



The Madaba Ring Road, Jordan. Evidence of cultural heritage assets from remote imagery in the Madaba hinterland

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1. Introduction

This report outlines the results of an impact study on cultural assets in the region of Madaba as affected by the construction of a ring road. The ring road, an infrastructural project currently under development in the municipality of Madaba, encompasses the construction of ca. 18 km of dual carriageway roads around the outer edges of the historical town of Madaba. A first construction phase has already begun, with some 5 km of the ring road in the south-eastern sector already completed by May 2013.

This survey represents a pilot study for a collaboration agreed upon by the Department of Antiquities of Jordan and the Endangered Archaeology in the Middle East and North Africa Project (EAMENA), University of Oxford – to record endangered cultural assets by means of remote imagery analysis ahead of large infrastructural projects. We are grateful to acknowledge the support of the Director General of the Department of Antiquities, HE Dr Monther Jamhawi for having agreed to this collaboration, and to Mr Jihad Haroun, the Technical Assistant for the Director General for having provided us with the necessary documentation to carry out our analysis (see section 2 below).



The scope of this investigation was to analyse remote imagery – including satellite imagery, aerial photography and topographic maps – with the aim of producing a comprehensive assessment of archaeological and cultural sites which are likely to be directly or indirectly endangered by the construction of the ring road. In anticipation of a likely increase in the rate of urbanisation outside of Madaba proper, following the construction of the ring road, the survey has been extended to an area delimited by a 7.5 km radius around the centre of the city.

Overall, a total of 141 potential cultural assets have been analysed during this investigation. Of these, 41 are site features or sub-sites, mostly of Madaba (29) and Kh. al-Mukhayyat (6). As many as 11 sites (including one sub-site) will be directly affected by the ring road and development in its immediate vicinity (within a buffer zone 500 m on either side of it). Of the 141 sites analysed, 86 lack MEGA-Jordan records (of these, 18 are site features or sub-sites). A comprehensive list of sites is given in Appendix 1 to this report. Appendix 2 covers the ancient road network of the region and the potential impact of the ring road and potential actions to be taken regarding these integral features of the ancient landscape.

It is hoped that this report will aid the Department of Antiquities during their ground survey ahead of construction work as well as in the subsequent recording and updating of MEGA-Jordan sites.

2. Methodology and sources

Extent of assessment

This assessment was a desk based review using available remote sensing sources to assess the area at risk around the modern city of Madaba from the development of a ‘ring road’. Sites investigated were those thought to have an historical or archaeological nature.

The geographical extent of the ring road was supplied by the Department of Antiquities of Jordan. Two shapefiles were provided: ‘Export_Output.shp’ provided the ring road blueprint; ‘Export_Area.shp’ included 8 survey areas along the eastern sector of the ring road. These represent areas which have already been ground-surveyed by the Department of Antiquities (J. Haroun, email comm., 5 Mar 2015). Based on the extent as provided in ‘Export_Output.shp’, a 7.5 km radius from Madaba was chosen as the study area so as to encapsulate the landscape directly at risk from the development of the road, and those sites that may be indirectly affected from follow on development from the road’s construction, such as increased housing development in the region.

Remote Sensing Source Material

1. Google Earth

The primary remote sensing source used to conduct this review was satellite imagery available through the application Google Earth. Dates of available imagery for the study area ranged from 2003 until 2014. The main provider of the imagery to Google Earth was Digital



Globe. Resolution of imagery varied considerably. Where necessary, the date of particular imagery is noted where it is of particular use in the consideration of a site.

2. Hunting Aerosurveys Photographs (HAS)

The modern satellite imagery was supplemented by the use of historical vertical Hunting Aerosurveys (HAS) photographs, produced by Hunting Aerosurveys Ltd. in 1953. The historical perspective is of particular importance to this region due to the high level of development in agriculture and urban expansion. The use of this imagery was limited as it is of varying quality in resolution and sharpness, and it is monochrome. This meant that, for example, the heavily degraded sites on a similarly toned background were much harder to interpret with certainty.

3. CORONA Satellite imagery

The CORONA imagery was not used as a source as the resolution was not adequate for our purposes, for similar reasons relating to the HAS imagery.

Other source material

Sources consulted to determine all currently known sites of archaeological or heritage value included existing archaeological and heritage databases, maps, and photographic material, as well as published historical and archaeological studies.

1. Archaeological and Heritage Databases:

- MEGA-J
MEGA-Jordan Database – <http://www.megajordan.org>
A CSV export of sites in the Madaba Governorate was supplied by the Department of Antiquities of Jordan. Information regarding MEGA-J listed sites outside of this region was consulted through the MEGA-J web interface.
- JADIS
Gaetano Palumbo (Ed) 1994. *Jordan Antiquities Database & Information System*. Amman, Department of Antiquities, Jordan & The American Centre of Oriental Research.

2. Maps:

- Series K737 1:50,000 Maps of Jordan.
 - 3153 I – Amman Edition 4 – DMATC (1975).
 - 3153 II – Madaba Edition 2 – TPC (1970).
 - 3153 III – Ma'īn Edition 2 – (post 1961).
 - 3153 IV – El Karama Edition 2 – (post 1963).
- German 1:50,000 Maps of Transjordan (c. 1918).
 - 71. Hesbān, 10.7.1918 Nr. 76^c, 4^{te} verbesserte Ausgabe, Vermessungs-Abteilung 27.
 - 72. Ammān, 24.6.1918 Nr. 101b, 3^{te} verbesserte Ausgabe, Vermessungs-Abteilung 27.
 - 81. Mādeba, Vermessungs-Abteilung 27.
 - 82. Kālaat Zīza, 22.6.1918 Nr. 152, Vermessungs-Abteilung 27.
- Jordan 1:25,000 Map, Palestine Grid.
 - Sheet 210/115 Mā'īn.
 - Sheet 210/125 El Quweijīya.
 - Sheet 225/115 Madaba.



- Sheet 225/125 Manja.
- Madaba 1:2,000 Palestine Grid Map, in: Bikai, P. M. & Dailey, A. 1996. *Madaba: Cultural Heritage*, American Centre of Oriental Research, Amman.
- 3. Photographic Material:
 - APAAME: Aerial Photographic Archive for Archaeology of the Middle East – <http://www.flickr.com/apaame/collections>
 - Aerial Archaeology in Jordan Project low level oblique photographs
 - 1918 German Deutsche Luftstreitkräfte aerial photographs from the Bayerisches Hauptstaatsarchiv Abt. IV Kriegsarchiv collection
- 4. Historical and Archaeological Studies
Major historical resources listed here. Comprehensive list of other published material is provided in References.
 - Conder, C. R. 1889. *The Survey of Eastern Palestine I: The 'Adwân Country*, Palestine Exploration Fund, London.
 - Musil, A. 1907. *Arabia Petraea I: Moab*, Buchhändler der Kaiserlichen Akademie der Wissenschaften, Vienna.
 - Glueck, N.
 - 1933-1934. Explorations in Eastern Palestine, I. *The Annual of the American Schools of Oriental Research* 14: 1-113.
 - 1934-1935. Explorations in Eastern Palestine, II. *The Annual of the American Schools of Oriental Research* 15: 1-202.
 - 1939-1939. Explorations in Eastern Palestine, III. *The Annual of the American Schools of Oriental Research* 18/19: 1-288.
 - 1945-1949. Explorations in Eastern Palestine, IV, Parts I & II. *The Annual of the American Schools of Oriental Research* 25/28: 1-722.

Source Material not consulted

Two archaeological surveys that have occurred but could not be consulted for this assessment were the hinterland surveys for the sites of Jalul and Hesban conducted by the Madaba Plains Project, Andrews University. Several references to surveys for the Hesban project later than Ibach's 1987 publication of the Archaeological Survey of the Hesban Region, and for the Jalul project were found in the published Madaba Plains Project seasonal reports. However, no final list of sites from the surveys was found in time for incorporation in this study.

The Mount Nebo Archaeological Survey (Mortensen et al. 2013) has to date only published the first volume of its comprehensive survey of the region surrounding Mount Nebo, and therefore the results of this survey could only be incorporated to a limited degree in this review.

