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Ante Quem

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tel. +39 051 2097700; fax +39 051 2097802; antonella.tonelli@unibo.it

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# GEOREFERENCING WOOLLEY'S "ROYAL CEMETERY" AND DEEP SOUNDINGS AT UR (IRAQ)

Giacomo Benati, Elena Leoni, Simone Mantellini

*The paper aims at proposing a new topographical analysis for the location of Woolley's excavations on the upper terrace of the mound of Tell al-Muqayyar, ancient Ur (Iraq). The excavations in this sector of the mound brought to light architectural and material remains from the 3<sup>rd</sup> millennium BC settlement. New aerial photos are combined with revised digital maps in order to produce a set of georeferenced vector maps that update and correct the datasets published in the final reports. In addition, remote sensing tools are used to provide a preliminary assessment of the changes occurred in the archaeological landscape surrounding Ur during the last decades.*

## Introduction<sup>1</sup>

This paper consists of a tentative update of available topographical datasets for the ancient city of Ur, Tell al-Muqayyar, in southern Mesopotamia (modern Dhi Qar Governorate, Iraq; fig. 1). The site was subjected to systematic digging by an expedition sponsored by the British Museum of London and the Penn Museum of Philadelphia, directed by C.L. Woolley between 1921 and 1934. The excavations at Ur have been renovated in 2015 by a team from Stony Brook University directed by E. Stone and P. Zimansky (Stone, Zimansky 2017).

Between 1934 and 2015 no significant archaeological explorations took place at Ur. Thus, the datasets produced during Woolley's dig are still of tremendous value for our understanding of this site, but a fresh analysis of its topography is instrumental for filling the gaps left by the archaeological and recording methods of the time. We now have the chance to combine new research into archival data (*Woolley's Excavation Strategy in Retrospect*; cf. Benati 2013; 2014; 2015a) with new digital

mapping produced on the basis of the available literature and new aerial datasets (*Positioning and Georeferencing the Early Dynastic City: New Aerial Data and Digital Mapping*; figs. 2-4). Our aim is to check and correct the topographical datasets published in the final reports and, by doing so, to locate and frame more precisely the areas excavated by Woolley in the 1920s-1930s and the associated findings.

Finally, this new information has been framed within a landscape assessment based on survey data collected during the 1960s, and re-elaborated via GIS and remote sensing tools, with the aim of better understanding the relationship between the site of Ur and its regional setting (*Preliminary Landscape Assessment*; figs. 5-6).

The outcome of this article provides an updated set of digital maps showing the location of Woolley deep soundings and excavation areas – among which the well-known Royal Cemetery Area – within the upper terrace of the Ur mound, and a preliminary assessment of the evolution of its surrounding archaeological landscape during the last decades.

## *Woolley's Excavation Strategy in Retrospect*

The strategy adopted by L. Woolley in excavating Ur was a carefully planned one. The aims of

<sup>1</sup> G. Benati wrote *Woolley's Excavation Strategy in Retrospect* and *Positioning and Georeferencing the Early Dynastic City*; E. Leoni wrote *Georeferencing Ur*; S. Mantellini wrote *Preliminary landscape Assessment*; the *Introduction* and *Concluding Remarks* have been written jointly. We thank Nicolò Marchetti for his encouragement and suggestions.

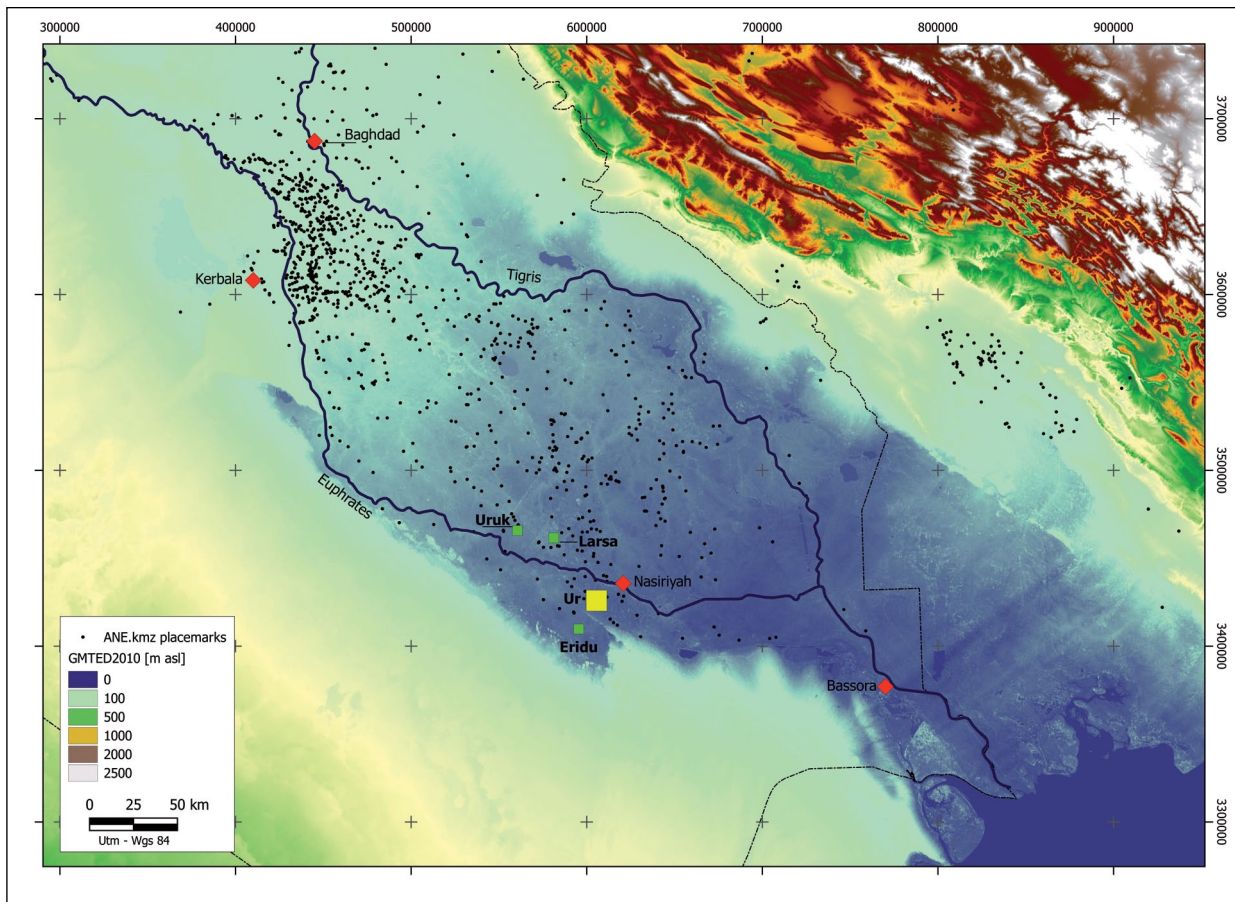


Fig. 1. Tell al-Muqayyar-Ur and the main archaeological sites in the southern Mesopotamian floodplain (basemap: USGS - Global Multi-Resolution Terrain Elevation Data 2010; computer graphics by S. Mantellini).

the excavators were not only to uncover objects suitable for museum display, but also to throw light on the history and topography of the site. Given the long-term perspective of the project and the fact that Ur was a large settlement, Woolley aimed at grasping the urban development patterns of the site, while unearthing and restoring its main monuments.

