Archaeological Atlas of Published Excavations

Rex Kwok and Mark Peters
rbhkwok@gmail.com|mp@parkmeters.org

July 3, 2020

Abstract

An atlas of archaeological features has been constructed from published literature and Google Earth satellite imagery. The scope of the atlas is global but restricted to the collections of Fisher Library in The University of Sydney, Australia.
Keywords: archaeology, atlas

1 Introduction

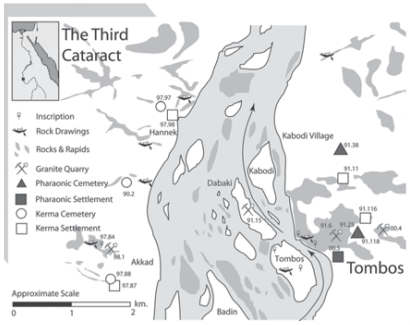
An atlas has been constructed that locates archaeological features based on published sources. Maps and site plans are matched with satellite imagery provided by Google Earth to derive the location of an archaeological feature. Sources that aid in locating a feature are attached in a list of references. The published material has been overwhelmingly sourced from Fisher Library in The University of Sydney. It includes an extensive collection of printed publications (archaeological journals and books) and electronic publications. The atlas described here currently holds over 85 000 features and over 35 000 references. A project that mapped some 2 000 archaeological sites in the Ancient Near East on Google Earth [Ped12] was released in 2012. References were not incorporated into that work. Federal laws in the United States of America (USA) seem to prohibit publishing the location of certain American archaeological sites. As such, the publicly available version of the atlas does not contain any sites within the USA. This section of the alas may be available on an individual basis by contacting the authors.

2 Folder Structure

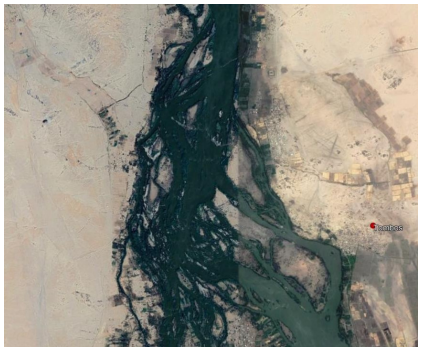
At the top level, archaeological features are placed under four folders: *Excavated Sites*, *Survey Sites*, *Approximate Locations*, and *Structures*. Under each of these folders is a collection of points and paths organised under a hierarchy based on geographical location. The geographical hierarchy reduces the number of points in a folder and makes atlas construction under Google Earth more efficient. Each point locates an archaeological site or a structure within an archaeological site. Structures include features such as theatres, tombs, and pyramids. Paths are used to mark out long linear features such as walls and enclosure boundaries.

2.1 Excavated Sites

An excavated site is an area of archaeological excavation that is the subject of at least one monograph. Typically, the precise location of an excavated site is established by a map or geographical coordinates that approximately locate a site to within several kilometres and a site plan that matches Google Earth imagery. An example is the excavation of Tombos pharaonic cemetery in Sudan [Smi07]. From a map of the Nile near Tombos 1a a matching satellite image of the area, Figure 1b [Goo19a], is easily found.



(a) Local area map around Tombos



(b) Google Earth image around Tombos

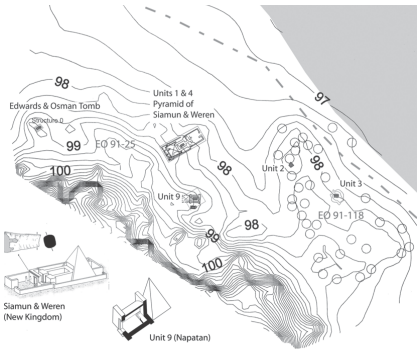
Figure 1: Maps narrow the location of an archaeological site to within a few kilometres

The Tombos area map in Figure 1a marks out two pharaonic cemeteries. For the southern cemetery, closer examination of the corresponding area in satellite imagery, Figure 2b [Goo19b], reveals a match with the plan of that cemetery, Figure 2a. Several structures have been pinpointed in the Google Earth imagery to highlight this match. In the centre can be seen the pyramid tomb of Siamun and Weren, the patch of circular tumuli is on the right while the probable location of "Structure O" is on the left.