Analysis of sites in survey area

The analysis of sites was undertaken using ESRI ArcGIS 10.2. A geodatabase named 'EAMENA_Madaba.gdb' and with CRS UTM zone 36N was created and is provided with this report. It contains the following feature classes:

- AllSites (point): containing all sites and site features of all types (point, polyline, polygon)
- RR_Sites (point): containing all sites and site features which fall within the ring road's buffer zone
- Extents (polygon): containing site extents (where applicable)



- Ring_road (polyline): ring road blueprint as given in 'Export_Output.shp' provided by the Department of Antiquities of Jordan
- RR_Buffer (polygon): containing a 1-km-wide buffer zone established using the blueprint of the ring road
- Anc_roads (polyline): containing all sections of ancient roads that could be detected in the study area
- Approx_roads (polyline): containing all sections of possibly ancient roads

Alongside this, all of the topographic and survey maps mentioned above were georeferenced and projected in the CRS given above. HAS imagery pertaining to the study area was georectified using 'Spline' transformation (with 11+ reference points/image) and imported as an overlay. This data may be made available to the Department of Antiquities on request.

Imported sites were checked for location accuracy against the HAS Imagery and Google Earth satellite imagery. Where a possible site was visible in the HAS and/or satellite imagery but not in an existing record, a new record was created. Where a site's location could not be verified, this was noted.

All bibliographical references to sites, whether written and/or visual, were recorded for each site. Where the visual record gave evidence of a site being negatively impacted, this was referenced.

This assessment was conducted in March 2015.

Difficulties in using the source material

Historical travellers' accounts and archaeological surveys, and historical maps are of considerable use in their ability to hold information regarding sites that have been erased due to the passage of time or through development. The source material is of limited use however due to the accuracy of the information being highly variable. The ability of this review to identify all sites mentioned in these sources was limited by these difficulties.

Travellers' accounts and archaeological surveys have the following constraints:

- They will commonly mention passing a site without commenting on the nature of that site. Where further information is given it can be incredibly generalized
- Names of sites given can vary considerably in transliteration into European languages making it difficult to identify the same sites across sources
- They will record distances in time travelled rather than in measurements
- What a traveller records is based largely on what they are interested in. Western travellers are particularly biased toward monolithic ruins and features that they believed to be able to relate to biblical sites or early Christianity
- Maps or plans are rarely provided
- The large scale maps that are provided are limited in accuracy due to the technology available and quality of cartography at the time
- Later historical accounts may simply reiterate observations of other travellers without checking the locations or information, and without referencing their source material



Historical Maps

- Limitations in accuracy due to the technology available and quality of cartography at the time
- Extents of sites or exact positions of sites not indicated
- Keys for different site types not used, or if different representations are used a key might not be given
- What is able to be recorded on a map is limited by the source material the cartographer uses, and this information is not always given

Remote Sensing Limitations

A remote sensing survey relies on traces of the archaeology in the landscape to be large enough that their trace can be discerned from a distance, and for the conditions of light and ground cover to be appropriate for an unimpeded view of that trace. The region of Madaba presented a number of difficulties in this regard.

Removal of features from the landscape through agriculture

The fertile plain surrounding Madaba has been under heavy cultivation for the majority of the 20th century. Consequently archaeological features that would have been visible in the landscape easily otherwise have been ploughed out or removed to make way for agriculture. Some remnants of archaeological features may be remotely seen in fields due to the alteration in growth and water retention caused by the existence of archaeological remains, but these cropmarks are only visible in certain ground and light conditions at certain times of years, and best viewed with low-level oblique reconnaissance. The satellite imagery available through Google Earth and the black and white vertical imagery of HAS are not ideal for viewing in these conditions. Surface survey, however, is probably the best method for identifying sites in a landscape as heavily cultivated as the Madaba Plain.

Visibility of features impaired

The visibility of a feature in a landscape is increased when its outline is brought into contrast through the play of light and shadow. This is incredibly important where the colour and tone of a structure is similar to the landscape on which it is situated, such as the stone built structures on the exposed limestone landscape west of the Madaba plain. The HAS imagery was often taken at the peak of the day with as little shadow as possible. Furthermore, the black and white imagery means that tonal variation in the landscape is lost. This has meant that the HAS imagery in particular was of limited use in the survey of the limestone region in the west of the study area.

3. Ring road footprint and its buffer zone: endangered cultural assets

In this section, the cultural assets identified within the ring road's buffer zone (500 m on either side of the footprint provided by the Department of Antiquities) are discussed in detail. A total of 11 such



sites have been identified. They are listed below according to the survey code order which may be checked against the complete site list in Appendix 1.¹ The MEGA-Jordan code (when one exists) is also listed the heading, along with the toponym (in English and Arabic).

MAD_0040. Et-Teim (التيم)

MEGA-J: 11193 ('Teim': Cave/Shelter; Water Structure, Cistern; Unspecified/Unknown; Sherd/Flint Surface Scatter); 58998 ('Ateem')

The site extends over two limestone ridges on either side of a narrow valley oriented NW-SE. Overall, the area of archaeological interest encompasses ca. 0.7 km² (700 dunum). While the site will not be crossed by the ring road, its north-eastern sector falls within the ring road's buffer zone. Although most of the site has now been built over, several ancient structures remain and warrant investigation before the building of the ring road leads to further construction on or around the archaeological site.

This site was first mentioned, though mistakenly located, by Burkhardt (1822: 367). A first assessment of the extant structures was provided by Conder, who visited it in 1881, noticing wall foundations, caves, cisterns and the remains of rough masonry (1889: 228). During his visit to the site, N. Glueck found most of the ceramics to belong to the Iron Age, with some Middle Bronze material as well as significant findings of Nabataean and Early Roman sherds (Glueck 1933-4: 33 n. 79).

The entire site is poorly visible in the HAS imagery (HAS 24.125 15/07/1953), except for some cisterns on the lower slopes of the eastern ridge. Google Earth imagery (DigitalGlobe and Astrium) from 18 Nov 2003 to 24 May 2013 allows mapping of the increasing urbanisation on the two ridges, particularly on the eastern one. As of 24 May 2013, the following key structures survived on the eastern ridge:

- a rectangular building oriented N-S and ca. 15 × 7 m in size. Currently buried underneath an olive orchard
- a natural depression/cave possibly used as ancient shelter and cistern. The site is within a fenced perimeter which has been in place since at least November 2004 (DigitalGlobe; APAAME_20130414_DLK-0321).

As for the western ridge, the following elements were detected in Google Earth imagery and in the APAAME aerial photographs taken on 14 April 2013 (refer to Appendix 1 for details):

- A nearly square enclosure of rough masonry built around and against a limestone outcrop. This feature, which is ca 17 × 34 m in size, may be partially modern and related to Bedouin camping evidence of which is attested already in the HAS imagery.

The western ridge remains mostly free of construction, with only one house appearing on its top between June 2006 and May 2008 and a gravel road replacing an earlier, beaten-earth path at some point between February 2010 and May 2013.

¹ With the exception of MAD_0028, for which see Appendix 2.



Kefer Abu Sarbut/Khattabiyah (MAD_0041; 0042). Location of mosque and winery



Kefer Abu Sarbut/Khattabiyah (MAD_0041;0042). Detail of multi-compartment winery in the north-eastern quarter of the town. Photograph: APAAME_20130414_MND-0315, Matthew Dalton.



MAD_0041; MAD_0042; MAD_0058. Kefeir Abu Sarbut/Khattabiyah (كفير أبو سربوط)

MEGA-J: 5691 ('Kfair Abu Sarbut': Church/Chapel; Inscription/Greek; Mosaic); 3034 ('el-Khatabeyah mosque')

Village

Kefeir Abu Sarbut is one of the most historically significant and among the largest (1.2 km² or 1200 dunum) sites in the study area. It was built over a low limestone mound with a N-S orientation, located ca. 3 km N-NW of the centre of Madaba. It is currently heavily urbanised. While some of the archaeological heritage of Kefeir Abu Sarbut has been investigated and some of its sites are protected, action is needed in order to protect other site features, most notably a large Byzantine-Umayyad winery located on the north-east corner of the site (MAD_0058).