As customary for that season of explorations in Mesopotamia, the dig was conducted on a grand scale. For five months a year, over 200 workers were employed in the field with little archaeological supervision, as stressed by Mallowan (1960: 1). This notwithstanding, the results produced by this expedition are likely to remain unmatched in the history of Mesopotamian and Near Eastern archaeology.

A strategy consisting of trial trenches and horizontal expositions was adopted. The accounts of the first campaigns make clear that trenches were cut in order to test the stratigraphy of some areas of the mound and the follow-up strategy was de-

vised according to the results of these tests. It is well-known that a trench excavated in the Royal Cemetery area in 1923 (Trench A) allowed them to expose a number of burials likely belonging to a cemetery, but since Woolley knew that the men were not adequately trained to dig graves, the full-scale investigation of this burial ground was postponed (Woolley 1928: 1). Therefore, the first campaigns were dedicated to the extensive clearance of the large public monuments dating from the Ur III period in the temenos area, already partially exposed by the previous work conducted by Hall during a brief excavation campaign in 1919.

It is only from the second part of the 1926-1927 campaign that the main efforts of the expedition were directed to the excavation of the Royal Cemetery Area (Woolley 1928; Zettler, Hafford 2015; see figs. 2-4). Here, hundreds of graves were cleared each campaign, cutting long trenches across the area that was then progressively excavated moving from the Ur III temenos wall towards the Neo-Babylonian temenos wall.



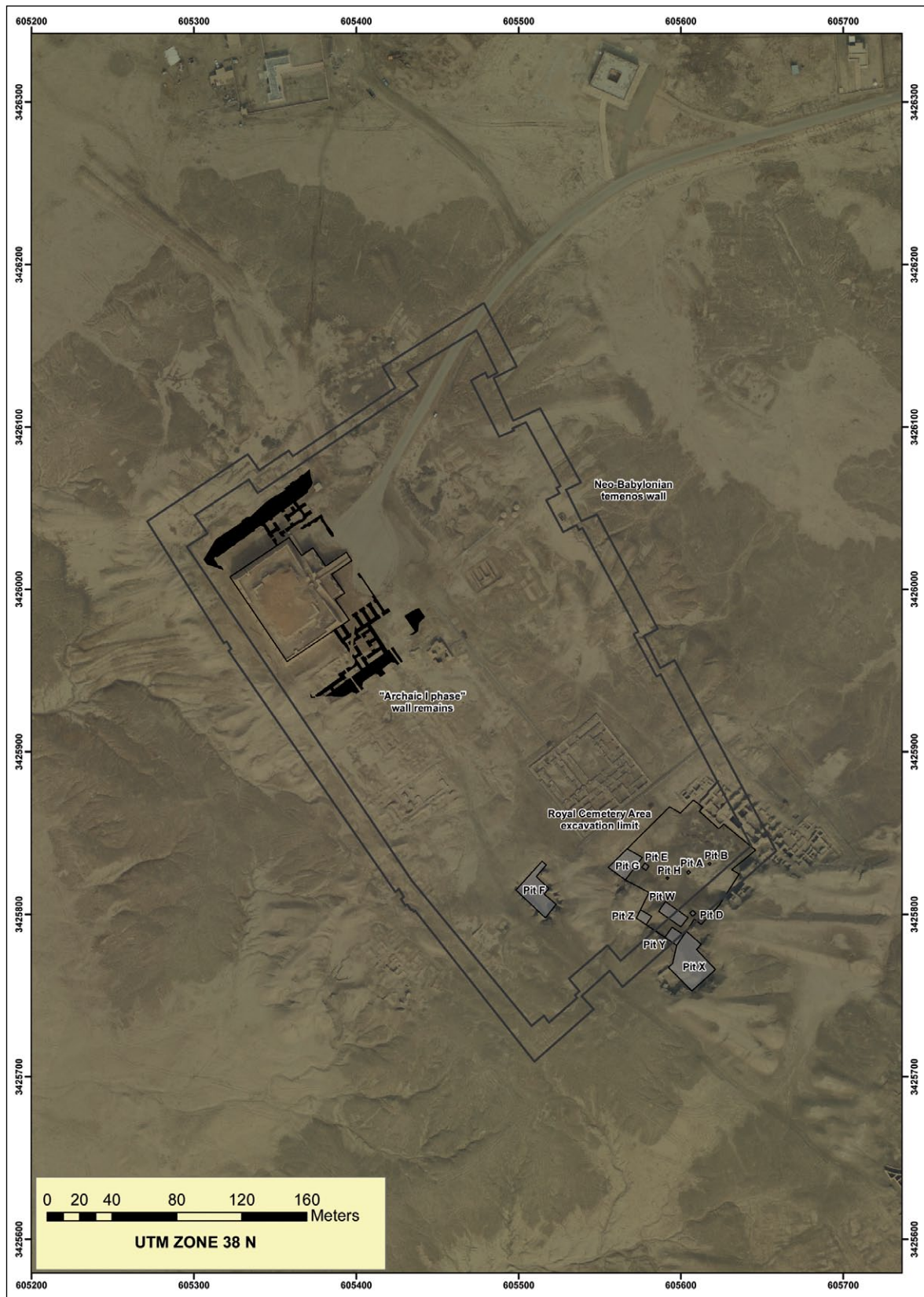


Fig. 2. Georeferenced map of Woolley's deep soundings and excavation areas on the upper terrace of Ur's mound, superimposed over BuckEye photo. Basemaps: Karstens 1987: fig. 2; Nissen 1966: pl. 41; Woolley 1956: pl. 1; Zimmerman 1998: fig. 53 (computer graphics by E. Leoni and G. Benati).