A point, called a "Placemark" by Google Earth, identifies the location of an archaeological site. The most significant attributes of a point are the name and the location. The name is typically the first label encountered from a publication that is used to locate a site. A few will have an alternative label in brackets. For example, the label "Paris (Lutèce)" is used to name the modern city of Paris in France while Lutèce refers to the Roman period archaeological site within Paris. A bracketed label is also used when a surveyed site is excavated. For example, located at 35°59.2′N, 43°51.76′E is an archaeological site labelled "Kurd Qaburstan (EP 31)". "EP 31" is the original survey label for the site [UdJG+13] while "Kurd Qaburstan" is the name of the site when excavated [SBC+17].

2.2 Survey Sites

Survey sites are characterised by a publication that identifies a number of archaeological sites within an area. These sites are typically placed on a single map. A description



(a) Plan of Tombos pharaonic cemetery

(b) Google Earth image

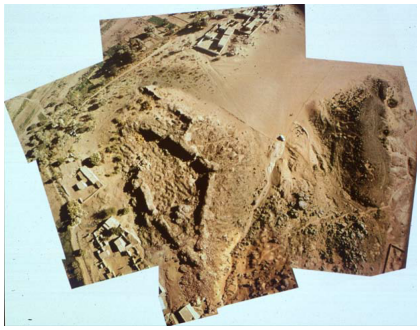
Figure 2: Matching a published plan of the pharaonic cemetery in Tombos with a Google Earth image

of each site is presented and a line drawing depicts size, shape, and orientation. Often, only surface collection is carried out. A survey of the area in Sudan between Old Dongola and ez-Zuma is presented in [Zur02]. Geographical co-ordinates of the site of ed-Deiga are given together with an aerial photograph from the north. Matching this photograph and Google Earth imagery [Goo19c], as shown in Figure 3, confirms the correctness of the location.

The information available for a survey site tends to be less precise than for an excavated site. As such, confidence in the correctness of the location of a survey site is lower.

2.3 Approximate Locations

When the available information can only narrow the location of an archaeological site to within a few square kilometres, such points are placed within the *Approximate Locations* folder. One cause of uncertainty is that Google Earth only provides low resolution imagery for an area of interest. More often it is that the available literature does not provide sufficient information. This is often the case with the results of an archaeological survey. At times the location data for a survey site are precise but its description is vague. The opposite also occurs. While a detailed site plan is provided, available information places the site in an area for which the site cannot be located with certainty. Small archaeological sites, such as caves and rock shelters, are typically placed within *Approximate Locations*.



(a) Published photograph from the north

(b) Google Earth image

Figure 3: Matching a published photograph of ed-Deiga fortress with a Google Earth image

2.4 Structures

For a large archaeological site, a published plan may identify discrete structures. An example is the site of ez-Zuma, Sudan (located at 18°22.07′N, 31°44.53′E) shown in Figure 4 [eTC11]. The mapping of the southern tombs, K.1 to K.4, can be seen in Figure 5a.

Since structures are much smaller than a site, small variations in the placement of maps by Google Earth can be problematic. Google Earth picks a default image to display. This is often the most recent image but may also be an older but clearer image. Over the many images that are sometimes available, some may have skewed structure labels. An example is seen for the site of ez-Zuma. It shows how labels that are placed when the default is a 2018 image, Figure 5a [Goo19d], become misaligned for the 2004 image, Figure 5b [Goo19e]. For this example, the difference measures approximately 14 metres. In serious cases of this problem, a label for a structure may shift onto a neighbouring structure.