The site is first mentioned by Conder, who visited it in 1881 (1889: 134-8).² Conder describes a building located in the north-eastern sector of the village, which is no longer extant. It comprised a rectangular structure with an open portico (ca. 27 × 19 m) where a monolith pillar ca. 2.6 m high (giving the name to the village) stood. Another building identified by Conder as a tower is likely to be the village's mosque (MAD_0042), already in ruins by the time Musil visited it in 1900 (1907: 216), and later identified by Harding as being built above a church (Harding *apud* Piccirillo 1989: 309 and 315 nos. 5-6).³ Two churches were excavated in the 1960s and in 1972. The former, the so-called 'Church of the Holy Fathers', was built out of the village in the vicinity of some caves and has been partially dismantled and re-assembled inside the Madaba Rest House (Piccirillo 1989: 309; 311-3; Michel 2001: 363-5). Finally, the church of John and Elias, located at the centre of the village, not far from the ruined mosque mentioned above, was brought to light during ACOR-DoA excavations carried out in 1972 (Piccirillo 1989: 309-11; Michel 2001: 363), which also revealed Islamic dwelling quarter reusing earlier architecture and a large cistern (Ibrahim 1972: 95).

The site was still scantily inhabited at the time of the Hunting Aerial Survey in 1953, with possibly as few as four houses occupied at that time (HAS 24.127 15/07/1953). DigitalGlobe and Astrium imagery covering the period Nov 2003 to May 2013 show a steady growth of the village, with new housing developments particularly affecting the north-eastern sector. APAAME aerial photographs at the site taken on 14 Apr 2013 allow the following observations to be made (see Appendix 1 for imagery details):

- The ancient mosque at the centre of the village has undergone restoration and its entire perimeter has been walled. A locked gate protects the site
- A new Byzantine-Umayyad winery (MAD_0058) can be clearly seen. It comprised at least four compartments and a central treading floor, on a plan similar to that known from the wineries of Kh. Yajuz. The site was already visible in the DigitalGlobe imagery of Nov 2003, and might have been revealed by excavation work connected to the laying out of roads. The

² Tristram (1873: 332) must have also strolled by it, though he did not provide any information concerning its ruins.

³ Piccirillo wrongly interprets the Conder's building containing the pillar as Kefeir Abu Sarbut's mosque. Measurements given by Conder clearly suggest that his tower

site is put at risk by increasing agricultural and housing development in the area. Fencing is highly recommended. The site should be added as a site feature to MEGA-J record no. 5691.

MAD_0046. Al Turkmaniyeh (التركمانية)

MEGA-J: 11194 ('Khirba', modern village: Settlement, No Fortifications)

Settlement (Ottoman/modern)

The site is located along the route linking Nebo with Madaba, ca. 1.4 km west of Keferir Abu Sarbut. It lies within the outer limits of the ring road buffer area. Marked as Khirba ('ruin') in the K737 1:50,000 topographic maps (whence the MEGA-J toponym is taken), it was previously known as al-Turkmaniyeh (Musil 1907: 126; 395) or, according to Conder (1889: 190) as Maṭa al-Turkmaniyeh ('The print of the Turkoman woman'). Conder refers that the site contained a footprint carved in on the flat bedrock which tradition wanted to belong to a Turkmen prophetess who was alighted from her camel on her Haj journey. The MEGA-J record gives the site as being a modern village.

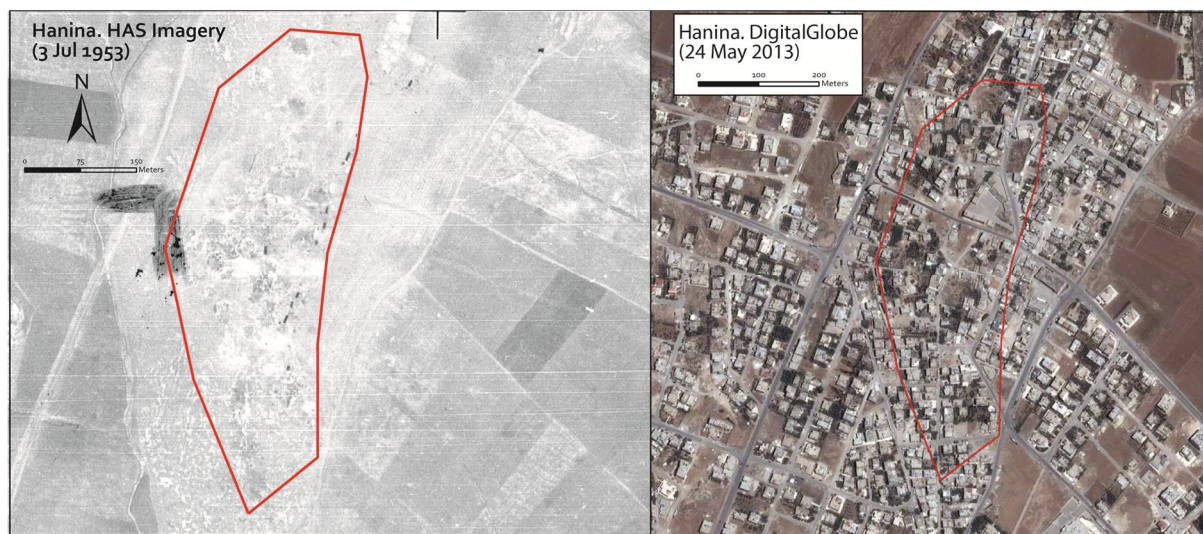
Inspection of the HAS imagery and of satellite imagery from the decade 2003-2013 (DigitalGlobe and Astrium) has not suggested the presence of any cultural asset. Occupied already in 1953 by a modern farm, the site is now completely overbuilt.

MAD_0048. Dhahret Khau

MEGA-J: 11185 ('Dhahret Khau': Cave/Shelter)

This site is present in MEGA-J as an import from JADIS. We suggest this to be a spurious site, likely the result of misplacement. The toponym is provided only by Conder (1889: 97), which however placed this 'ridge of caves' to the west of Madaba, rather than north of it (where the site is located on MEGA-J). The JADIS record for the site (2212004) refers provides a further reference to survey work conducted by the Madaba Plains Project (LaBianca 1987: 210 n. 229), which we were unable to track down.

Both historical aerial photographs (HAS) and satellite imagery (DigitalGlobe and Astrium for the decade 2003-2013) do not suggest the presence of a site of archaeological significance here.



**MAD_0051. Hanina. Comparison of HAS aerial photographs and DigitalGlobe satellite imagery****MAD_0051. Hanina (حنيينة)**

MEGA-J: 11188 ('Hanina': Burial/Cave; Sarcophagus/Stone anthropode coffin; Isolated structure/house; Sherd/Flint scatter. Periods: 9024; 9034; 9049; 9060)

Necropolis?

The site of Hanina is located on a low limestone spur with a NE-SW orientation, which descends more sharply to the west. Overall, the archaeological site must have encompassed more than 1.1 km² (1100 dunum) judging from the HAS imagery. Road construction will affect directly the northernmost sector of the site and ca. 50% of it falls within the ring road buffer zone.

The site is first documented by Conder (1889: 103) who describes it as a ruined village with bell-shaped cisterns and a rock-cut tomb. According to Musil, who regrettably only refers to this site in passing, Hanina would have been the 'necropolis' of Madaba (1907: 215). The presence of a large polyandria tomb is confirmed by Ibach (1987: 26 n. 116), who states that it contained at least 36 loculi arranged on three tiers. The same author adds that the site had been excavated by the Department of Antiquities.

The site of Hanina appears nearly clear of modern occupation, except for Bedouin encampments, in the HAS imagery (APAAME_19530703_HAS-8-044). Despite this, no visible structure could be made out in this imagery. DigitalGlobe- Astrium imagery covering the decade 2003-2013 shows the entire site to be heavily built over. Until 2009, however, the central sector of the site remained relatively free of modern housing. A small feature, possibly a rock-cut wine press, may be discerned in DigitalGlobe imagery for Nov 2003. This was subsequently obliterated by a house built between May 2008 and Dec 2009 (DigitalGlobe).

The extent to which the site has been made part of Madaba's urban network suggests that little more may be gained by further investigation. Survey conducted ahead of road construction may, however, help specify the chronology of occupation of Hanina.

MAD_0072

No MEGA-J entry for site

Cistern?