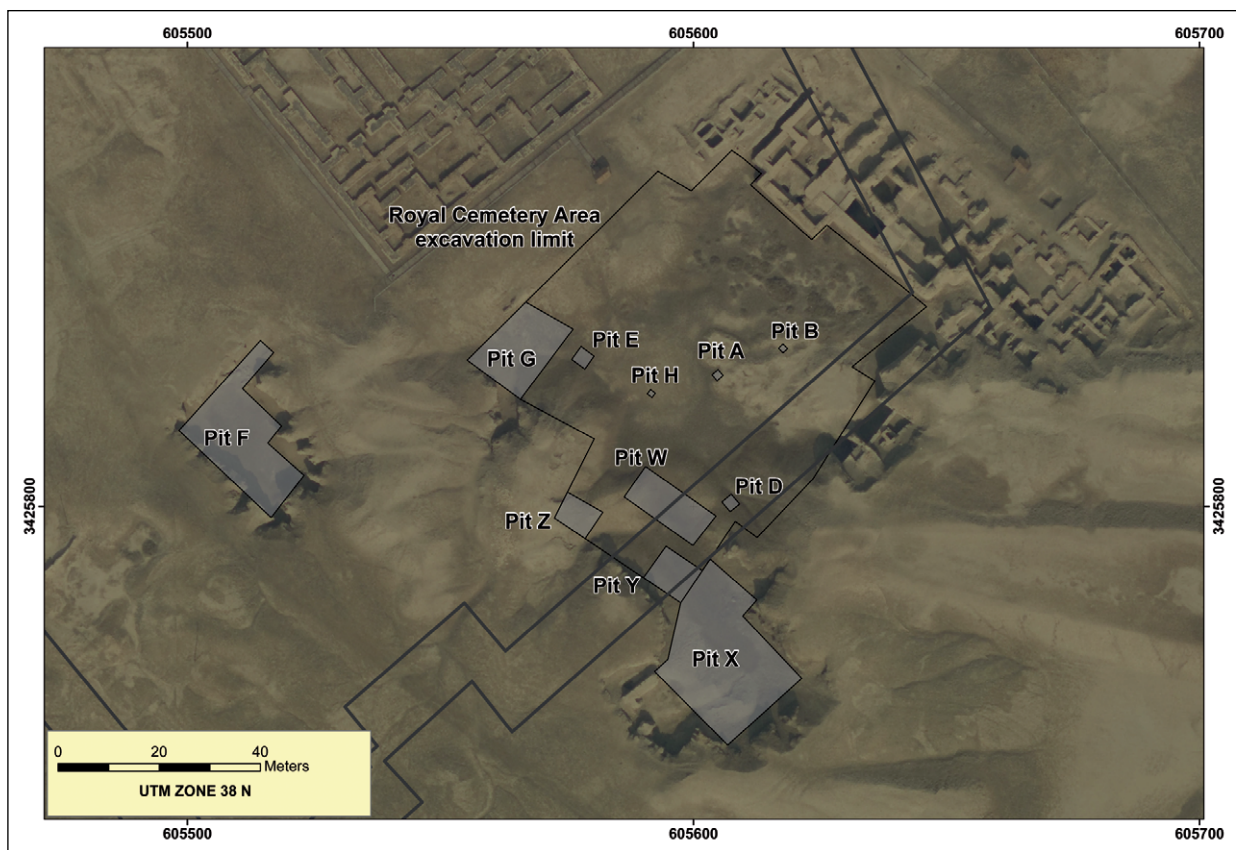


Fig. 3. Close-up georeferenced map showing the Royal Cemetery excavation area and the deep soundings excavated inside it and its proximities. Basemaps as fig. 2 (computer graphics by E. Leoni and G. Benati).

Once the excavators reached to the bottom of the stratum containing the Early Dynastic graves, the strategy changed. From 1928 the excavators decided to investigate the layers lying below the cemetery in order to throw light on the levels pre-dating the Royal Cemetery. Deep stratigraphic soundings, labelled “Trial Pits” were then excavated in order to test the pre-cemetery stratigraphy. Some pits were excavated directly from the bottom of the cemetery layer (such as Pits Z-Y), or starting from the floor of the Royal Tombs as Pit H), some others started at surface level (Pit F and Pit X outside the Royal Cemetery Area).

In 1929-1930 another sounding (Pit F) was excavated in an area located to the back of the Royal Cemetery but still inside the Neo-Babylonian temenos wall. The excavation of Pit F targeted a plot of land in which wall remains were visible on the surface (Woolley 1930: 330; fig. 3). Indeed, here the excavators dug through 11 m of superimposed layers of domestic buildings dating from the Early Dynastic and Jemdet Nasr periods (Benati 2014; Benati 2015a), set upon the debris of a pottery production area dating from the Uruk

period (Kilns Strata), which in turn rested upon several meters of Ubaid period debris with floors, remains of huts and burials. At the bottom of the pit the excavators encountered a thick layer of water-laid mud, the “flood stratum”, that was associated with the famous deluge of biblical memory (Mallowan 1964; Mörner 2015).

Once completed these stages of excavations inside and outside the RC Area, Woolley could grasp the main occupational phases of the mound, from the Ubaid period to the 1<sup>st</sup> millennium BC, and he was then able to set more specific targets to pursue. For instance, between 1930 and 1933 the expedition focused on investigating the remains located at the foot of the Ziqqurat and pertaining to the main sanctuary of the site, the temple of the moon-god Nanna (figs. 2, 4). Here, several architectural phases, spanning from the Neo-Babylonian down to the Early Dynastic, and possibly Uruk periods, were exposed in extension. The monumental architectural remains of the Early Dynastic phases – the so-called Archaic II-I levels (Benati 2013) – lying directly below the sanctuary built by the Ur III kings, were exposed horizontally, while a series of