When the available information can only narrow the location of an archaeological When the exact location of a structure is questionable the name of the structure is appended with a “?”.

3 References for a Feature

The description field is an attribute of each feature in the atlas and is used to hold source information and synonyms. Source information cites the references used to locate an archaeological feature. For the most part, these are publications in journals and books. In a few cases source information comes from web sites. Where references have different names for the same archaeological site, some attempt has been made to collect such synonyms in the description field. The source information is written

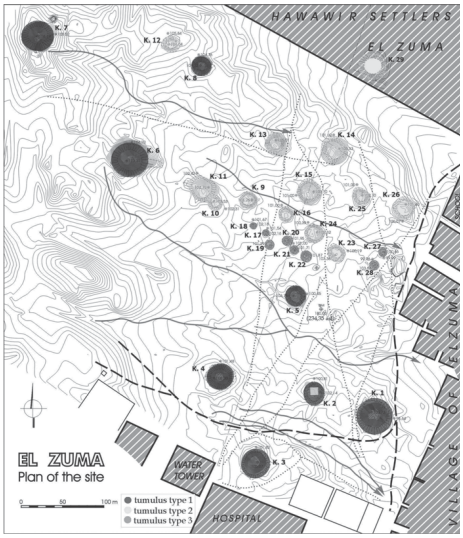


Figure 4: Identified tombs in the site of ez-Zuma, Sudan

in elementary Hyper Text Markup Language (HTML) for the simple expedient that Google Earth renders such a description as Hyper Text with a left-click on a feature. An example is seen below for the excavated site of Jebel Abu Thawab (located at 32°9.772′N, 35°50.741′E) in Jordan.

<h4>References:</h4>

Gillet, E., and Gillet, C., Jebel Abu Thawab, Jordan in Levant 15 (1983), pp. 187-190.
Gordon Jr., R. L., and Knauf, E. A., Er-Rumman Survey, 1985 in Annual of the Department of Antiquities of Jordan 31 (1987), pp. 289-298.
Kafafi, Z., Second Season of Excavations at Jebel Abu Thawwab, 1985. Preliminary Report in Annual of the Department of Antiquities of Jordan 30 (1986), pp. 57-67.
Kafafi, Z., First Season of Excavations at Jebel Abu Thawwab (Er-Rumman), 1984 (Preliminary Report in Annual of the Department of Antiquities of Jordan 29 (1985), pp. 31-41.
Nashef, K., Ausgrabungen und Geländebegehungen Jordanien (II) in Archiv für Orientforschung 33 (1986), pp. 148-299.
Kafafi, Z. A., Abu-Jaber, N., et al., Jebel Abu Thawwab (Er-Rumman), Central Jordan : the late Neolithic and early Bronze Age I occupations, Berlin, ex oriente, 2001.
Kafafi, Z. A., Late Neolithic architecture from Jebel Abu Thawwab, Jordan in Paléorient 11(1) (1985), pp.

(a) ez-Zuma as mapped in 2018

(b) ez-Zuma as mapped in 2004

Figure 5: Images of tthe southern tombs of ez-Zuma at different times

125-127.

Kafafi, Z. A., The Impact of Modern Human Activities on Archaeological Heritage: an Example from the Jebel Abu Thawwab Site in Proceedings of the 8th International Congress on the Archaeology of the Ancient Near East : 10 April-4 May, 2012 University of Warsaw, Volume III, Bieliński, P., Gawlikowski, M., Koliński, R., Ławecka, D., Sołtysiak, A., and Wygnańska, Z., (eds.), Wiesbaden : Harrassowitz Verlag, 2014, pp. 283-294.

