Firstly, we present a damage-and-destruction assessment of the site of Khirbet al-Khalde undertaken during a survey in the summer of 2023. Secondly, we present the multiscale

approach used to document, trace, and analyze such damage through the combined use of ground survey, drone imaging, historical satellite and aerial photography, as well as descriptions of previous visits to the site. This brings to the forefront the ways in which such integrative methodology creates a more holistic understanding of the processes of damage and destruction.

### The Fort and Caravanserai at Khirbet al-Khalde

Khirbet al-Khalde is situated approximately 26 km northeast of Aqaba in the Wadi al-Yutm and along the Via Nova Traiana (Fig. 1). Even before the construction of this Roman road, the wadi supported the movement of trade between the Red Sea and the settlements of the Hisma desert and beyond. The remains of Khirbet al-Khalde are situated between two low hills that provide good observation points over the wadi and a higher jebel that hosts

a spring (known as 'Ain or Moyet el-Khaldeh by Savignac and Glueck: Savignac 1932: 595; Glueck 1937–1939: 15). As is common in the Wadi al-Yutm, granite and basalt dominate the geology of the site.

The remains include a quadrangular fort and a second, smaller rectangular building to the southwest. The latter has been traditionally interpreted as a caravanserai, but this remains a hypothesis yet to be tested by archaeological investigations (Fig. 2). The northeast-oriented fort was defended by four rectangular corner towers (Fig. 3). The debris caused by the collapse of the walls makes it difficult to discern the plan of the military compound without excavations; however, the still visible in situ remains reveal that the fort was accessed via a gate on its northeast side. The interior of the compound was divided into two irregular open areas by a partition wall while rooms were situated against its perimeter wall. In the middle of the southern half of the fort was a cistern, and, in the northern section, a deep sounding conducted by Mohammad

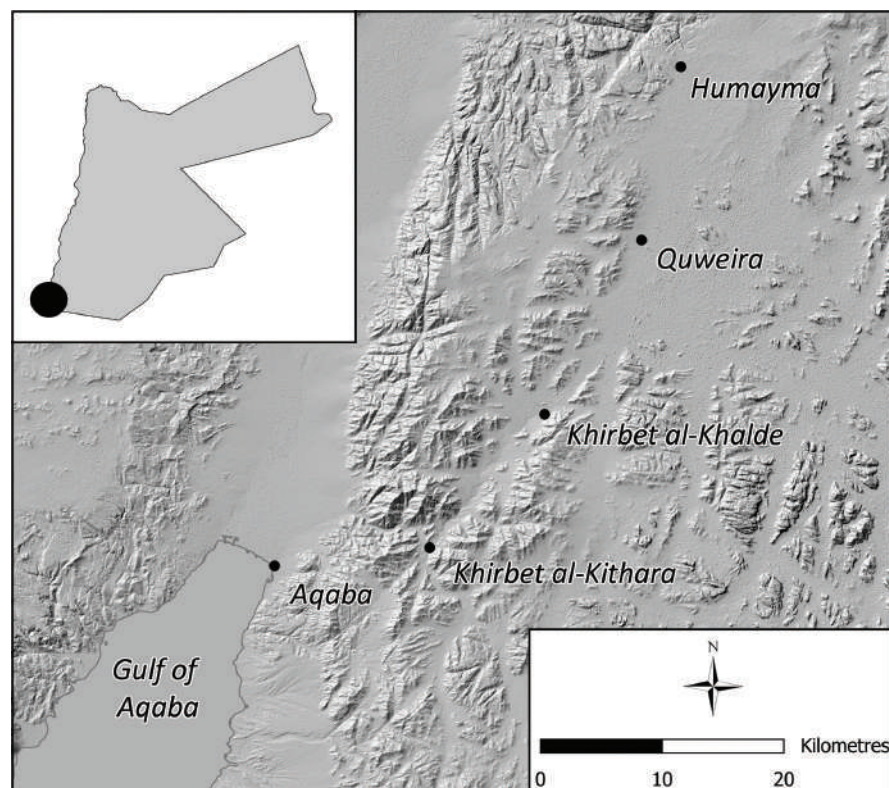


FIG. 1

Map showing the main sites in the area.  
(Courtesy of the Khirbet al-Khalde  
Archaeological Project.)





**FIG. 2**  
**Drone photo of the supposed caravanserai structure.** (Courtesy of the Khirbet al-Khalde Archaeological Project.)



**FIG. 3**  
**Drone photo of the fort structure facing southwest.** (Courtesy of the Khirbet al-Khalde Archaeological Project.)

Waheeb and his team in 1995 brought to light a hypocaust (Waheeb 1996: 346). The presumed caravanserai is situated southwest of the fort and had a gate on its northeast side. The building centered around an open courtyard onto which opened rooms built against its perimeter walls. In addition to the fort and caravanserai, the remains of two watchtowers are situated on the two low hills to the north and southwest of the fort, and an aqueduct (measuring just under 1 km in length) connects a spring to the military compound. Other visible archaeological remains include a cemetery, cisterns, and a lime kiln (for an overview of the remains, see Kennedy 2002, with bibliography).

Earlier visitors to the site dated the occupation of Khirbet al-Khalde from the Nabatean to the late Byzantine periods. In addition to confirming this conclusion, the data collected from our 2023 survey suggests occupation may have extended into the Islamic period. This continuity, which seems to contrast the situation in other long-distance trade routes in this region (e.g., see the Petra-Gaza route: Erickson-Gini and Israel 2013: 50–51), is likely to be explained by the growing importance of Aila as a trading center in late antiquity (Parker 2009: 82–83) and the longevity of sites in the Hisma Desert and further north (see, e.g., Humayma: Oleson and Schick 2013: 551–53; and Petra: Fiema 2002). If confirmed, the presence of a caravanserai next to the fort would be indicative of the strong link that existed between international trade and the military in the Roman period and beyond. The caravan-fort combination is not new, but it is not attested elsewhere along this southern stretch of the Via Nova Traiana. All this makes Khirbet al-Khalde a unique site to study when it comes to the evolution of long-distance trade over the *longue durée*, the relationship between trade and the military, and, more generally, the level of resilience and everyday life of borderland communities (Seland 2014; Cobb 2018; Bar-Oz et al. 2022).