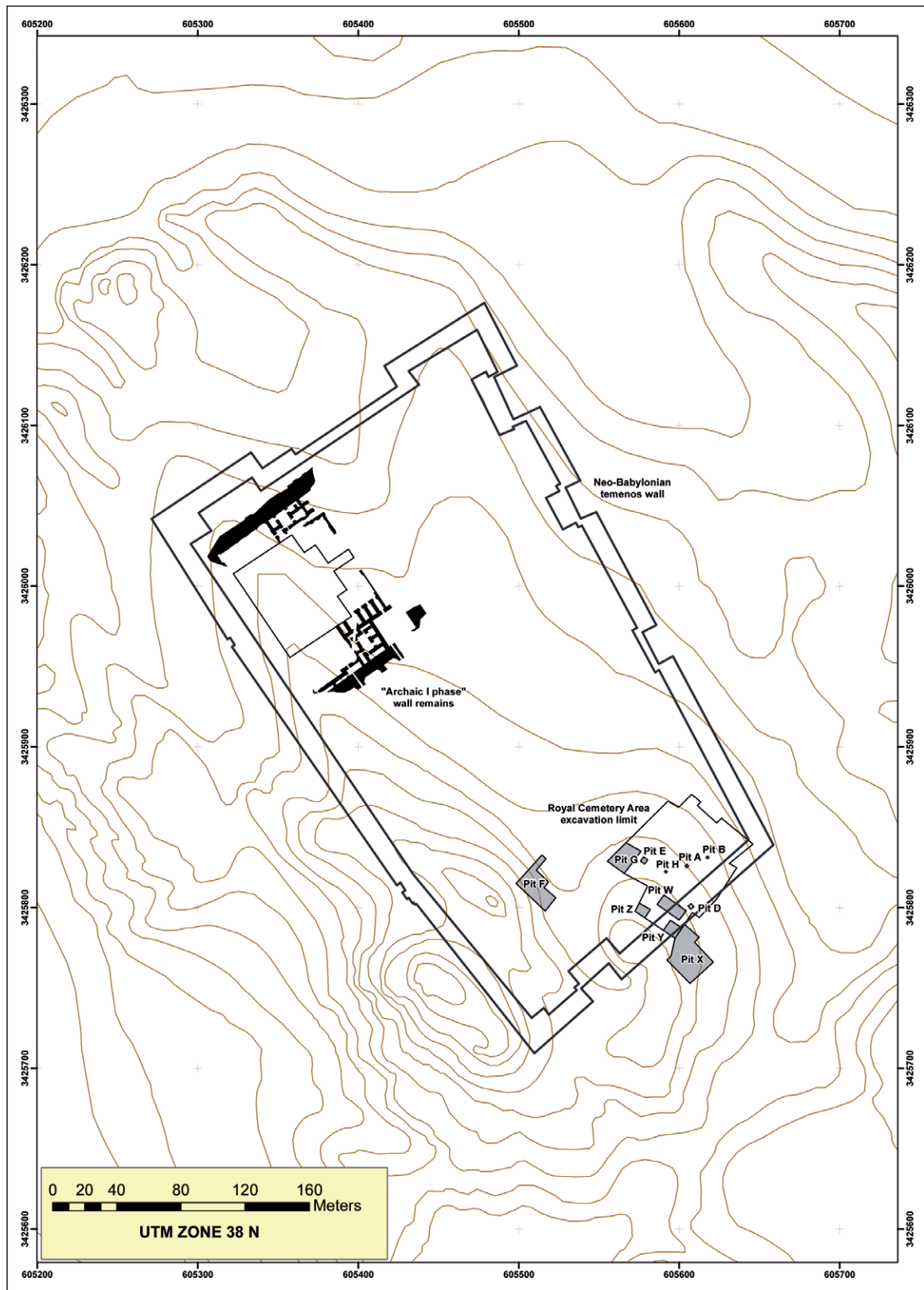


Fig. 4. Georeferenced map of Woolley's excavation areas and deep soundings located on the upper part of the mound, superimposed over contour lines and showing the Neo-Babylonian temenos wall. Basemaps: Karstens 1987: fig. 2; Nissen 1966: pl. 41; Woolley 1956: pl. 1; Woolley 1974: pl. 60; Zimmerman 1998: fig. 53 (computer graphics by E. Leoni and G. Benati).

stratigraphic soundings revealed features and layers dating from the 4<sup>th</sup> and possibly 5<sup>th</sup> millennia BC in some sectors of the area.

The last two field seasons (1932-1933, 1933-1934) were devoted to gather more data on the administrative materials from the discard layers underlying the Royal Cemetery, the so-called Seal-Impression Strata (SIS), and on the graves of the so-called “Jemdet Nasr Cemetery” that were detected below the SIS in Pits Z, Y (Benati 2015b)<sup>2</sup>. Both these tasks were successfully accomplished by cutting large soundings within (and in part out of) the cemetery area, Pits W and X (figs. 3-4). As for the latter, the graves belonging to the JN Cemetery were detected at the bottom of the pit, in turn covered by a discard layer rich in administrative finds, hundreds of Akkadian and late Early Dynastic graves, and domestic remains dating from the 2<sup>nd</sup> millennium BC.

#### *Positioning and Georeferencing the Early Dynastic City: New Aerial Data and Digital Mapping*

##### *Digital Mapping of the Excavation Areas*

The main tool for organization a fresh analysis of the topography of the RC Area has been the creation of a digital environment capable of managing maps, plans, sections and photos, an approach pioneered by P. Zimmerman (1998) for the case-study of the RC Area.

All the relevant published topographic material, and the relevant photos, have been converted to high quality raster files, uploaded into the CAD software (AutoCAD© 2014, student version), scaled and layered. Subsequently the raster images have been vectorized in order to transform the salient topographic features in discrete components manageable in the digital platform. This method made possible to integrate the maps drafted by different authors and to produce new digital outputs that are the result of careful cross-checking of the multiple topographic and photographic datasets.

Below follows a brief discussion of the main problem dealt with in preparing the new topographic assessment of Woolley’s excavations and the solutions adopted for solving conflicts in the available documentation.

<sup>2</sup> On the date of the graves of the Jemdet Nasr Cemetery, spanning most probably the whole Jemdet Nasr – ED I period, cf. Zettler and Hafford 2015: 383 and references cited therein.

##### *The Royal Cemetery Area*

The Royal Cemetery Area is the portion of mound located immediately to the South-East of the Ur III *éhursag* palace, mostly extending beneath the southern corner of the Neo-Babylonian temenos wall (Zettler, Hafford 2015: 376; fig. 3). The excavation limit of this dig was not indicated on plan by Woolley and can only be traced on the basis of aerial photos taken in the course of excavation<sup>3</sup>.

As said above, although a test trench (A) was cut here in the first field season, it is only during 1927 that an extensive and intensive program of excavations was started (Moorey 1977: 24; Zettler, Hafford 2015: tab. 1)<sup>4</sup>. At the time, the area was a fairly flat plot of land. The ground level was between 18 m and 17 m amsl, gently sloping towards the SE. The preliminary reports make it clear that starting from Trench A, a fresh strip of land was excavated every field season from the surface down to the bottom of the cemetery stratum, proceeding towards SE (thus towards the line of the Neo-Babylonian temenos wall). At the end of the following five campaigns, the excavation area measured ca 70 x 55 m ca (Zettler, Hafford 2015: 376), for a total of about 3850 sq. m. of extension, for 1850 recorded burials (idem).