<h4>Synonyms:</h4>

 = Jebel Abu Thawwab (Kafafi 1986)

Under a "References:" heading is a list of publications - journal articles, articles from the proceedings of conferences, book chapters and books. Each item contains a reference. Effort has been made to keep the grammar of each reference consistent across the atlas. A reference starts with a list of authors with an Oxford comma and the word "and" separating the penultimate and last authors. An author consists of a surname with initials following a comma. Where the author list is long and listing all authors is overly difficult, the last listed author is followed by the italicised abbreviation "et al.". Book references follow a simple pattern. After the author list comes the book title in italics followed by publisher information and ending with the publication year. Other references have a moderately more complex grammar. After the author list is the reference title and the publication title separated by the word "in". Following this is the publisher information, the year of publication and the page range.

The fifth reference by K. Nashef shows an example of a HTML entity code. The citation contains an accented character "ä" and in this case it was more efficient to enter the HTML code "ä".

The order in which references appear has some significance. The first reference is typically the one that is used to locate the site. More rarely, a combination of the first few references are used in conjunction to verify the location. For instance, the first reference may provide a coarse map that narrows the location of a site to within a small area and the second reference may provide an aerial photograph that locates the site in that area. Other references included are typically excavation reports that corroborate the location of an archaeological site.

An archaeological site may accumulate synonyms. Where a synonym has been noticed in the literature it is placed in a list after the references. The list has a "Synonyms:" heading and each item in the list is a synonym. An example is seen above where a synonym consists of the "=" sign, the synonym, and a pointer to a reference where the synonym is used. The collecting of synonyms has not been done systematically and the reference list can be mined for synonyms in publication titles. Due to the lengthy construction period of the atlas, a few sites may still have synonyms listed at the start of the description field with line(s) beginning with "=" followed by the synonym. In the example above, "Thawab" is spelt with an extra "w" as "Thawwab".

Occasionally, a point will have internet references. An example is the site of Hawara (located at 29°16.45′N, 30°53.94′E) in the Faiyum of Egypt.

```
<h4>References:</h4>
<ol>
  <li>Petrie, W. M. F., Wainwright, G. A., and Macka, E., <i>The
labyrinth, Gerzeh, and Mazghuneh</i>, London, British School of Ar-
chaeology in Egypt, 1912.
  <li>Szynkiewicz, A., <i>GPR research around the Hawara pyramid
(Fayum, Egypt)</i> in <i>Archaeologia Polona</i> <b>53</b> (2015),
pp. 383-386.
</ol>

<h4>Web Sites:</h4>
<ol>
  <li><a href="http://fayum.arts.kuleuven.be/oud/hawara/general.htm">
Katholieke Universiteit Leuven Hawara 2000 - Fayyum project
</ol>
```

A modern archaeological excavation often has web pages dedicated to the excavation. Where such a resource has contributed to the finding of an archaeological site, it is included under a "Web Sites:" heading. What follows is a list of Hyper Text links with the label describing the institution and project behind the web site. In the example above this is the "Katholieke Universiteit Leuven" with a project in the Faiyum of Egypt called "Hawara 2000". Web resources are notoriously ephemeral and often change locations. They are avoided as far as possible. For web sites that have moved,

entering search terms from the label in a search engine should locate the appropriate web site.

The location of a structure for an archaeological site is derived from the references for the site. More haphazardly, a publication that reports on the excavation of a structure in an archaeological site is referenced within the description of the structure itself. For example, the Arch of Constantine in Rome (located at 41°53.388′N, 12°29.438′E).

Inconsistencies exist within the atlas when dealing with references. Some are unavoidable while others are reparable. In a few cases the location of a point will have been derived from Wikipedia without other supporting references. This will be evinced by an empty description field. Such archaeological features are typically classified as *Approximate Locations*. They are often prominent features and indicate archaeological sites for which publications have been inaccessible. Another inconsistency occurs when dealing with authors of references from Chinese journals. For such references, the name of an author is a sequence of two or three Chinese characters. The first character is the family name. The second character, if it exists, being the generational name and the final character the personal name. Some references will be truncated due to inefficiency and the inability to type characters in certain languages. For instance, references from the journal *Russian Archaeology* will often only contain details of the volume, year, and page numbers.