### The Khirbet al-Khalde Survey Project 2023

In July 2023, an international survey project was launched at Khirbet al-Khalde (Figs. 4–5). The project's aim is to examine the site in a *longue durée* perspective including its modern history, embracing earlier work at

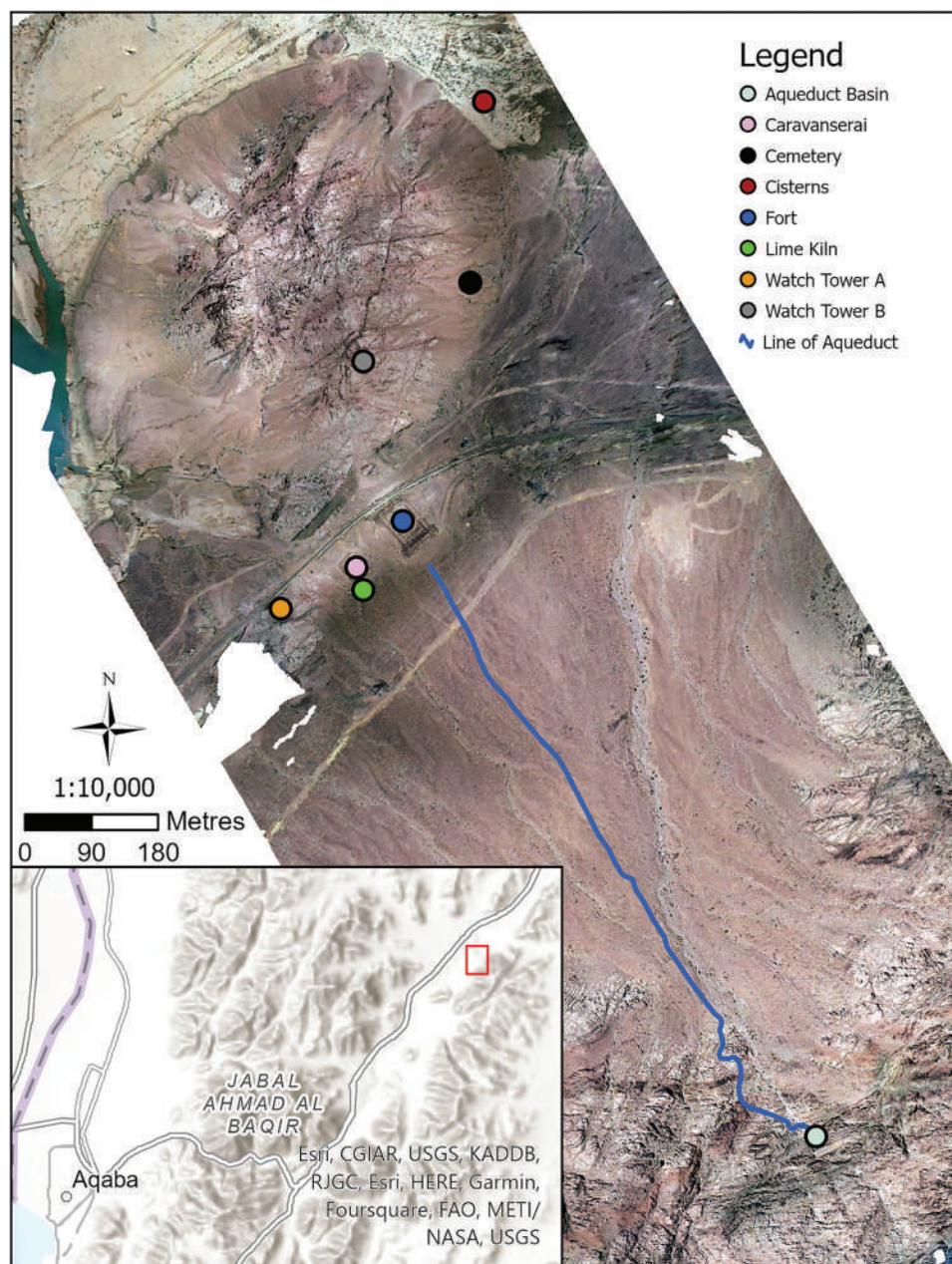
the site, documented visits by travelers, the impact that modern developments around the site have had on the site's structures, as well as modern destructions. The site's potential to shed light on the Roman military and trade routes from a *longue durée* perspective coupled with the necessity to clarify certain conclusions reached by modern scholarship initiated the first systematic investigation of the remains at Khirbet al-Khalde. The primary aims of the survey were to develop an improved chronology, investigate the site's history from a diachronic perspective, better understand the role of trade, and assess the damage and threats to the site to help develop a conservation plan for its physical remains. This was achieved through a multiscalar methodology that included surface collection, architectural survey, 3D modeling, drone photography, laboratory analyses on selected artifacts, and the study of previous reports and satellite imagery (Harvey, Intagliata, and Raja 2024; Harvey, Intagliata, and Raja, forthcoming). In particular, the analysis of past reports and photographs, including satellite imagery, proved to be pivotal in tracking the transformations and destructions that the site experienced over the twentieth century.

### The History of Khirbet al-Khalde and the Historiography of Research

Despite its research potential, Khirbet al-Khalde has never been the focus of systematic, in-depth archaeological investigation. The reasons for this are numerous: the site is situated in a location that is fairly difficult to reach—not least in terms of bringing equipment for survey and excavation. In addition, its remains are currently threatened by human activities, including illicit excavations and natural erosion resulting from continual flooding of the wadi as well as the runoff from the hill to the east of the site (Fig. 6). The closest community to the site is located across the highway from it within sight of its remains, but it was not possible during the short and limited survey season to engage properly with local stakeholders.