In order to record the position of the burials on map, a relative reference system was created using the preserved brick-work of the Neo-Babylonian temenos wall as fixed line. This system of measurements was neither described nor traced on map in the final reports, but luckily it has been reconstructed by Nissen (1966: figs. 40-41) on the basis of the unpublished records kept in the British Museum. In the southern part of the area, four posts (A-D) were positioned. These posts were used to measure the position of the finds by triangulation using a prismatic compass or through direct measurements (Mallowan 1966: 214-215). The same system was used in the northern portion of the area. Here six posts were fixed and labelled A-F.

<sup>3</sup> In particular, aerial photo taken on March 9, 1932, kept in the IoA Collections, digital copy provided to the author by Dr. Tim Clayden upon permission granted by Mr. Ian Carroll, Collections Manager. Cf. also the photo taken on March 12, 1930 published in Zettler, Horne 1998: fig. 19.

<sup>4</sup> Trench A can be clearly spotted in an aerial photo on November 22<sup>nd</sup>, 1922. The photo is kept in the Archive Section of the Penn Museum and a digital copy was kindly provided to the author by Dr. Alex Pezzati, Senior Archivist.

Nissen's contribution to the understanding of the RC Area's topography is fundamental also for another reason. As summarized by Zimmerman (1998: 30), Nissen, after examining the original records, noticed that on the general map published by Woolley (1934: pl. 274) the temenos wall was drawn with a wrong alignment. Consequently, he drew fresh maps plotting the graves according to the measurements registered in the field notes. Notwithstanding the harsh criticism of Nissen's work given by Mallowan (1970), Zimmerman concluded that, overall, Nissen's maps are to be considered as the most accurate.

To plot afresh the graves, Nissen created a L-shaped grid for the RC Area on the basis of the points fixed by the excavators and recorded in the original notes. Nissen then re-plotted the burials on plan using the data from the original records. He also drew a series of schematic profile drawings displaying the stratigraphic position of the graves (cf. Nissen 1966: figs. 24-36).

Nissen, however, did not plot the position of the deep soundings. One of the most evident conflicts contained in Woolley's publications, in fact, concerns the position of the deep soundings excavated within and outside the Royal Cemetery Area (Woolley 1956: pl. 1). The plan showing the location of the pits is totally inaccurate, as already noted by several scholars (cf. Zimmerman 1998: 31). After Nissen, other studies dealing with the topography and stratigraphy of the cemetery have been produced: the ones by Gockel (1982), Karstens (1987) and Zimmerman (1998) are the main sources of information for attempting to restore the correct position of the soundings on map. In this regard, it seems that Karstens (1987: fig. 2) provided the most accurate reanalysis. While dealing with the evidence from the Akkadian period graves, this author drew fresh topographic plans of the area showing the position of the pits on the basis of preliminary and final reports combined with the work done by Nissen (cf. Karstens 1987: 22-30, fig. 2).

Zimmerman (1998), not aware of Karstens' work, attempted to do the same on the basis of Gockel's and Nissen's studies. Although the maps provided by Zimmerman are by all means more accurate than the ones from the reports, the photographic and archival documentation at disposal largely confirms Karstens' reconstruction, which is therefore chosen as base for the present work. The only adjustments that need to be operated on Karstens' plan are related to the position of Pit W, Pit X and Pit G.

The orientation of Pit W – a large exposure of 15 x 7 m – has been correctly reconstructed

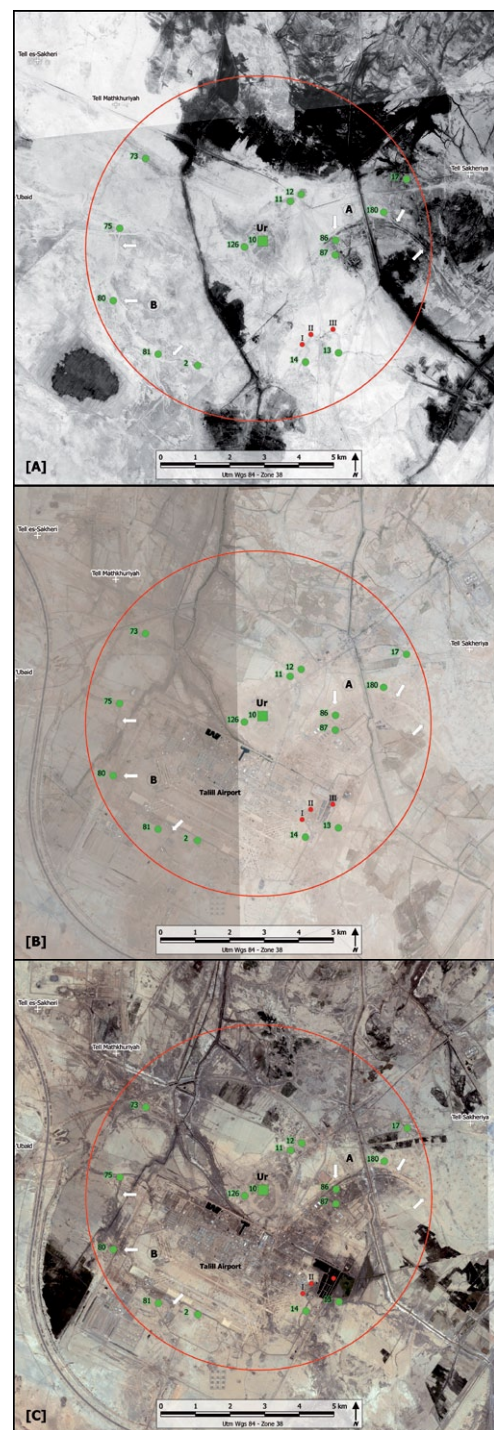


Fig. 5. The archaeological sites (green, Arabic numbers) around Tell al-Muqayyar/Ur from the 1965 SMS survey by Wright and new evidence (red, Roman numbers) detected by the satellite-based assessment. White arrows refer to traces of the Euphrates paleo-riverbed (A) and an ancient major canal (B). Basemaps: [A] CORONA images (id ds1103-1041da-061 and 062, May 4th 1968); [B] Microsoft Bing image (2016); [C] ESRI World Imagery (2016; computer graphics by S. Mantellini).



by Karstens but the position needs to be slightly corrected (cf. fig. 3). As noticed by Zimmerman (1998: 35) the “temenos wall” depicted on the top left corner of the profile drawing of Pit W (Woolley 1956: pl. 77) is the inner face of the outer (southern) temenos wall (i.e. the temenos is a double-wall system). In this light, the position of the pit, as plotted by Karstens, needs to be moved some 3 m to the North-West. This also agrees well with the position of the tomb PG1648, the walls of which are depicted in Woolley’s profile, although with a wrong caption (i.e. PG1631; cf. Zimmerman 1998: 35). In this light, the correct position of Pit W is the one plotted by Zimmerman (1998: fig. 53; fig. 3).