This previously unrecorded feature, possibly a cistern or a rock-cut winery, has not been previously recorded. It stands on an eroded limestone slope oriented N-S, about 1.8 km south of Madaba on the Madaba-Ma'in road. Faintly visible in the HAS imagery, it appears clearly on DigitalGlobe imagery (from Nov 2003 to May 2013), and particularly on imagery from February 2010.

This small feature (ca. 4*5 m) is likely to be associated to other evidence of occupation. Considering that the slope along which it is located remains nearly free of modern buildings (at the date of last available imagery, Astrium for 24 May 2013), survey is encouraged before construction work begins.

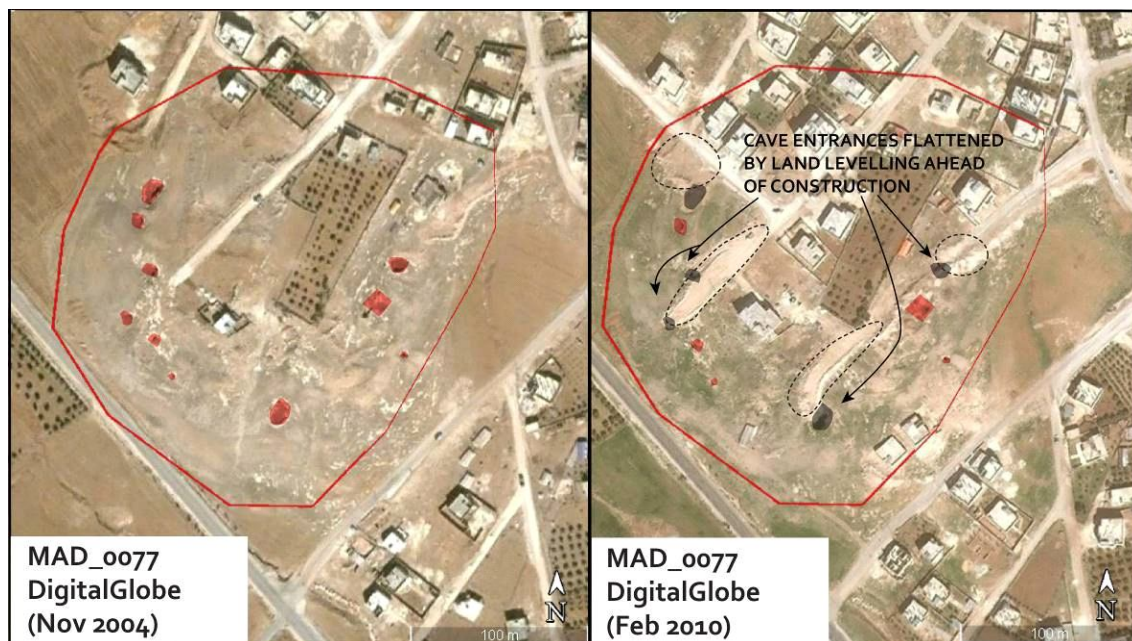


MAD_0076

No MEGA-J entry for site

Rectangular building?

This previously unrecorded feature (ca. 7*6 m) is located just east of the modern bridge on the wadi al-Habis, within a wide wadi loop, oriented WNW-ESE. Its remains are only visible in satellite imagery dated from February 2010 (DigitalGlobe). Only faint traces can be detected in the HAS imagery. The identification of this feature as an archaeological structure must thus remain conjectural. Its position, right off the road leading from Hawarah into Madaba and 200 m west of the ring road intersection, warrants inspection.



MAD_0077. Comparison of DigitalGlobe satellite imagery showing damage to potential cultural assets

MAD_0077

No MEGA-J entry for site

Ridge of caves/tombs?

This previously unrecorded site stands at the southern edge of Madaba, immediately to the north of et-Teim (MAD_0040) and separated from it by the Madaba ring road, which in this sector is projected to follow the track of a pre-existent road linking the Madaba-Ma'in road with the Madaba-Dhiban road. The site, which extends over a low, limestone mound (0.43 km², 430 dunum), features a number of caves and enclosures, some of which have been obliterated by modern construction. However, as of May 2013 (Astrium), the southern and eastern slopes of the mound remained relatively free of occupation and should be investigated during ground survey before the current road is upgraded to become part of the ring road.



The site was entirely free of occupation at the time the HAS imagery was collected. Except for some animal enclosures, which could have been in recent use at the time, the imagery shows clearly a number of cave entrances and possible cistern mouths/tomb entrances. Most of these were still in a good state of preservation in May 2008, but were later levelled or filled when during a large-scale expansion of housing which took place between May 2008 and December 2009 (DigitalGlobe).

In view of the rising rate of urban growth in this area, inspection of the remaining features along the lower southern slopes of the mound is strongly recommended.

MAD_0082

No MEGA-J entry for site

Cairn (?)

This previously unrecorded site is located at the top of a limestone spur facing site MAD_0072. It is located well within the ring road buffer zone, in an eroded landscape which remains free of modern occupation, bar for a small Bedouin encampment to the north (latest imagery: 24 May 2013, Astrium).

The site, which is faintly visible in the HAS imagery, is well documented in the satellite imagery from 2003 to 2013. It appears to be a circular structure, a cairn or watch-tower, ca. 5 m in diameter, surrounded by a larger ring of debris.

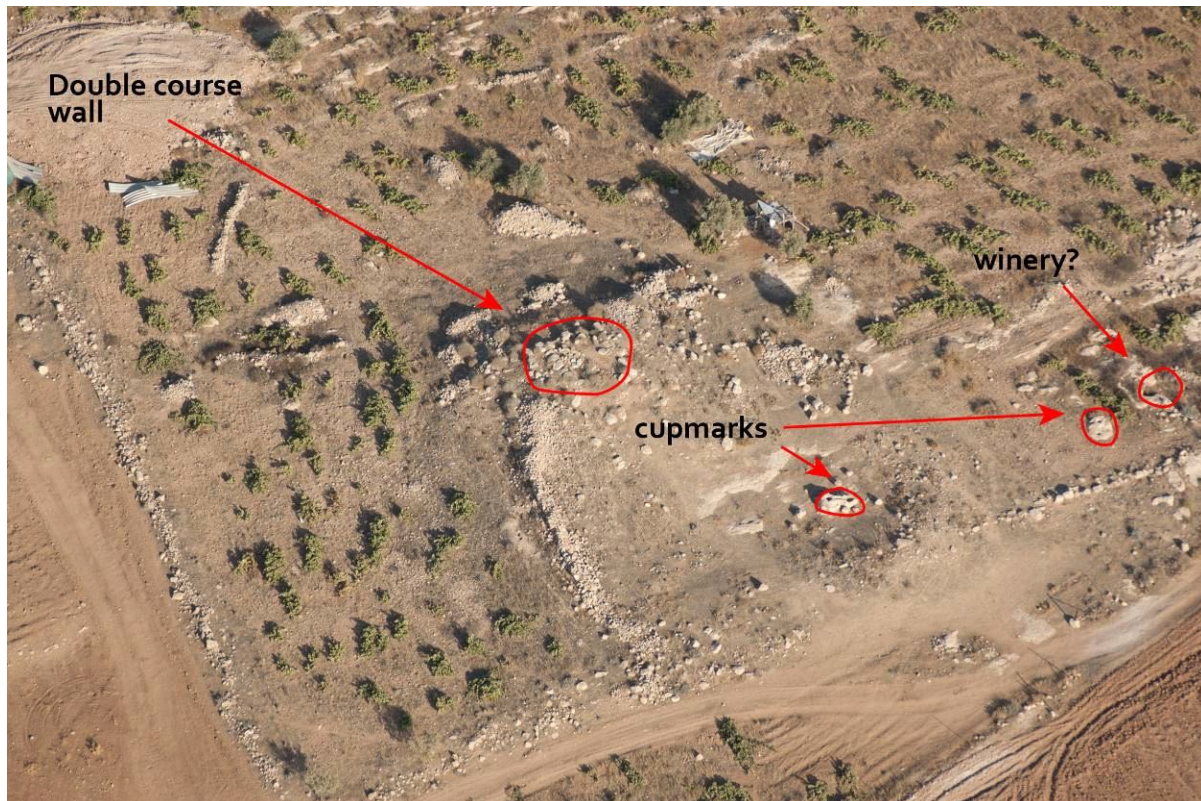
Considering the suitability of this area for construction, it is likely that the laying out of the ring road will lead to further modern development in this sector. Inspection of this feature is therefore highly recommended.