Shepherds pass through and around the site, as do camel herders, and there are a few modern uninhabited



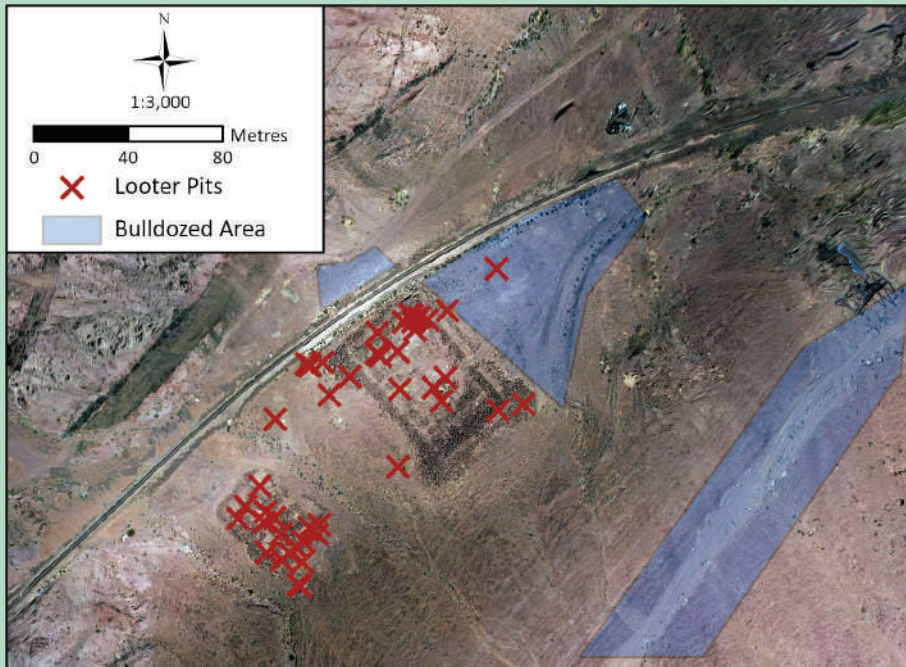


**FIG. 4**  
**Map of Khirbet al-Khalde**  
**with the main features of the**  
**site marked.** (Courtesy of the  
 Khirbet al-Khalde Archaeological  
 Project.)

structures some way from the site of shelter-like character. There is no permanent guard at the site, although monitoring by the Department of Antiquities does take place. Furthermore, the construction of the Aqaba branch of the Hijaz Railway resulted in the partial demolition of the north tower of the fort, while the area

to the north and northeast of this compound shows evident traces of invasive bulldozing (Fig. 7). To the south, there is a service dirt road associated with the north-east-southwest power line, and this cuts through the aqueduct, which comes from the hill southeast of the site and runs in a more or less straight line into the fort





**FIG. 5**  
Map of the site showing the extent of bulldozed areas and looters' pits. (Courtesy of the Khirbet al-Khalde Archaeological Project.)



**FIG. 6**  
Overview photograph of Khirbet al-Khalde showing bulldozing, trench to redirect runoff, and numerous small channels carved by runoff water, facing southeast. (Courtesy of the Khirbet al-Khalde Archaeological Project.)



FIG. 7

Photograph showing the bulldozing area in front of the northeast facade of fort, facing southwest. (Courtesy of the Khirbet al-Khalde Archaeological Project.)

structure (Fig. 8). A large number of looters' pits dot the site, mostly concentrated within the fort and caravanserai structures. Furthermore, the cemetery to the northeast of the fort has been heavily looted.

Until the recent survey, the destruction, which had been noted by earlier visitors to the site (De Backer and Scott 2015: 315; Scott 2016: 224), was not systemically documented, despite it being an integral and profound part of the site's history. The remains at Khirbet al-Khalde have attracted the attention of travelers and archaeologists since the late nineteenth century, resulting in invaluable preliminary descriptions of the site's remains and observations about its nature, chronology, and function. Among those travelers, Sir Aurel Stein visited Khirbet al-Khalde in 1939 and was the first to correctly identify it as the *Praesidio* from the Tabula Peutingeriana. Stein's visit also resulted in the earliest drawn plans of the fort and the presumed caravanserai (Stein 1940: 437; Gregory and Kennedy 1985: 308–14). In 1976, S. T. Parker conducted a brief surface collection of the site and confirmed earlier assessments that the site was occupied from the Nabatean to the late Byzantine period (Parker 1976: 25, no. 38; Parker 1986: 108–9).

The first damage assessment of the site, however, did not occur until the mid-1990s when Khirbet al-Khalde

was visited by G. Bisheh and his team as part of the Desert Highway Realignment Project, which produced a short report. Although Khirbet al-Khalde is listed among those sites that are “not in immediate danger of destruction,” the report noted that one of the towers of the fort had been bulldozed for the construction of the railway (Bisheh et al. 1993: 124–25; this observation was later confirmed by our survey). Among the most recent visits to the site, noteworthy are those conducted within the framework of the Wadi Yutm Archaeological Survey directed by J. M. Scott (Scott 2014, 2016) and the Khirbet al-Khalde Archaeological Salvation Project directed by F. De Backer and J. M. Scott (De Backer and Scott 2015). The latter, which included a visit to the site in 2011, produced a short report that noted damage from human and natural activities (De Backer and Scott 2015: 315–16). Such types of damage are not novel in the Wadi al-Yutm and have previously been reported at other sites, perhaps the most emblematic situation being that at Khirbet al-Kithara, where the fort was cut through by the railway (Parker 1986: 109). Despite this recent attempt, before our survey, there had been no systematic collection of data pertaining to the damage brought about to the site by modern disturbances and their various phases.





**FIG. 8**  
 Photograph of partially exposed  
 aqueduct with the run-off from the  
 hill visible in the background, facing  
 southeast. (Courtesy of the Khirbet  
 al-Khalde Archaeological Project.)