As to Pit G, the only way to reconstruct its correct position is by looking at aerial photos taken during the 1930s, since the only plan published by Woolley plotting this pit is incorrect. Luckily, it is possible to spot very clearly the features of Pit G in one photo taken in March 1932, likely from a RAF carrier (see n. 3 above). The position of Pit G reconstructed according to this photo does not differ much from the plans provided by Karstens (fig. 3).

Pit X also poses similar problems since it was wrongly plotted on the general map by Woolley. Pit X was a very large sounding of ca 30m x 23m, the layout and the general orientation of the pit can be reconstructed from plans and the cross-section published in the final reports (Woolley 1956: pls. 78-81)<sup>5</sup>. Karstens plotted Pit X outside the line of the Neo-Babylonian temenos, in correspondence of one of the ramps used to access the RC Area, at least until 1933. This positioning cannot be checked against old photos since no photographs dating from the last excavation campaign could be found in the archives consulted. The layout of Pit X is, however, visible on the new aerial photo that we are using in this article. In this photo, it is possible to distinguish quite clearly the southern and eastern limits of the sounding, while to the West, it is possible to see the stub of a wall depicted by Woolley on the plans and cross-sections of Pit X (Woolley 1956: pls. 78-79), and labelled as “mud-brick Neo-Babylonian wall”. This wall, running roughly parallel to the outer face of the Neo-Babylonian temenos wall, was cut during the dig of Pit X and therefore the standing stub can be used as reliable anchor point for reconstructing the position of Pit X. In this light, it must be stressed that the features on the ground

do not agree well with Karstens’ (1987: 28-29, fig. 2) reconstruction. Although it is assured that the pit was running perpendicular to the Neo-Babylonian temenos wall – as postulated by Zimmerman (1998: 36, fig. 53) and Karstens (1987: fig. 2) – the traces suggest that Pit X was actually excavated beyond the South-Eastern corner of the RC excavation area, thus projecting the line of Pits Z-Y. This contradicts not only Karstens’ (and Zimmerman’s) reconstruction, but also Woolley’s statement (Woolley 1956: 24) that the graves retrieved in Pit W and Pit X were contiguous. It seems plausible that he confused Pit Y and Pit W in making this remark since there is no doubt that Pit Y and Pit X are contiguous, while Pit W is located few meters away. Even if we accept Zimmerman’s positioning of Pit X, this and Pit W are not contiguous (in Karstens Pit X and W are contiguous but as demonstrated above the position of Pit W is wrong in this author’s plan). By adapting the layout of the pit to the traces on the ground, the plan published by Woolley (1956: pl. 79) results somewhat distorted in the northern portion of the pit, but the dimensions and the southern half of the pit remain unaltered (cf. fig. 3).

As for the rest of the deep soundings (fig. 3), which were rather small test pits, it must be noted that Pits A and B were excavated to the sides of PG1236 and thus they are plotted in relation to the position of this grave (not shown in our new figures) and in agreement with Karstens’ reconstruction (Pit A is misplaced in Zimmerman 1998: fig. 53). The same holds true for Pit H, excavated in the middle of PG779 from the floor of this grave, and Pit E, excavated in the corner between PG777 and the walls of a structure pre-dating the Royal Cemetery, cut by PG777. Pit D is plotted here tentatively to the side of Pit W. The general profile produced by Woolley (1956: pl. 72) makes it clear that Pit D was dug to the side of PG1332, the question whether the sounding was actually excavated to the right or to the left of PG1332 is still to be resolved. Also, we decided not to plot Pit C, positioned by Karstens (1987: fig. 2) and Zimmerman (1998: fig. 53) in the North-Eastern part of the excavation area, over the outer segment of the Neo-Babylonian wall, because of the lack of detailed information on it: as reported by Zimmerman (1998: 32), no information on its size or location is provided in the reports.

#### *The Ziqqurat Terrace and Pit F (figs. 2, 4)*

Plotting the archaic remains excavated at the foot of the Ziqqurat and Pit F, on the other hand, was a much lighter task. The wall remains labelled

<sup>5</sup> Note however that the north arrow is misplaced in the plans of Pit X (Woolley 1956: pls. 79-81).

as "Archaic I" phase, dating from the Early Dynastic IIIb period (Benati 2013), were plotted according to the plans provided by Woolley (1939) and in relation to the block of the standing Ziqqurat tower. The remains of the Archaic I walls are no more visible today because these were partially dismantled by Woolley to dig below them, and, in part, obliterated by later construction works – the area around the Ziqqurat is now an esplanade.

Pit F can be positioned very easily due to the very clear traces of its limits on the ground, visible in the aerial and satellite photos. Once again, this positioning provides the means to correct the mistakes in the general map of the sounding published in Woolley 1956. The now refined plotting of Pit F and the soundings sunk into the Royal Cemetery Area provide the basis for a better understanding of the different formation processes in these two critical excavation areas as described in the reports by Woolley.

### *Georeferencing Ur*

A further step for contextualizing Woolley's excavations has been the georeferencing of the digital maps produced. The archaeological line and polygon features resulting from the digital mapping effort explained above have been layered on an aerial digital photo taken above the research area.

The photo is a snapshot from a 10 cm color imagery, taken by high-resolution BuckEye platform of the US Army. It is an archival unclassified image, releasable for detailed geospatial analysis.

Buckeye is a platform-dependent system, the characteristics of which are as following:

- Digital electro-optical camera system with a true color sensor;
- Altitude: 250m – 3000m (depending on the platform);
- Ground Speed: 90-120 knots;
- Swath Width: ~540 meters;
- Resolution: 10 cm (potentially up to 3 cm based on the profile and lenses used).

The released aerial imagery final product is georeferenced as UTM 38 N Zone, with an expected positional absolute accuracy of (+ or -) 0.3 m. In this way, the vector files resulting from the digitization of the field surveys, which had a local coordinate system, were shifted on the image through the ESRI Arcgis software Spatial Adjustment tool. Finally, the image and survey layers were properly portrayed within a map layer frame.

The output of these interconnected operations consists of an accurate positioning of Woolley's

excavation areas, now georeferenced and checked against still existing traces on the ground. On the basis of this fresh topographical dataset it is now possible to locate more precisely the provenance of items and features excavated by Woolley in the 1920s-1930s (these can now be accessed online: [www.ur-online.org](http://www.ur-online.org)).