4 Geographical Taxonomy

Mirrored across the main folders (Excavated Sites, Survey Sites, Approximate Locations, and Structures) is a hierarchy of sub-folders that organises points by geography. At the top level is a division into continents. The *Central Asia* folder holds the republics of the former Soviet Union while the *Pacific* folder contains all the island nations found in the Pacific Ocean – including New Zealand and Papua New Guinea. At deeper levels, the folders are derived from the *Borders* layer in Google Earth that delimit *International Borders*, *1st Level Admin Borders* and *2nd Level Admin Regions*.

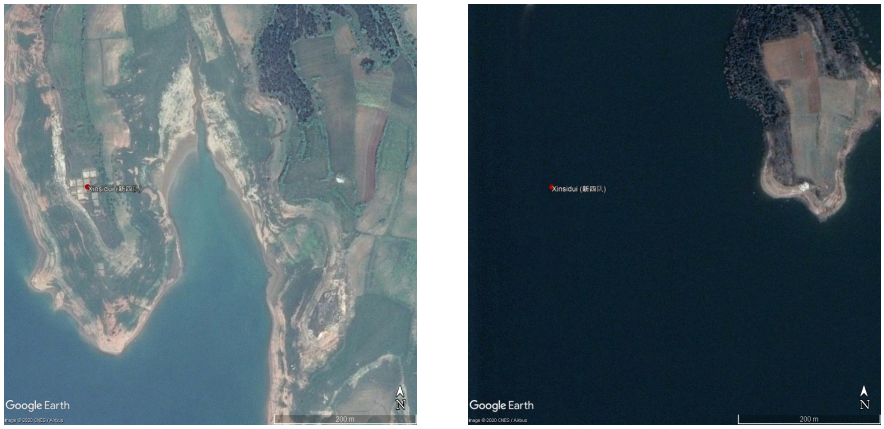
A few known exceptions exist where a grouping of points is based on a particular publication. An extensive survey of Iraqi archaeological sites [AN72] spans the modern governorates of Al-Qādisiyyah and Dhī Qār in Iraq. Points derived from this seminal archaeological survey are placed within a single folder *Adams - Uruk 1972* under Iraq.

When a large archaeological site has identifiable structures, points indicating structures are placed in a folder that mirrors the archaeological site. For instance, the archaeological site of *Rome* is place in the following path: *Excavated Sites* → *Europe* → *Italy* → *Lazio*. The various structures within *Rome* are placed in the path: *Structures* → *Europe* → *Italy* → *Lazio* → *Rome*.

When a country has few archaeological sites for which structures have been identified, structure folders are collected in a single folder for that country. For instance, excavated sites in Bulgaria are split across 27 provinces. Currently only 22 Bulgarian archaeological sites have mapped structures. As such, they are collected under *Structures* → *Europe* → *Bulgaria*. When too many structure folders accumulate here, they will be placed in province sub-folders.

5 Recent Excavations

Google Earth archives historic satellite imagery and certain images show an archaeological site more clearly. This is especially the case with *rescue* excavations where modern infrastructure construction can destroy or obscure an archaeological site. The archaeological site of Xinsidui in Henan, China (located at 32°42.252′N, 111°29.744′E) can be seen in a 2012 image Figure 6a as a grid of square excavation trenches while the Three Gorges Dam has left the site submerged in 2018 Figure 6b.



(a) Xinsidui in 2012 (b) Xinsidui in 2018

Figure 6: Images of Xinsidui at different times

Enclosures seen as crop marks are clearer under certain environmental conditions. An example can be seen in the survey site of Lawhitton Enclosure (located at 50°36.878′N, 4°29.744′W). Seen in Figure 7a is satellite imagery from 2001 that clearly shows the enclosure outline. With the 2018 image Figure 7b, the outline is less clear.