### Damage from Bulldozing

Throughout the last quarter of the twentieth century, Khirbet al-Khalde suffered heavily from building activities for the construction of the Ma'an–Aqaba railroad and the Amman–Aqaba transmission line. The railroad's

origin—although not in the physical location of the present one—goes back to the Hejaz Railway constructed at the time of the Ottoman Empire, which connected Damascus and Medina directly. However, after World War I, the railway did not operate south of Ma'an. It was only in 1975 that the Hedjaz Jordan Railway company



constructed a one-track railroad between Ma'an and Aqaba, whose main purpose, from the late 1970s, was to transport phosphates from mines close to al-Abiad and Ma'an to the harbor in Aqaba for export. The railroad closed in 2018. Both the construction of the railroad and the train traffic on the stretch likely attracted attention to Khirbet al-Khalde, which the trains passed.

The now-disused railroad tracks run alongside the northwest wall of the fort. The railroad's construction in 1975 caused the partial demolition of the north-projecting corner tower (Bisheh et al. 1993: 124–25) through the earth-moving operations for the building of the high embankment on which the railroad sits (Fig. 9). A dirt road is situated north of the railroad and runs parallel to it. The role of this feature is unknown, but since it follows the railroad, it might be interpreted as its service road. The installation of the transmission line saw the creation of a northeast–southwest 10 m wide access dirt road situated some 80 m south of the fort. The construction of this road resulted in extensive leveling and bulldozing activities that affected the visibility and integrity of nearby archaeological features. Particularly disturbed were the remains of the aqueduct, which was cut through by the dirt road.

The construction of the railroad and transmission line are associated with traces of bulldozing in two crucial sectors of the site, namely Sectors C and H. The former is delimited to the south-southwest by the fort's wall, to the north-northwest by the railroad, and to the east

by an irregular embankment. The area, which is roughly triangular in shape, shows traces of bulldozing activities and is rich in ceramic finds with fresh breaks. Sector H is situated north of the military enclosure and the railroad. In this area, the survey identified fragments of a northeast–southwest wall emerging from the ground with an exposed height of just a few cm. The presence of this wall, which was documented for the first time in 2023, suggests that the site might have been more extensive than previously believed. However, bulldozing activities, evidenced by a large soil heap at the center of the surveyed area, have hindered any attempts to identify further architectural features in this sector of the site.

Traveler's photographs and satellite and aerial imagery show no traces of infrastructural works at the site prior to the late 1960s. Stein's late-1930s photograph of the northwestern side of the fort shows a small section of Sector C still covered by collapsed blocks and with no evident traces of recent earthworks (see Fig. 9a). A photo taken during the Hunting Aerial Survey of Jordan, which documents the state of the site in 1953, shows only a winding dirt road from the Wadi to the fort's gate and the presumed caravansera (Fig. 10). Despite its lower resolution, a Corona satellite image confirms that no significant infrastructural works were conducted until at least 1967 (Fig. 11). However, it shows a dirt road not present in the Hunting Aerial Survey photograph that circumvents the hill and reaches the site from the northwest. This road was later cut by the railroad. In both aerial and satellite

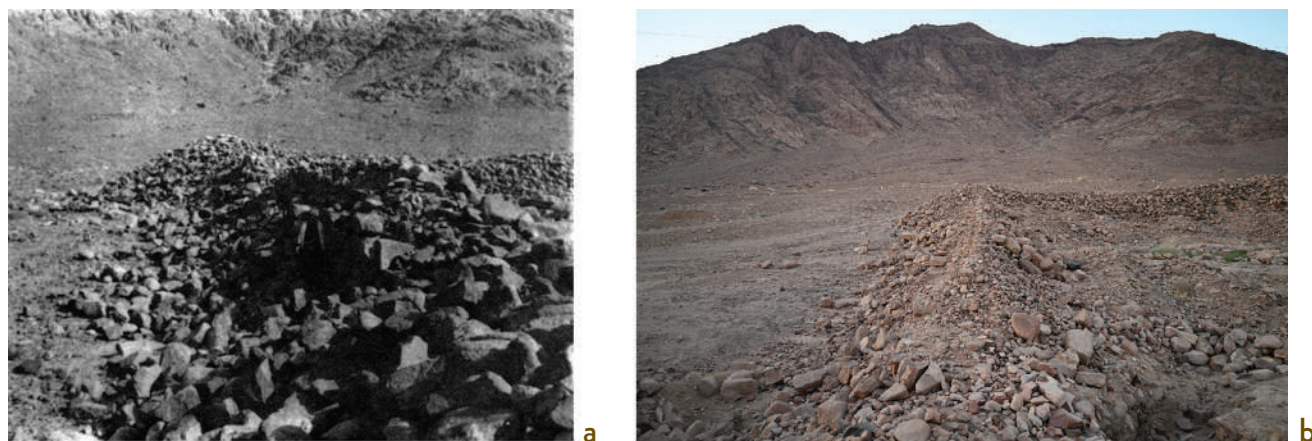
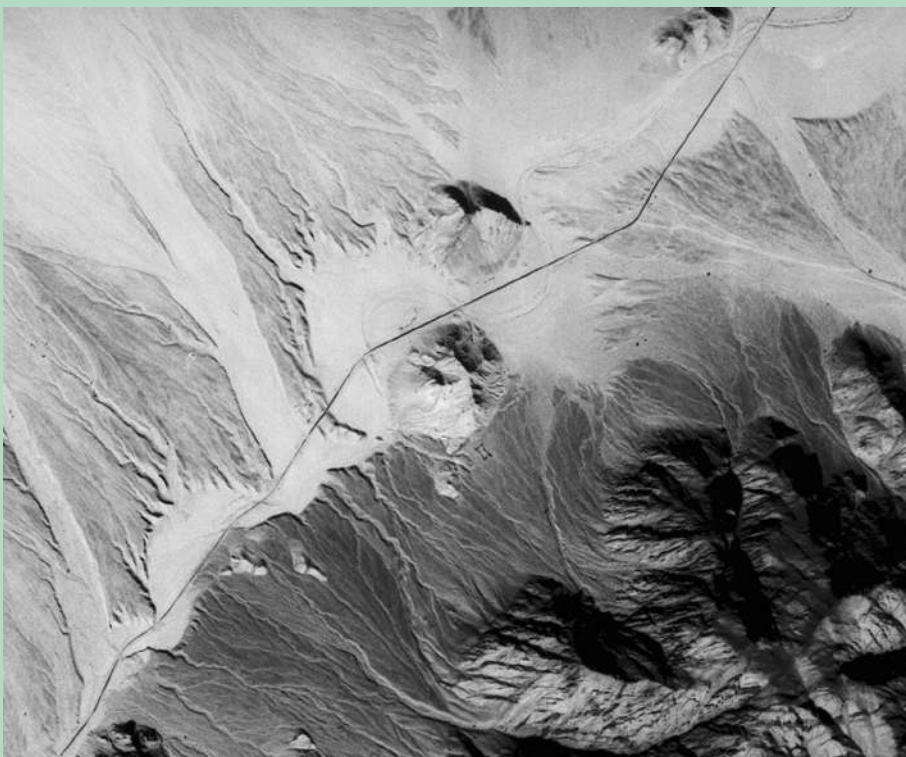