### *Preliminary Landscape Assessment*

To conclude our re-analysis of ancient Ur topography, we turn now to the wider context in which the site is located. The hinterland of Tell al-Muqayyar/Ur is, in fact, one the richest in archaeological evidence of the entire Mesopotamia (fig. 1). Hundreds of multilayered tell and traces of ancient irrigation networks testify to an almost uninterrupted occupation of this area since at least the 5<sup>th</sup> millennium BCE up to today. However, despite its importance in the historical dynamics of this region, no systematic investigations were carried out after the Southern Margins of Sumer Survey (SMS) conducted by H. T. Wright in 1965 (Wright 1981), within the frame of the well-known expedition organized by R. McC. Adams along the Euphrates central floodplain (Adams 1981).

The survey resulted in the mapping of 192 sites, located over an area of about 1,000 sq. km. on the right side of the modern course of the Euphrates (Wright 1981: 298, 299, fig. 1). Ishan al-Kharita (SMS-69) north and Tell al-Lahm (SMS-172) south are the outermost limits of the investigation area. The maps also indicate the presence of several traces of abandoned canals, pertaining to different historical periods and crisscrossing the whole region. Notably, this region has undergone a significant development during the last decades. The construction of the Tallil Airbase just south of Ur mound, as well as roads, buildings, houses and canals, completely transformed this landscape and its historical perception (fig. 5). As many other Iraqi regions, this area also suffered from, and is still endangered by: 1) Illegal activities and looting; 2) construction of military installations during the recent civil war; 3) uncontrolled development. Recent satellite-based remote sensing applications have been done on Ur cultural heritage management (Di Giacomo, Scardozzi 2012; Fleming, Pournelle 2016), whereas, an updated archaeological assessment of the site and its closest surroundings would be, therefore, also be appropriate and necessary<sup>6</sup>.

<sup>6</sup> On this matter, it must be noted that Wright himself



In this phase, a first evaluation of Tell al-Muqayyar hinterland was attempted over a buffer of 5 km (78.5 sq. km) around the ancient city. This study is mainly based on remote data and it followed an approach well established for the Middle East during the last decades (Hritz 2014). The sites mapped by Wright in 1965 (Wright 1981: 299, fig. 1) were positioned on some CORONA KH-4 photographs, dated May 4<sup>th</sup> 1968<sup>7</sup>. Then, the most recent Microsoft Bing©, Google Earth© and Esri World Imagery satellite images were used for verifying the sites preservation and to assess whether they are currently under risk of threat and damage or not<sup>8</sup>. The same datasets were also used to search for potential anthropogenic traces not reported by Wright in his survey. The *ANE.kmz* placemarks dataset (Pedersén 2012) only includes some of the sites surveyed by Wright, and only Tell al-Muqayyar within 5-km buffer selected for this first assessment.

The sites are fifteen (tab. 1) and all of them are located in close proximity to abandoned watercourses either natural or artificial. Alongside several traces pertaining to multi-temporal canals of the ancient irrigation network, a large meander of the Euphrates bed is clearly traceable just west of the mound of Ur (see also Di Giacomo, Scardozzi 2012: 11).

Acquired only few years after the *Southern Margins of Sumer* survey, the CORONA images represent a landscape that should not differ much from what was seen on the field by Wright. However, tell identification on CORONA and recent satellite images resulted more or less difficult. It was based on the information provided in the SMS site catalog, their location on the base map (Wright 1981: 299, 338-345), as well as their shape, size, contour, or pattern. Although very preliminary, this appraisal was partially conditioned by two factors: 1) Many of the sites investigated by Wright were not really tell, but rather sherds and brick fragments scattered on the surface, either

flat or 0.5-1 m raised from the ground. Hence, they are difficult to recognize even at the highest resolution dataset available; 2) already at the time of the SMS survey, the possibility of discovering archaeological remains in the southern Mesopotamian floodplain was deeply conditioned by geological changes and alluvial deposits covering the ancient anthropic evidences.

Starting west of Ur, and proceeding clockwise, the first site is SMS-126, located on the western slope of Tell al-Muqayyar and only 1 m high, which is very hard to identify on both historical and recent satellite datasets<sup>9</sup>. Just under 4 km north-west of SMS-126, SMS-73 is instead well recognizable on both historical and recent datasets, and it looks well preserved despite a modern canal dug on its western side. The four sites located along a major ancient canal south of SMS-73 and ca. 4 km west of Ur appear differently on CORONA. SMS-2, downstream from the canal, is the only one that may be positioned accurately while the presence of several ancient levees and sediments make the position of SMS-75, SMS-80 and SMS-81 approximate. The recent satellite images show how the construction of the Tallil Airbase and the military base in this area may have seriously affected (possibly destroyed) the state of preservation of these sites (see also Di Giacomo, Scardozzi 2012: 11).

Some interesting observations come from SMS-13 and SMS-14, ca. 3 km southeast of Tell al-Muqayyar (fig. 6). They are two small sites located along a canal derived from the major canal west of Ur and mentioned above. Both sites are located on the canal right bank and their dark gray pattern stands out on CORONA images compared to the pale grey surroundings. This minor canal changed suddenly its prevailing regular and straight direction: first with a ca. 800 m squared 'C-shaped' course, then meandering for ca. 1.2 km before approaching SMS-13. It is worth noting that, on the opposite bank of the canal, there are three dark grey spots resembling the two associated with SMS-13 and SMS-14. Their location – on the outer corner of the C-shaped stretch and in the middle of the meander – and their almost squared contour suggest the presence of three archaeological sites not recorded by Wright and his team (see n. 6). The comparison between 2002 and a 2010 Google Earth© images show recent development of this area, which is partially

stressed the incompleteness of their survey: «... in no case was such survey complete. Sites of interest seen on these trips will be noted in passing in the text rather than included in the site catalog» (Wright 1981: 298) and «One should not forget that this survey used elementary methods and that improved resurveys must be done in the future» (*ibidem*, 300).

<sup>7</sup> The ID frame is ds1103-1041da-061, -062, -063 and ds1103-1041df-054, -055, -057. CORONA images have been downloaded from the U.S. Geological Survey (USGS) Earth Resources Observation and Science (EROS) Center.

<sup>8</sup> No targeted higher resolution and more recent satellite data have been purchased for this preliminary assessment.

<sup>9</sup> According to Wright (1981: 343), this site was «perhaps excavated by Woolley».

covered by the Tallil Airbase and other buildings. Many archaeological remains have therefore been obliterated, whereas it is still possible to recognize some traces of the canal and the site SMS-13.