4. Sites indirectly affected by the Madaba ring road

Indirect development from construction of ring road

It is likely the construction of the ring road will facilitate transport across the Madaba Plain by bypassing the increasingly dense urbanized area of Madaba. Consequently, minor villages in the hinterland of Madaba will become more desirable as locations for development, in particular-residential development.

The current pattern is for development to favour the low limestone knolls across the plain, along linked roads to/from Madaba, and positions that overlook the Jordan Valley from the edge of the plain. The following list of sites is that of those most likely to be impacted by this kind of development in the short to long term.



MAD_0002. Rujm al-Jazel showing potential cultural assets. Photograph: APAAME_20111010_MND-0064, Matthew Dalton

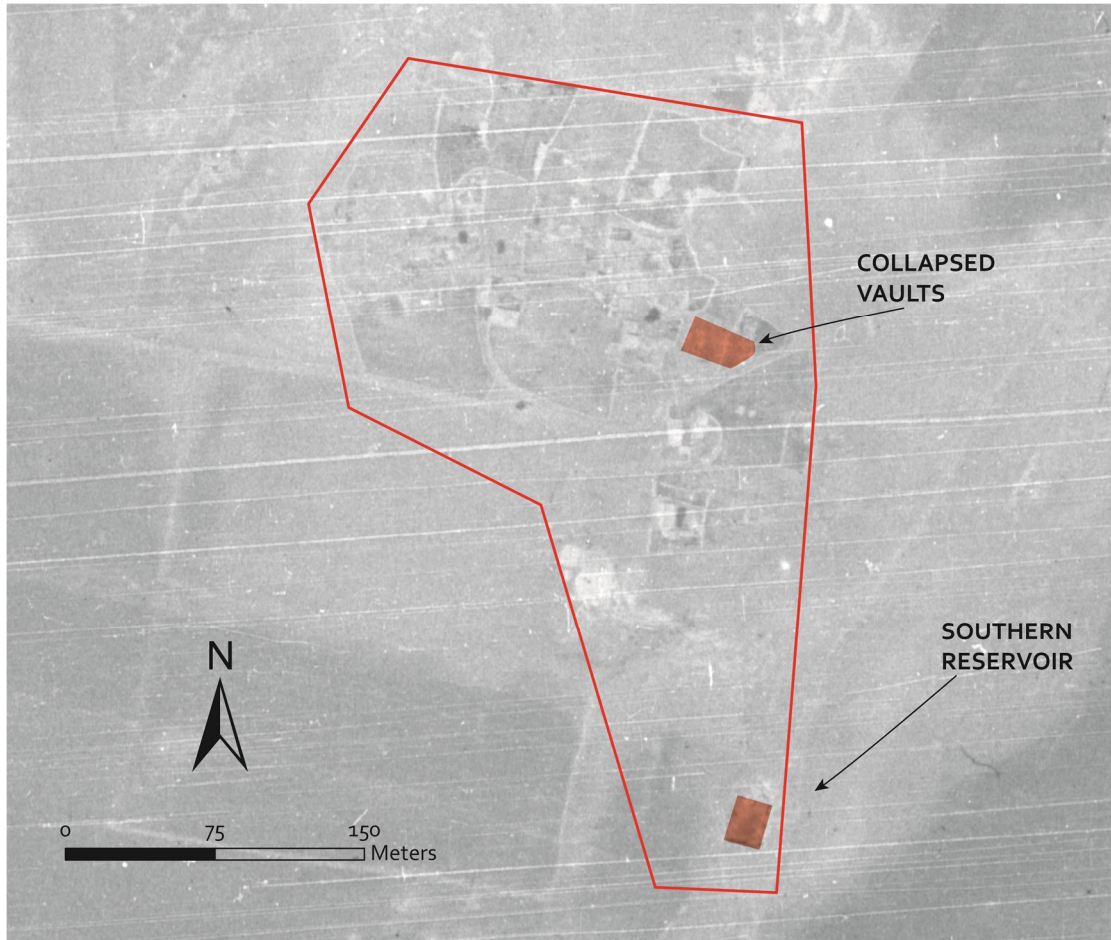
MAD_0002. Rujm al-Jazel (رجم الجازل)

No MEGA-J entry for site

This now very disturbed site has been known since Tristram visited the countryside of Madaba in 1872, noticing the presence of a 'heap of stones, marking a central fort' (Tristram 1873: 332); Conder and his surveyors described the ruins as a watch-tower by the road which leads west out of Madaba. The site is located just west of the ring road buffer zone. No MEGA-J record exists for it.

Rujm al-Jazel is visible in the HAS imagery, though no structure of the kind described by the 19th-century travellers and surveyors could be discerned. APAAME aerial photographs taken in the vicinity of the site in 2011, show a much disturbed site, largely bulldozed ahead of establishing a vineyard. This latter has been in place since before the earliest satellite imagery becomes available in Nov 2003 (DigitalGlobe). Despite this, remains of a double-parament wall line oriented WE may be detected in the midst of the vineyard. A series of cup-marks and, possibly, the remains of a small rock-cut winery are also visible.

Ground survey is encouraged in order to ascertain the real nature of the site before it is completely destroyed by further bulldozing.



MAD_0035. Keфир Abu Khinan (West). Ancient structures recognisable on HAS imagery 24.127 (15/07/1953).





MAD_0035. Kefeir Abu Khinan (West). In evidence are the vaulted structures in the N sector of the town. Photograph: APAAME_20100519_SES-0011, Stafford Smith.

MAD_0035; MAD_142. Kefeir Abu Khinan (West)/Kfeir al-Wusta/Ma'amouniyah (كفير أبو حنان / مأمونية)

MEGA-J: 5693 ('Abu Khinan/Hesban region surv. Site 111: Burial/cave; grave; cave/shelter; settlement, no fortifications; tower; milestone; rock art; storage facility/silo; water structure, cistern; reservoir; sherd/flint scatter).

This site was renamed Ma'amouniyah in 1985 (Piccirillo 1989: 309). This village, together with its homonym to the east (MAD_0036), is among the sites to the north of Madaba which are most likely to be indirectly affected by increased construction due to the establishment of the ring road. It is located just east of the Madaba-Hesban road, ca. 3.3 km north of Madaba. Its extent may be reckoned at ca. 0.65 km² (650 dunum).

The site was first visited by Conder (1889: 138-40) who gave a very detailed description of the site, noting structures with barrel vaults, lintels decorated with crosses and a vaulted reservoir (ca. 7*4.8 m in size) as well as an open-air reservoir (*birkeh*) located at the southern limits of the site. The vaults were noticed also by Musil, who also noted the presence of a mosque built by reusing the ruins (Musil 1907; 216-7). Barrel vaulted buildings were also recorded by Ibach (1987:25 no. 111) who noticed that some were being used for grain storage and as animal shelters. Most of these structures are likely Medieval, as the pottery found by Ibach suggested. Ibach (*ibid.*) also noticed the presence of a standing column, which he proposed to view as a milestone.

The site is perfectly visible in the HAS imagery (APAAME_19530715_HAS-24-127). This helps detect the south reservoir (MAD_00142), which has been subsequently filled with debris, probably shortly before the first satellite imagery becomes available (DigitalGlobe, Nov 2003).

The only surviving structures of the site are located at the centre of the village. APAAME imagery taken on 19 May 2010 shows a series of three (potentially four) collapsed vaulted structures wedged between a group of houses and a road. This area was still in relatively good condition in May 2013 (Astrium).