FIG. 9  
Northeast side fort showing development since 1930s: (a) Photo from Stein in the 1930s; (b) current situation.  
(Courtesy of the Khirbet al-Khalde Archaeological Project.)





**FIG. 10**  
**Hunting Aerial Survey Jordan photo of Khirbet al-Khalde.** (Photo by Huntington Air Survey; courtesy of APAAME.)



**FIG. 11**  
**Corona image of Khirbet al-Khalde.** (Courtesy of the Khirbet al-Khalde Archaeological Project.)

photographs, the Desert Highway is clearly visible to the west of the site.

### Damage from Modern Looting and Destruction

The goal of the surface assessments of modern disturbances at and around Khirbet al-Khalde was to understand the nature of these disturbances and, where possible, their temporal sequence. Each of the modern disturbances was individually recorded (coordinates, orientation), measured (width, length, and depth), photographed, and described (basic characteristics such as shape, overall condition, and stray finds). The resulting dataset provided crucial three-dimensionality to the looting activities at Khirbet al-Khalde, used to monitor and assess the risk of future looting as well. The areas of the site particularly affected by the modern disturbance were the fort, the caravanserai, and the cemetery. Additional looting was present at both watchtowers, as well as at the spring, which was the source that fed the aqueduct, where recent illicit activity was confirmed by the left-behind looter's tools (Fig. 12).

#### *Looting Activities in and around the Fort and the Presumed Caravanserai*

Altogether, 52 modern disturbances were recorded at and around the fort and caravanserai of Khirbet al-Khalde (Fig. 13). These included looting pits of varying sizes and shapes (although semirectangular to semioval shapes prevail), some of which crosscut. The heaviest looting activity occurred within the standing perimeters of the fort (18 pits) and the caravanserai (15 pits) and continued extramurally, with additional looting also visible in between and in the space around these two structures. The fact that most looting had taken place within the ruined structures is not surprising, since the looters would have expected to make finds most likely within the structures.

The largest of the looting pits (MD003) was over 7 m in diameter. Located inside the main fort, it significantly disturbed the hypocaust installation, further damaged by additional crosscutting pits (MD003A–MD003E) (Figs. 14–15). The deepest recorded pit (MD010) was



FIG. 12  
Photograph of looter's tools at the source of the aqueduct showing recent illicit activity. (Courtesy of the Khirbet al-Khalde Archaeological Project.)

located in the southwestern part of the caravanserai's courtyard and was some 2.8 m deep (Fig. 16). MD010 exposed stone walls of a room cleared by this illicit activity down to the floor level. The total exposure of the archaeological features from looting occurred in several instances. In the presumed caravanserai, the almost complete outline of four adjacent rooms, each lined by a stone wall, was revealed to a depth of about 0.6–0.8 m (MD029–MD032) (Fig. 17). The lime kiln, situated to the south of the presumed caravanserai, was cleared entirely by illicit digging activity (MD038 and MD039) (Fig. 18). Here, a 2 m deep hole showed the masonry outline of the lime kiln, comprising round walls from which a still largely intact draw hole protruded.





**FIG. 13**

Satellite image with embedded overview of modern disturbances at and around the fort and the caravanserai, as recorded in 2023 by the Khirbet al-Khalde Project. (Courtesy of the Khirbet al-Khalde Archaeological Project.)



**FIG. 14**

Photograph showing the looting pit (MD003) and the crosscutting smaller pits. (Courtesy of the Khirbet al-Khalde Archaeological Project.)



Regarding the temporal occurrence of the looted features, the ground survey observations and recordings contributed to identifying and discerning which features intersected with the others, thus providing a relative sequence for the looting pits (see Fig. 15). Additionally, the Google Earth function of “Historical Imagery,” used to track site looting (e.g., Daniels and Hanson 2015; Agapiou 2020), provided further insight into the emergence of the looting activities at Khirbet al-Khalde, with the vast majority of it occurring before February 2012 (e.g., pits MD003, MD021 [= bulldozing heap]; MD038 [= lime kiln]). Observations on several modern disturbances at the site following 2012 were also possible; for example, MD012 must have been dug between February 2012 and December 2014, as it does not appear in the 2012 satellite image.

### *Damage Assessment at the Cemetery*

The cemetery is located on a hill slope approximately 250 m northeast of the fort. It houses 53 looted and heavily damaged graves (G001–G053) as found and recorded by the ground survey (Fig. 19). Additionally, 19 pit features of less than 0.3 m depth, recorded as “possible graves” (PG001–PG019), were identified and documented separately from the graves. Perhaps these are failed attempts or tests of the illicit diggers trying to understand the nature of the soil and the position of the burials, or these might possibly be graves left unexcavated because of a lack of funerary goods (Fig. 20).