East of Tell al-Muqayyar, three sites were located close to the Euphrates paleo-riverbed: SMS-86 and SMS-87, on the southern bank next to each other and SMS-180 on the opposite bank. Their

| ID      | Name                        | Notes on preservation                                   |
|---------|-----------------------------|---|
| SMS-2   | Tell Ghaghla Gharbi         | Possibly destroyed by Tallil Airbase                    |
| SMS-10  | Tell al-Muqayyar / Ur       | Preserved   |
| SMS-11  | Diqdiqah 1                  | Partially damaged by looting and military installations |
| SMS-12  | Diqdiqah 2                  | Partially damaged by looting and military installations |
| SMS-13  | unnamed                     | Preserved   |
| SMS-14  | unnamed                     | Possibly preverded                                      |
| SMS-17  | Tell Sughariyya             | Well-preserved  |
| SMS-73  | Ishan Karib Makina Muhammad | Well-preserved  |
| SMS-75  | Ishan Abu Dhib              | Unclear   |
| SMS-80  | unnamed                     | Unclear   |
| SMS-81  | unnamed                     | Possibly destroyed by Tallil Airbase                    |
| SMS-86  | Tell Ur Junchsen            | Possibly destroyed                                      |
| SMS-87  | unnamed                     | Possibly destroyed                                      |
| SMS-126 | unnamed                     | Possibly preverded                                      |
| SMS-180 | unnamed                     | Possibly destroyed                                      |
| I       | unnamed                     | Destroyed   |
| II      | unnamed                     | Destroyed   |
| III     | unnamed                     | Destroyed   |

Tab. 1. List of the sites, and note on their potential preservation, from the 1965 SMS survey and the satellite-based assessment (prepared by S. Mantellini on the basis of Wright 1981).

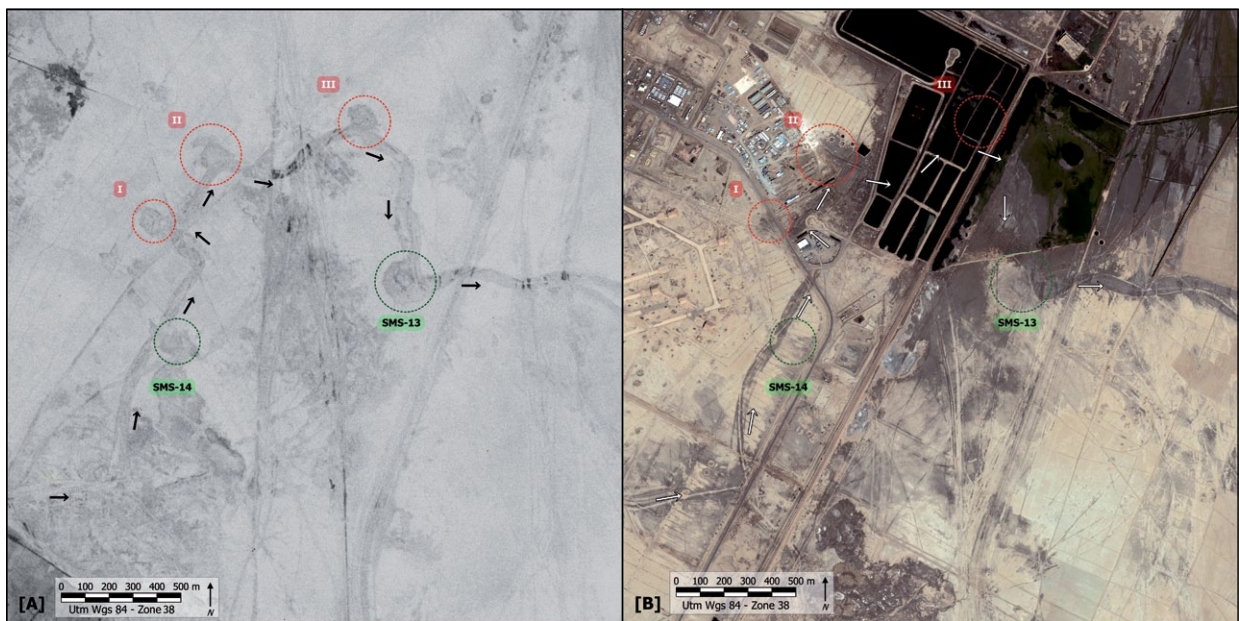


Fig. 6. Identification of potential sites (red, Roman letters) not included in the SMS survey (green, Arabic numbers) on: [A] CORONA image (id ds1103-1041da062, May 4th 1968); [B] ESRI World Imagery [2016; computer graphics by S. Mantellini).

identification, on recent satellite images, is almost impossible, where the construction of roads, buildings and military installations expanded sharply compared to some decades ago. In the case of SMS-86 and SMS-87 the situation is even more complicated because CORONA images show how this area was affected by anthropic activities already in the 60s.

About 1 km northeast of SMS-180, the oval-shaped contour of SMS-17 is instead very clear on historical and recent satellite images. Finally, the two mounds of Diqdiqah (SMS-11 and SMS-12), just northeast of Ur, are clearly distinguishable on CORONA while their contours are less clear on recent images, where both sites show evidence of likely looting and damage due to construction activities.

### Concluding Remarks

In spite of the incredible overall quality of Woolley's final excavation reports – published in the series “Ur Excavations” (UE) – which are to be regarded as a stellar achievement for the period, the dataset related to the position of the excavation areas in the upper part of the mound is tainted by macroscopic errors and inconsistencies. The present paper aimed at correcting these mistakes by means of a new topographic assessment organized on the basis of fresh datasets produced digitally, checked against the traces of Woolley's soundings still visible on the ground. The outcome of this effort is that of a new set of maps that depict the position of Woolley's trenches and excavation areas with greater detail, now also georeferenced.

On the basis of this new set of maps it is now possible to position with greater accuracy the important features belonging to the early periods of Ur, brought to light by the English archaeologist. Among them, the famous Royal Cemetery with its built tombs and its rich grave goods, the early phases of the sanctuary of the moon-god Nanna located at the foot of the Ziqqurat, and the unbroken sequence of domestic buildings and productive areas spanning from the Ubaid to the late Early Dynastic period in Pit F.

Furthermore, the paper aimed at placing Ur in the broader setting of the archaeological landscape surrounding the site. A preliminary reanalysis of survey and remote sensing data allowed us to observe a series of ancient sites and hydrographic features located in the proximity of the mound of Ur, of which only a very small percent-

age have been adequately investigated and documented. This is important since, as demonstrated above, the rapid urban sprawl that interested the area from the 1960s forward likely obliterated some of the ancient features of this territory and is likely to endanger more sites in the future.

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