MAD_0036. Kefeir Abu Khinan (East). Photograph: APAAME_20100519_RHB-0027, Robert Bewley

MAD_0036. Kfeir Abu Khinan (East)/Kfeir esh-Sherky/al-Ma'amuniya al Sharqiya (كفير أبو خنان / مأمونية الشرقية)

MEGA-J: 11186 ('Sherky': Grave; Cave/Shelter; Settlement, No fortification; Unspecified. Periods: 9049, 9058); 11187 ('Abu Khinan/Hesban region surv. Site 115': Cave/Shelter, Mosaic, Statue/Sculpture, Unspecified, Sherd/Flint scatter)

Like its homonym (MAD_0035), this site's name was changed in 1985 to Ma'amuniya (al-Sharqiyah to distinguish it from the other). The site is ca. 0.76 km² (760 dunum) in extent. It was first visited by Conder in 1881 (1889: 138), who dismissed it as a site of little importance with only some caves and scatter. Nearly a century later, the site was revisited by the Hesban Region Survey (Ibach 1987: 26 n.115), who noticed a number of vaulted buildings and caves furnished with masonry entrance, much like those of MAD_0035. Pottery collected at the site suggests occupation in the Iron Age, Early Roman, Byzantine and Ayyubid/Mamluk periods. The north-western sector preserves a number of archaeological features that warrant immediate investigation.

It is particularly in the north-western sector that several wall lines can be detected in the HAS imagery (when only one modern farm existed on the site). DigitalGlobe imagery from Nov 2003 shows a number of wall lines at the centre of the village, some of which are preserved right up to the latest available imagery (May 2013, Astrium). APAAME imagery of the site (dated 19 May 2010) highlights in particular the presence of rectilinear walls belonging to a building of some importance as well as a cistern/quarry partly covered by rubble. These are located in the north-western sector of the village, wedged in a corner between three houses.

Inspection and test trenching is recommended to ascertain the chronology and function of the ruined building, which is partly hidden underneath one of the house's gardens.



Ma'in (MAD_0102) viewed from the northwest. Photograph: APAAME_20130414_MND-0479, Matthew Dalton.

MAD_0102. Ma'in (ماعين)

MEGA-J: 10262 ('Ma'in': Church/Chapel; Church/Chapel; Settlement, no fortifications; Baths; Mosaic; Mosaic; Statue/Sculpture; Periods: 9043; 9048; 9050)

Settlement – Ancient/Modern

Ancient and Ottoman settlement concentrated on eastern mound, while modern development has spread to western mound and to a northern limestone knoll, but so far has been limited in the 'old town' where many ruined structures possibly dating back to the Ottoman period can clearly be seen in the satellite imagery. Three churches are reported in association with this site but only one is indicated in the MEGA-Jordan record. One (MAD_0108 – the 'West Church') can be seen in the satellite imagery, and low level obliques by AAJ, as excavated. The excavated site has been left exposed however in close proximity to a modern road which is likely to cause considerable damage over time.



Ma'in West Church (MAD_0108). Photograph: APAAME_20130414_MND-0484, Matthew Dalton.

MAD_0110. Um Jureisat (أم جريسة)

No MEGA-J entry for site

Settlement

The site located on ridge extending from Madaba Plain. Development has currently centred along road from Madaba Plain to Jordan Valley.

MAD_0113. Qasr el-Ward (قصر الورد)?

No MEGA-J entry for site

Ruin, Cistern

Site believed to be that referred to as north east of Ma'in in early travellers' accounts. Site was undisturbed until development starting between 14/06/2006 and 24/05/2008, and further development in period 09/02/2010 and 24/05/2013. Further development is likely and site should be investigated to see if any trace of the structure is left.



Qaryat el-Jureina (MAD_0119). HAS 8.042 (03/07/1953).

MAD_0119. Qaryat el-Jureina (قرية الجرينة)

MEGA-J: 5692 ('Jureina': Mosaic; Sherd/flint scatter; Periods: 9032; 9033; 9054); 11201 ('Jureina': Stone circle, Grave, Cave/shelter, water structure/cistern, Sherd/flint scatter, unspecified/unknown; Periods: 9034; 9039; 9044; 9045; 9049; 9060)

Settlement – ancient underlying modern

Satellite and low level oblique imagery of this site reveals no easily discernible trace of ancient structures. Information regarding the likely extent and nature of the ancient settlement is hinted at by the recording of a partial mosaic in Ibach 1987 site 110, and the historical HAS imagery. Duplication of site in MEGA-J needs to be amended and site extent investigated and recorded.



Kufeir Abu Bedd (MAD_0122) viewed from the north on German photograph dated 11/09/1918 (Bayerisches Hauptstaatsarchiv Abt. IV Kriegsarchiv).

MAD_0122. Kufeir Abu Bedd/Kufeir al-Wakhian/Faysaliyyah (فَيْصَلِيَّة)

MEGA-J: 11192 ('Abu Bedd': Settlement/no fortifications; Sherd/flint scatter; Periods: 9046; 9049; 9055; 9060), 11195 ('Kufeir el-Wakhyan': Settlement/no fortifications; Periods: 9060)

Settlement – ancient underlying modern

Site largely overlain by Ottoman and Modern development, but AAJ imagery indicates that older structures still in situ and discernible, as well as surrounding possible agricultural structures.



Kufeir Abu Bedd (MAD_0122) detail where a wall and entrances to vaulted rooms are evident underneath the modern town. Photograph: APAAME_20130414_MND-0324, Matthew Dalton).

MAD_0132. Deir Shillikh

Monastery ?, Tower, Cave

Site immediately east of Kufeir Abu Bedd. It is now overlain by modern development. The site was known to the early explorers of the region (see related entry in Appendix 1), but has not been subsequently added to MEGA-J.

MAD_0141. Unidentified Ruin (Arish/العريش ?)

MEGA-J:5696 ('Arish': Grave; Periods: 9058)

Settlement (Ancient) ?

HAS Imagery 8.042, 24.128 indicate a possible ruin on this limestone knoll, the knoll beginning to be used in 1953 for permanent settlement, and now covered by a modern village. The knoll may be that referred to by Conder (1889: 87) as Arish "a little knoll in the plain with modern Arab graves of flint stones", but 20 years later by Musil (1907: 355) as a "ḥrejbēt" (the current MEGA-Jordan location for 'Arish' is not indicative of a site).



5. Other sites of interest

In this final section we present a brief selection of other archaeological sites in the study region which require attention, whether because they are threatened by causes other than the building of the Madaba ring road or because they have as yet not been identified as archaeological sites.



MAD_0039. Khirbet Yusra. Photograph: APAAME_20130414_DLK-0211, David Kennedy.

MAD_0039. Khirbet Yusra

MEGA-J: 5694 ('Yusra': Unspecified/unknown')

This site, a clustered, small settlement (0.24 km² or 240 dunum) located on the top of a low limestone mound ca. 1 km SW of Kfeir Abu Bedd (MAD_0122), has never been investigated in any detail.

First mentioned by Conder (1889: 279-80), who proposed to recognise in it Eusebius's *Iessa*, and noticed a rock-cut cistern and several vaults and arches built of rude masonry, Kh. Yusra was reported on the K737 topographic maps and thence imported in JADIS and MEGA-J. Piccirillo mentioned the site in his study of the antiquities of Madaba and its hinterland, but did not apparently visit it himself (1989: 315).

The site is clearly visible in the HAS imagery (APAAME_19530715_HAS-24-127). A roofless house, possibly of late-Ottoman date, is particularly prominent in this imagery. Through the decade covered



by satellite imagery (Nov 2003-May 2013, DigitalGlobe/Astrium), the site has experienced remarkably little modern encroaching. The only exception is a secondary tarmac road laid out to the south-west of the mound starting around May 2008 (DigitalGlobe) and still under construction at the date of the latest available imagery (May 2013, Astrium). This has led to some soil clearance in the vicinity of Kh. Yusra. The piles of rubble visible in the APAAME imagery (April 2013) in the southern sector of the site are also likely connected to road construction.

The site comprises a cluster of buildings, mostly constructed with double-parallel masonry. A small section of a more imposing wall along the western edge of the site may suggest that the settlement once had a defensive function. Along the eastern edge, a modern cemetery is visible, beneath which a series of arches and vaults suggest the presence of reservoirs.

The site is likely Medieval in date. Although not subject to immediate threat, it should be surveyed so as to ascertain function and chronology of settlement.



MAD_0066. The walled site in February 2013 (CNES/Astrium)

MAD_0066. Walled site

No MEGA-J entry for site

This previously unrecorded site is located ca. 1 km south of Hawarrah (MAD_0038), due east of a side road leading SW off the main Madaba-Umm Quseir road.