The grave features differ in orientation, with 79% of the graves being oriented north–south, 15% east–west, and the rest are undetermined (Fig. 21). The graves have

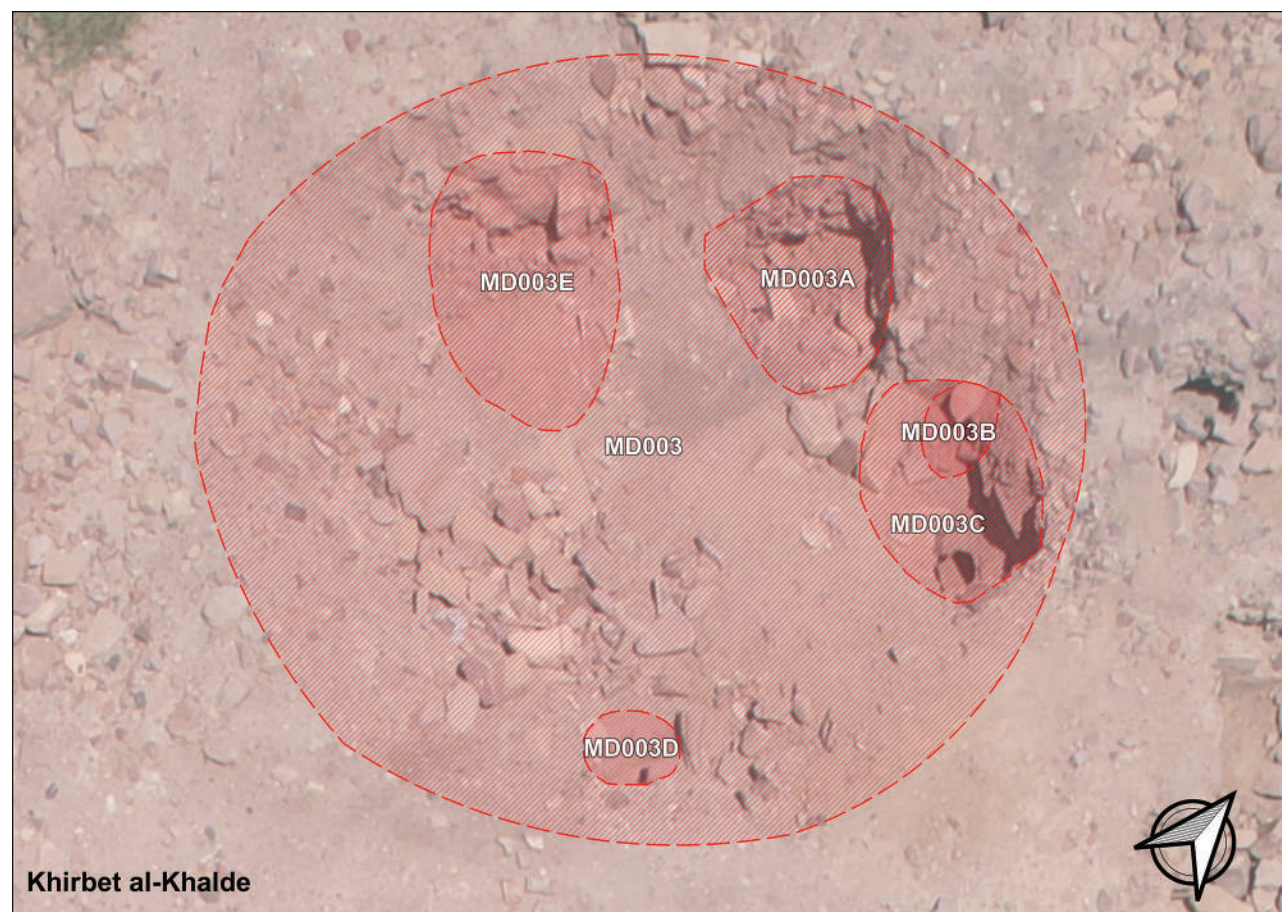


FIG. 15

Spatial representation of the relationship of crosscutting pits within the larger pit (MD003). The smaller pits are distinguished by letters rather than numbers to preserve contextual association with the main pit (MD003A–E). MD003 is earlier than the rest of the smaller pits. (Graphics by K. Mokráňová; courtesy of the Khirbet al-Khalde Archaeological Project.)





**FIG. 16**  
Overview of MD010, the deepest pit, in the southwest part of the fort. (Courtesy of the Khirbet al-Khalde Archaeological Project.)

a rather uniform shape, roughly rectangular to roughly oval, and size of about 1.5–2.0 m in length and 0.5–1.0 m in width. The largest grave is over 1.6 m wide (Go18), the longest is over 2.5 m in length (Go16), and the deepest is about 1.6 m in depth (Go17). Most graves have clusters of medium-sized stones either placed both on their long sides and their short sides or fallen to the bottom (Figs. 22–23)—these might be fallen grave markers.

Remains of grave goods have not been found, except for two pottery fragments located in the immediate vicinity of Go09 and Go51 and two inside Go50. Only one bone fragment was found immediately next to the east limit of Go25. This is quite contrary to the situation observed at the fort and the caravanserai areas, where archaeological material was abundant. This absence of finds is unsurprising, and we can assume that the illicit





**FIG. 17**  
Overview photograph of the modern disturbances (MD029-MD033) in the southeastern part of the caravanserai, exposing a series of rooms. (Courtesy of the Khirbet al-Khalde Archaeological Project.)



**FIG. 18**  
Overview photograph of the lime kiln, MD038, heavily damaged by illicit digging activities. (Courtesy of the Khirbet al-Khalde Archaeological Project.)