When a point is created using historical data, Google Earth adds a tag that indicates which image was used. With the example of Xinsidui, the location data includes:

<gx:TimeStamp><when>2012-05-06</when> </gx:TimeStamp>

- an invisible tag that is invoked with a double left-click; changing the display to the image with that time stamp.

6 Future Work

Archaeology, a field of endeavour that investigates the past, has itself a history that extends several centuries. It will continue into the future with ever more sophisticated techniques. As such, it will provide more material that can be incorporated into the atlas. As regards archaeological excavations in the past, more archaeological journals are digitising their archival content. In short, there is no shortage of material for refining and augmenting the archaeological atlas. One major shortcoming of the atlas, as it

(a) Lawhitton in 2001 (b) Lawhitton in 2018

Figure 7: Images of Lawhitton Enclosure at different times

exists as a file on Google Earth, is the limited ability to search or mine the information. The conversion of the atlas into another format, such as a relational database, would facilitate this.

References

[AN72] R. McC. Adams and H. J. Nissen. *The Uruk countryside; the natural setting of urban societies*. University of Chicago Press, Chicago, 1972.

[eTC11] M. el Tayeb and E. Czyżewska. Early Makuria Research Project. excavations at ez-Zuma. the third season, Jan.-Feb. 2009. *Sudan and Nubia*, 15:108–123, 2011.

[Goo19a] Google Earth Pro 7.3.3.7699. <http://www.google.com/earth/index.html>. *Tombos Area, 19°43.3′N, 30°22.4′E, elevation 6km, image date 3rd July 2019*, 2019.

[Goo19b] Google Earth Pro 7.3.3.7699. <http://www.google.com/earth/index.html>. *Tombos pharaonic cemetery, 19°42.79′N, 30°24′E, image date 25th March 2011*, 2019.

[Goo19c] Google Earth Pro 7.3.3.7699. <http://www.google.com/earth/index.html>. *ed-Deiga Fortress, 18°10.74′N, 31°36.315′E, image date 9th November 2018*, 2019.

[Goo19d] Google Earth Pro 7.3.3.7699. <http://www.google.com/earth/index.html>. *ez-Zuma, 18°22.07′N, 31°44.53′E, image date 9th November 2018*, 2019.

[Goo19e] Google Earth Pro 7.3.3.7699. <http://www.google.com/earth/index.html>. *ez-Zuma, 18°22.07′N, 31°44.53′E, image date 21st January 2004*, 2019.

[Ped12] O. Pedersén. Ancient near east on Google Earth: Problems, preliminary results, and prospects. In R. Matthews and J. Curtis, editors, *Proceedings of the 7th International Congress on the Archaeologyof the Ancient Near East, 12 April - 16 April 2010, the British Museum and UCL, London. Volume 3: Fieldwork & Recent Research Posters*, pages 385–396. Harrassowitz Verlag, 2012.

[SBC+17] G. M. Schwartz, C. D. Brinker, A. T. Creekmore, M. H. Feldman, A. Smith, and J. A. Weber. Excavations at Kurd Qaburstan, a second millenium B.C. urban site on the Erbil plain. *Iraq*, 79:213–255, 2017.

[Smi07] S. T. Smith. Kirwan memorial lecture. Death at Tombos: Pyramids, iron and the rise of the napatan dynasty. *Sudan and Nubia Society*, 11:2–14, 2007.

[UdJG+13] J. Ur, L. de Jong, J. Giraud, J. F. Osborne, and J. MacGinnis. Ancient cities and landscapes in the kurdistan region of Iraq: The Erbil plain archaeological survey 2012 season. *Iraq*, 75:89–117, 2013.

[Zur02] B. Zurawski. Survey and excavations between Old Dongola and ez-Zuma. *Sudan and Nubia*, 6:73–85, 2002.