The site is ca. 0.11 km² (110 dunum) in extent. It appears, though only faintly, in the HAS imagery, where a number of depressions suggest the presence of collapsed structures or caves. DigitalGlobe imagery (esp. from Feb 2010) shows a roughly circular walled site with internal wall lines and a possible reservoir.



Except for an animal shelter built just outside of the south-western limits of the site between February and April 2013 (Astrium), the site is not immediately under threat. However, as a previously unrecorded site, it should be subject to urgent ground survey.



MAD_0087. Photograph: APAAME_20130414_DLK-0243, David Kennedy.

MAD_0087

No MEGA-J entry for site

Circular Enclosure

The site is a circular enclosure ca. 43 m. in radius. Visible on 1918, HAS and satellite imagery. No internal structures evident. Enclosing wall in an increasing state of rubble and low level oblique imagery from AAJ indicates area inside is being used for agriculture. Resembles 'Conder's Circle' (MAD_0100) in structure and size. A cistern may have been placed in centre of site – the cover of which is partially visible on low level imagery.

MAD_0101 Al-Kanisah Monastery on the Wadi Afrit

No MEGA-J entry for site

Monastic complex investigated by J. Ripamont (Caracas) and excavated from 1965 by the 'Friends of Mount Nebo' (Piccirillo & Alliata 1998: 205-209). Excavation clearly evident on satellite imagery. An access road to the site becomes increasingly used between 14/06/2006 to 24/05/2008, and the installation of terracing walls east of site, presumably extending the farm further up the wadi, also occurs during this period. Potential damage to site consequently increased.



Quweijiya (MAD_0103). Photograph: APAAME_20130414_DLK-0297, David Kennedy.

MAD_0103. Quweijiya (قويجية)

MEGA-J:5695 ('Quwaijiya': Settlement, no fortifications; Periods: 9060)

MEGA-J entry records only modern period remains of a settlement, but low level oblique imagery taken by AAJ project indicates older, possibly ancient, ruins on top of peak as well as associated structures such as possible cisterns, tombs, caves and a quarry, some of which appear to be reused. The later modern settlement is lower down the slope to the west. Dolmen are also noted by Musil (1907: 111-114) in association with the site location. Ground survey to investigate full extent of site is required. Clearance of peak appears to have occurred which may have damaged some of the structures.



MAD_0104. The source of the Ain Jedeideh. Photograph: APAAME_20060910_DLK-0010, David Kennedy.

MAD_0104. Ain Jedeideh

No MEGA-J entry for site

Spring

No MEGA-Jordan entry for site of the spring and fertile area of wadi valley, but cf. MEGA-J:11245 which holds the name "Ain Jedideh" but does not encompass the Spring or valley, and MEGA-J:58435 named "Ain Jedeideh" but clearly referring to the site of 'Conder's Circle'.

Extensive area with visible Ottoman (?) structures and probably earlier traces of settlement and agriculture due to the location of the permanent water source. Conder (1889: figure between 100 and 101) documents a carved lintel stone, and associates the Spring with 'Hadanieh' where he also mentions 'Conder's Circle'.

MAD_0105

No MEGA-J entry for dolmen fields

Dolmens

Historical travellers accounts are profuse in their documentation of Dolmen Fields on the slopes west of the Madaba Plain. These types of sites are very difficult to capture from the vertical perspective thus extents and condition of landscape cannot be confirmed and must be done by ground survey. The forthcoming publication from the Mount Nebo Archaeological Survey on the megalithic monuments of their survey area (Mortensen et al. 2014: 139) will provide important



information regarding the distribution and current state of the monuments (cf. Mortensen et al. 2013: fig 10, 13, 20-21, 25).

MAD_0107; Al Fehaa / Rujm Ghuweinim

MEGA-J: 59331 ('Al fehaa')

Rectilinear Structure – Tower?

A collapsed rectilinear structure, possibly a tower c. 30m square, on a peak (835m according to K737 3353.III - Ma'in Sheet) on the ridge that extends west from the Madaba Plain (referred to by Musil as el-Maslubijje) which overlooks the Wadi Judeid and Kunaiyisa valleys to the north and Wadi 'Uyun adh Dhib valley to the south. A collapsed small cairn or Rujm can possibly be seen c. 100m to west on the same peak. An ovoid enclosure (c. 120 x 230 m), possibly a low field wall, encapsulates the two structures. A road passes from the plain to the east just north of the site, descending into the Jordan Valley.

MEGA-Jordan record does not contain any detail regarding structure.

MAD_0115

No MEGA-J entry for site

Rectilinear Structure

A ruined structure c. 7 x 17 m. with several internal partitions (up to four). A modern dwelling has been erected alongside the site.



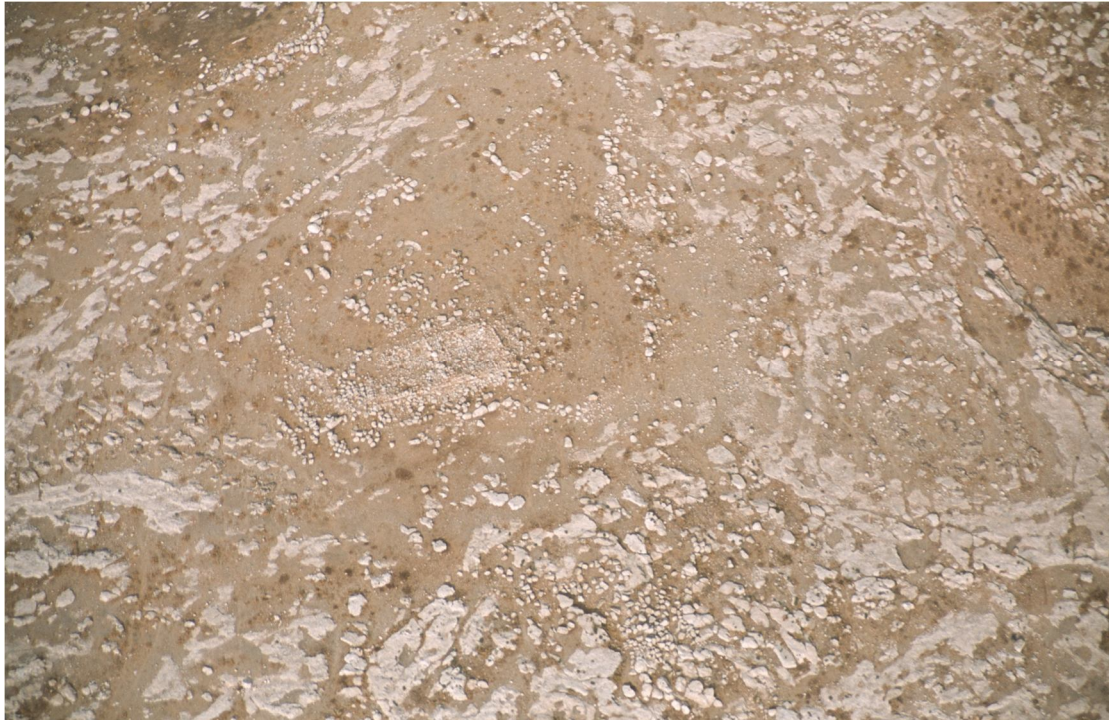
MAD_0120. Photograph: APAAME_20021002_DLK-0136, David Kennedy.

MAD_0120

No MEGA-J entry for site

Rectilinear Structure – tower?

Site is clearly evident in HAS and satellite imagery as a ruined structure. c. 12 x 12 m. with buttresses evident across north and south walls. Extent of buttresses suggests site may be Ottoman. May be related to site MAD_0121 which is c. 115 m. to south. A road may be in the vicinity of this site if this is a road tower. Possibly entrance to a cistern and associated drain also visible in low level oblique imagery by AAJ (note: AAJ project may incorrectly refer to site as Qubur Abd Allah).



MAD_0121. Photograph: APAAME_20021002_DLK-0139, David Kennedy.

MAD_0121

No MEGA-J entry for site

Rectilinear Structure – tower?

Site not clear on HAS imagery, barely visible on satellite imagery, but clear on low level oblique photographs taken by the AAJ project. c. 5 x 11 m with at least one internal division to create two square rooms of equal size. May be related to site MAD_0120 which is c. 115 m. to north. A road may be in the vicinity of this site if this is a road tower.