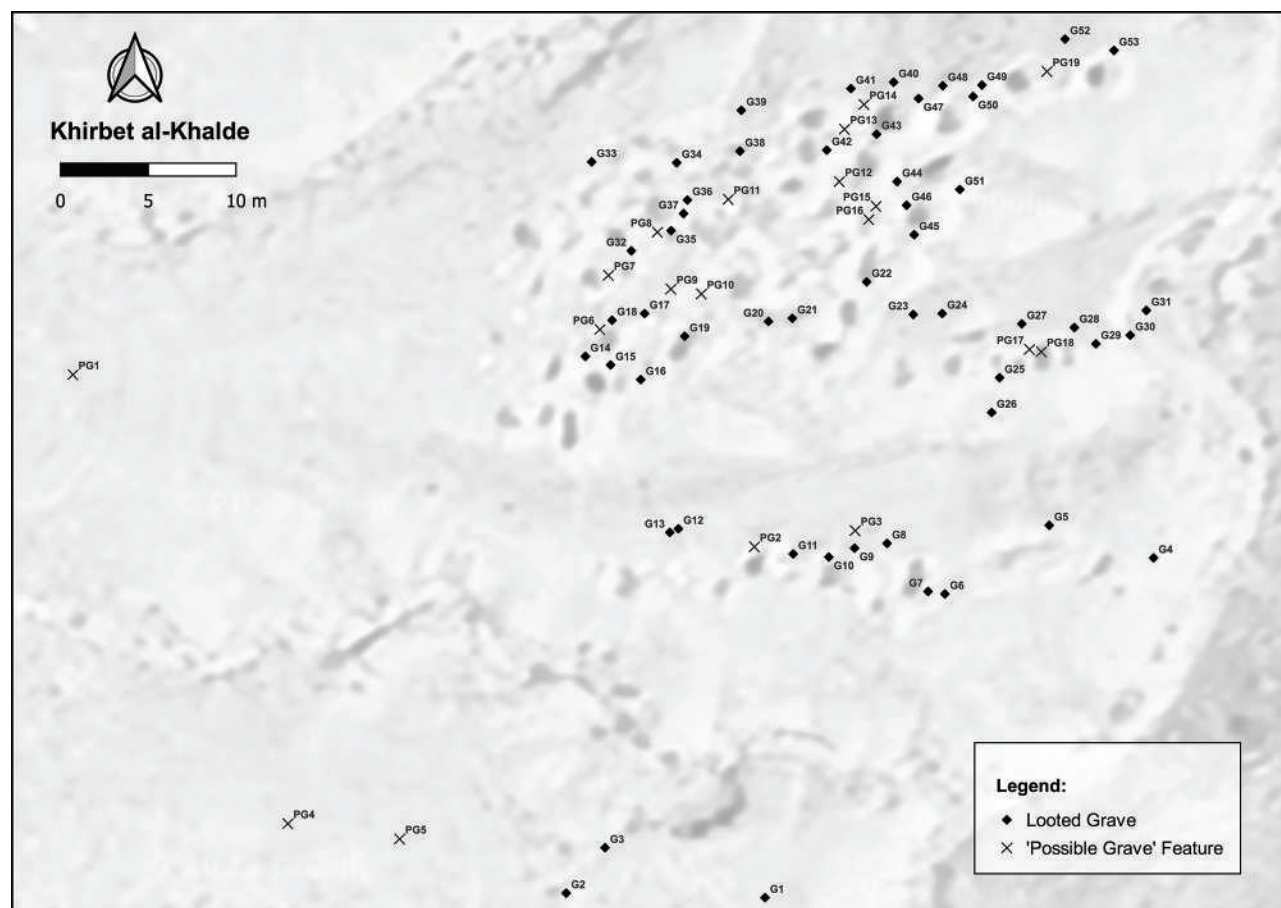


FIG. 19

Map showing all the modern disturbances—graves (G) and possible graves (PG)—in the cemetery area. Aerial photo is taken during the drone survey. (Courtesy of the Khirbet al-Khalde Archaeological Project.)



FIG. 20

Photograph of a possible grave feature, facing east. (Courtesy of the Khirbet al-Khalde Archaeological Project.)

activity at and in the graves was more intense and invasive. Unfortunately, it is difficult to pinpoint when the looting activities started, but the documentation of this looting between 2010 and 2013 by the Wadi Yutm Archaeological Survey suggests that the disturbances at the cemetery occurred before this time—an observation consistent with the rest of the looting activities at the site (Scott 2014: 184, figs. 85–87; 2016: 224, fig. 10). The intensity of the looting at the cemetery, with pits located close to each other (often less than 50 cm apart) is unsurprising when compared to other regional examples that showcase the attractiveness of cemeteries to looters (Al-Houdalieh 2014: 224–40; Mahoney 2019: 71–87).

The looting activities at and around the fort and the caravanserai have, of course, caused irreparable damage





**FIG. 21**  
Photograph of parts of the cemetery area heavily damaged by modern disturbances (G048, G047, G046, G045, G044, G043, G042), facing east. (Courtesy of the Khirbet al-Khalde Archaeological Project.)



**FIG. 22**  
Photograph of stone outline of G018, north-south oriented. (Courtesy of the Khirbet al-Khalde Archaeological Project.)





**FIG. 23**  
Overview photograph of G021 facing north: a rectangular shaped stone is clearly visible at the base of the grave. (Courtesy of the Khirbet al-Khalde Archaeological Project.)

to the structures and landscape. By recording the modern disturbance, a record of illicit activities at the site of Khirbet al-Khalde has been unraveled and now presents the possibility of monitoring the developing state of the site in the future on a much more detailed basis.