Vicinity of sites Kabr Abdallah (MAD_0124) and Khirbet Berdala (MAD_0128) on HAS imagery 24.129 dated 15/07/1953.

MAD_0124. Kabr Abdallah / Tombs of Abdallah (قبور عبدالله)

MEGA-J:5699 ('Kabr 'Abdallah': Unspecified/unknown; grave; Statue/Sculture; Periods: 9059)

Burial (s), Tomb(s), Cairn(s)?

MEGA-Jordan location and location on Jordan 1:25,000 Palestine Grid 210/125 El Quweijīya Map not in agreement. Approximate site location is in vicinity of modern development which is likely to expand. Site should be investigated and confirmed so not lost to modern development.

MAD_0126. Serarah (رحم صرارة)

MEGA-J: 5706 ('Serarah': Stone fences/enclosures; Periods: 9049)

No site in this location evident in HAS or satellite imagery.

MAD_0128. Khirbet Berdala (خربة بردالا)

No MEGA-J entry for site

Settlement

Location is not certain. No MEGA-Jordan or JADIS registered for this site, but mentioned in early 20th century sources. HAS imagery identifies several small settlements in this area that may relate. Further investigation required.

**MAD_0130**

No MEGA-J entry for site, but may in fact be site 'Serarah', for which see MAD_0126

Rectilinear Structure

Site appears as the lower courses of a c. 15 x 18 m structure. It is evident on the 1953 HAS imagery. First sign of damage to site in 15/06/2009 imagery due to the creation of a fence or track alongside field. Site appears completely damaged by 24/05/2013. Ground survey required.



Farmstead MAD_0133. Photograph: APAAME_20130414_MND-0302, Matthew Dalton.

MAD_0133

No MEGA-J entry for site

Farmstead – Ottoman/Modern

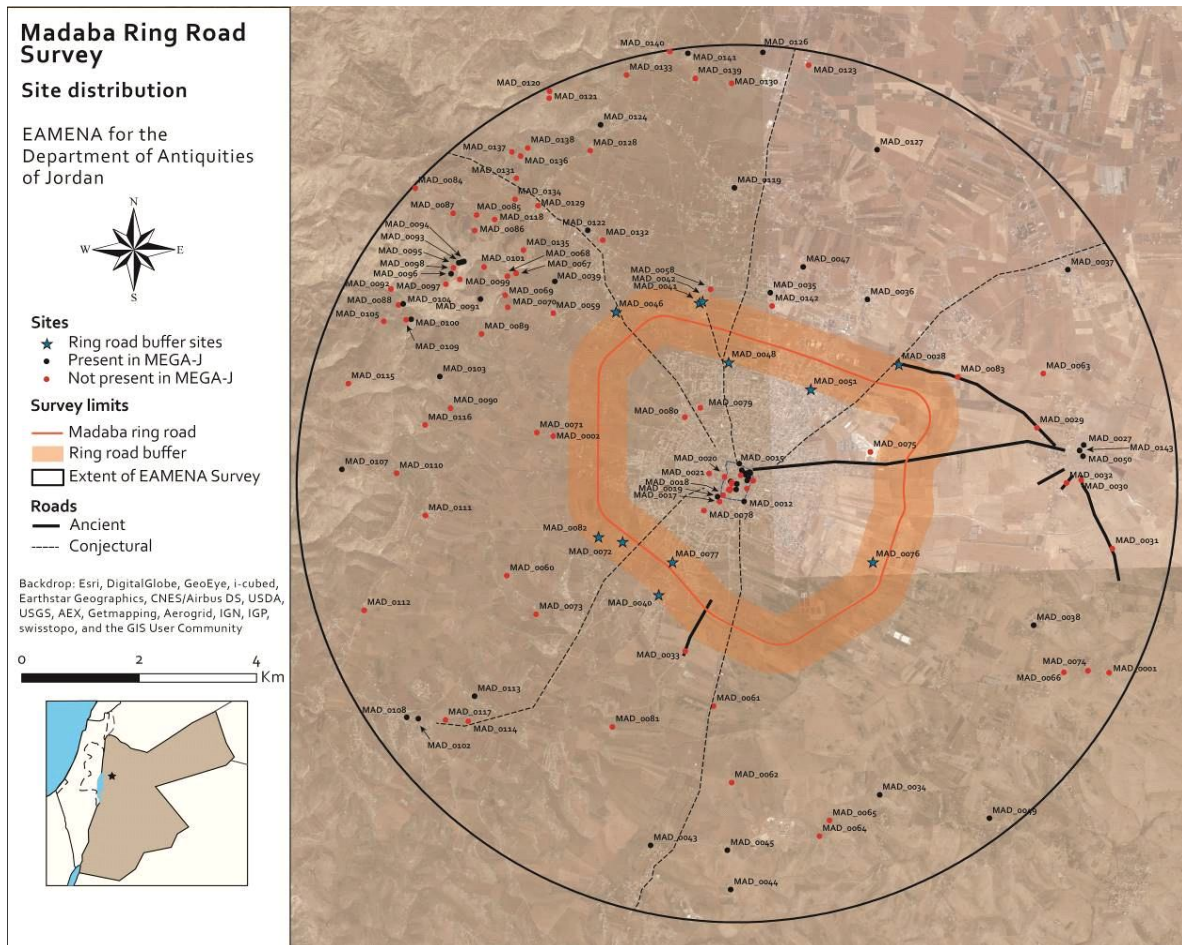
A farm complex c. 18 x 16 m. with external structure c. 4 x 7 m. that possibly dates to the Ottoman (?) period. A modern extension of farmstead has been built alongside. Low level oblique photographs identify large worked stone blocks that may indicate stone has been utilized from an even older site. Structure of what possibly could be a tomb entrance, and two cisterns, also visible on low level imagery. Ground survey is required to determine if worked stone is indeed ancient, and if an ancient site is underlying farmstead or is in another location.

MAD_0140

Unidentified Ruin - Rectilinear Structure?



HAS 8.042, 24.128 indicates a ruin, possibly rectilinear, over an area c. 35x40m, visible on a limestone knoll c. 300m east of MAD_0141. Modern village is overlying possible site.



6. Conclusions

This report details a rapid remote sensing survey conducted around the city of Madaba during the month of March 2015. Considering the quick turn-around necessary in this instance, our report cannot be regarded as entirely comprehensive, nor as an end product in itself. Despite this, it is hoped that it will serve the needs of our partners, the Department of Antiquities of Jordan, in conducting ground survey work in the coming weeks ahead of the completion of the ring road, as well as in devising strategies for the protection of sites directly and indirectly affected by this important infrastructural project. Another area in which we believe that this report will be of use is that of contributing data to populate new MEGA-Jordan records and improving the quality of pre-existing ones (whether through the correction of spatial data or the inclusion of further site features/bibliography).



Aside from the 11 sites and site features immediately at risk because of the ring road, all of the other sites mentioned in this report, as well as most of those which appear in Appendix 1 deserve immediate attention. This is particularly true for sites lying within the perimeter of the ring road, or just outside of its buffer: experience shows that the establishment of ring roads naturally leads to the infill of urban space up to the perimeter of the road. Strategies for the preservation or, where this results to be impossible, the careful documentation of cultural assets in this region should be urgently set in motion.

Overall, while no compelling evidence has been detected to legitimise substantial change in the ring road's projected layout, we encourage high-intensity, site-specific survey of all of the sites directly and indirectly affected by the ring road project. In particular, we would encourage test-trenching along the track of MAD_0033, an ancient road which is projected to be crossed by the ring road. Very little is known about the ancient road network in and around Madaba (see Appendix 2 for discussion): investigation of MAD_0033 may provide much needed information as regards dating and construction techniques. Other priority sites are MAD_0040, MAD_0077 and MAD_0082 (for all three, intensive survey is recommended).

This survey was chosen as a pilot study to test what we hope to be a durable collaboration between EAMENA and the Department of Antiquities of Jordan. This collaboration aims to assess the state of endangered cultural assets in areas affected by forthcoming infrastructural/development projects or other threats, such as looting. We believe that the results of this report show the validity of our approach and the usefulness of the documentation that we are able to provide. We look forward to furthering our collaboration with the Department of Antiquities of Jordan and to contributing our expertise for the protection and monitoring of Jordan's endangered cultural heritage.