### Damage from Natural Erosion

In addition to the damage suffered from bulldozing and illicit digging, the archaeological remains of Khirbet al-Khalde are also at risk from natural erosion. The placement of the site, high on the south slopes of the Wadi al-Yutm, has kept the remains relatively safe from flood

waters rushing through the wadi. Still, the site remains susceptible to the erosive action of runoff water flowing from the mountains to its southeast. This runoff has carved numerous small channels that cut through the main site and have slowly encroached on its remains. Damage from natural erosion is most pronounced along the course of the site's aqueduct, which once carried water to the fort from a still-active spring to the southeast. As a result of this runoff, large sections of the aqueduct have been completely washed away, while in other places only the line of its foundation or packing stones remain extant (Fig. 24). This damage was recorded during our survey of the aqueduct's course and, in many instances, prevented a complete mapping of its entire route. The force of the water, and doubtlessly the millennia of human and animal movement over these slopes, has caused fragments of the ceramic pipeline to dislodge and scatter downslope, aiding the tracing of the aqueduct line and allowing the collection of pipe samples during the survey.

The threat of this natural erosion is also apparent near the main structures of the site, where runoff from the hills has carved small ravines that have begun to threaten the standing remains (see Fig. 6). One of these small channels runs immediately to the southwest of the possible caravanserai and appears to be gradually encroaching on its southwestern wall. This same channel has begun eating away at the midden northeast of the possible caravanserai. While this small channel poses no immediate threat to the structure, continued erosion will begin to undercut its foundations, putting its walls at risk. Evidently, the threat posed by this runoff water was also recognized by the builders of the rail track who excavated a deep water-diversion trench to the east of the fort (see Fig. 6). This trench, seemingly cut after the construction of the rail line, was likely intended to direct runoff water away from the rail tracks and toward a concrete culvert under the tracks to the east.

Our survey of the site also identified a wall line to the southeast of the fort (Fig. 25). This nonlinear wall is approximately 43 m long and does not appear to have been part of a roofed structure. Although the function of the wall remains uncertain, one hypothesis is that it may have similarly served as a diversion wall for runoff, directing water away from the fort. This hypothesis remains tentative, however, and further analysis is required.



**FIG. 24**  
 Photograph of a section of aqueduct showing undercutting of mortared bedding due to natural erosion. (Courtesy of the Khirbet al-Khalde Archaeological Project.)



**FIG. 25**  
 Photograph of wall line southeast of fort, facing southwest. (Courtesy of the Khirbet al-Khalde Archaeological Project.)

The last example of damage from natural forces to be discussed here is also connected to water management. Between 2016 and 2017, a large retaining dam was constructed immediately to the west of the site to control flood waters through the Wadi al-Yutm.

Although the structures of the main site are above the maximum elevation of the retention basin, the two stone-cut cisterns to the north of the site are not. The impact of this new retention dam was immediately visible at the start of the 2023 season. These two cisterns, largely visible in 2022, were covered in a thick layer of mud crack that extended over the area of inundation in 2023. Although the subterranean position of the cisterns limited the damage, their location within the retention basin will significantly impact future investigations and attempts at restoration and consolidation.

### **Analysis and Discussion of the Nature of the Damage at the Site**

While the history of Khirbet al-Khalde in antiquity has received much attention from archaeologists and travelers, the same cannot be said for its later phases. The site appears to have suffered much damage over the second half of the twentieth century as a result of the construction of a branch of the Hijaz Railway connecting



Aqaba to Ma'an and the Aqaba–Amman transmission line. Nonetheless, it was not until the mid-1990s that the first report about modern destruction at the site was written.

Aerial and satellite imagery taken before and after 1967 have been found to be particularly useful in tracking the extent of these modern disturbances. Before this date, historical aerial photographs and satellite imagery show only a few dirt roads connecting the wadi area to the fort and presumed caravanserai; however, recent drone photographs and satellite imagery suggest that these were later bulldozed. The nearby railroad, constructed on a high embankment 5–10 m northwest of the fort causing its north tower to be partly demolished, might be associated with these earth-moving operations. The later installation of the transmission line further south determined the construction of a service road oriented northeast–southwest. The road destroyed a section of the aqueduct but left untouched other visible architectural remains at the site.

These two infrastructure projects might have resulted in increased access to the site, thus leading to more looting. Looting pits are widespread at Khirbet al-Khalde, with the vast majority concentrated in areas where architectural remains are still visible but also, unsurprisingly, in the cemetery. Most of these pits are rather small, suggesting that they might have been excavated by occasional visitors; however, others take the form of large excavations, such as those between the fort and presumed caravanserai. These excavations created large and deep depressions clearly visible in satellite images and must have certainly required well-equipped and organized crews working over multiple days. One might presume that the movement of people and equipment for these operations was facilitated by the service roads associated with the transmission line and the railroad, which are sufficiently wide for a car or a truck.

## Conclusion

By integrating survey data with information obtained from the analysis of earlier satellite images, aerial

photographs, and old reports, it has been possible to track the extent and the various phases of destruction as well as their potential origin and reasons for the invasive destructions at Khirbet al-Khalde in modern times. It is clear that during the last century the site increasingly received attention, a result of the expansion of the infrastructure in the region, including the layouts of the main north–south highway in two different places as well as the construction of the railway immediately to the northwest of the site's major structures. The construction of the railway damaged the site massively. It must also have attracted attention to the site and made access to it easier, and looters must, therefore, have had a more direct access to it than earlier. Furthermore, the construction of the dirt roads in connection with the installation of the power lines also increased access to the site. The damage assessment undertaken in the summer of 2023 is the first one ever undertaken to comprise the entire site, including the hilltop towers, the extent of the aqueduct, as well as the cemetery to the west of the site's major structures. By combining on-ground methods with drone photography and with the available legacy data, it has been possible to construct a plausible chronological narrative of the development of damage done to the site over the last many decades and the reasons behind these waves of destruction. The 2023 survey and assessment have also been pivotal in identifying areas at risk of further destruction and facilitated the planning of future research campaigns at the site, pinpointing areas where the stratigraphic record might already have been much disturbed. The results obtained at Khirbet al-Khalde show the research potential of an integrative approach to damage assessment based not solely on field data collection but also on the study of old satellite photographs, satellite imagery, and old reports. As such, the work underlines the importance of legacy data and the potential that such data holds when integrated into fieldwork projects from their initial phases.

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