

## TOWARDS A NEW DEFINITION OF ANCIENT AKRAGAS' URBAN GRID. PRELIMINARY CONTRIBUTION FOR A NEW IMAGE OF THE CITY

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### Abstract

New research activities are being promoted by the Archaeological Park of Agrigento with contributions from several Italian universities as well as from other countries.

The archaeological investigation of the so-called *upper Agorà*, directed by Bari's Politecnico and University of Catania, consists of rebuilding the architecture that once characterised the ancient urban landscape of this area. E. Brienza and M. Liuzzo, from Enna's Kore University, have focused their collaborative efforts on a new analysis of evidence linked to the ancient street patterns. Through this collaboration, a new image of Agrigento's planning scheme has been produced that is quite different from the previously suggested one by Griffo and Schmidt in 1958.

### Keywords

Landscape Archaeology, Site Survey, 3D Modelling, Ancient Urban Development Analysis

### 1. Introduction

The study is part of an interdisciplinary program aimed at creating an integrated system for the interpretation of an extremely fascinating and complex location such as the ancient urban landscape of Agrigento.

With this objective in mind, it becomes fundamental to have the possibility of integrating, overlapping and comparing various readings of the investigated *topos*.

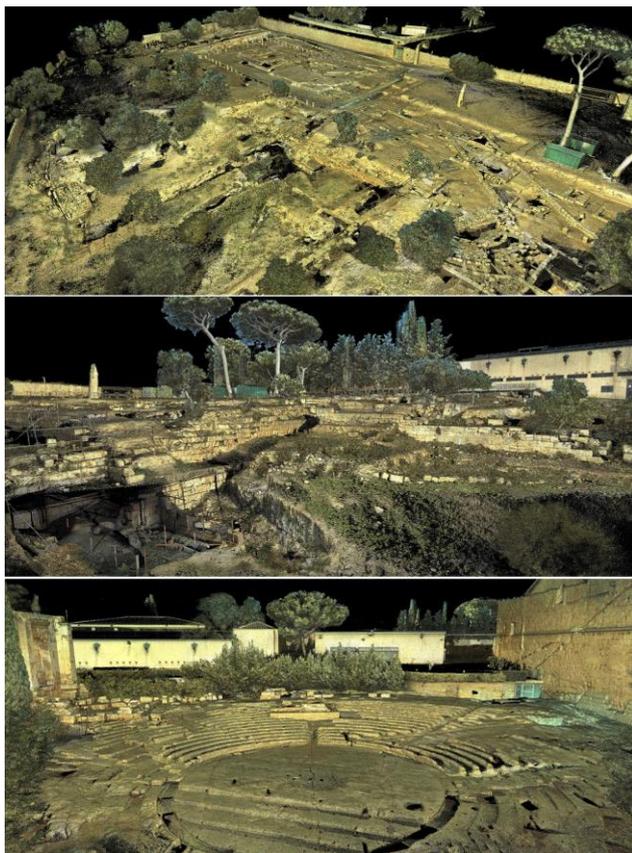
The readings were carried out during various times, with different objectives, and with different skills and technology, using an innovative instrument/document for data sharing and management. This instrument/document was capable of linking different data by precise correspondence to the location's geographic coordinates.

The daily and consolidated techniques of integrated survey and 2D-3D graphic representation (CAD and GIS) demonstrated their potential in becoming a shared and efficient instrument capable of guaranteeing a common objective.

The need for combining 3D laser scanning survey techniques with both integrated camera and GPS positioning came from the expansive size of the investigated area as well as the need for both precision and detail in the survey. Other topographic and image-based survey systems, terrestrial or with a drone, would have been less efficient for these reasons as well as for the presence of physical and perceived obstacles.

The data gathered in the on site activity resulted as being extremely versatile and able to be integrated in both 3D graphic representations, obtained through 3D modelling of point clouds and mesh, as well as in critical and interpretive mapping of the territorial phenomena obtained by GIS instruments.

New survey instruments were pushed to their full potential during a research project that was characterised by its rigorous method, aimed at answering past historical questions and aware of the research opportunity offered.



**Fig. 1:** *Upper Agora*. Perspective views of the point cloud model. From top to bottom: the site of the *Iseion* and of the *Bouleuterion*; the terracing system; the *Ekklesiasterion* and the *Falaride Oratory*

## 2. A three-dimensional survey of the ancient architectures of upper Agora (M. Liuzzo)

Agrigento's *upper Agora* is an area that is characterised by various important man-made structures, which together make it a complex asset on various levels. Aside from the ancient architecture, which is the topic of this study, there are the structures of the Cistercian church of S. Nicola, the remains of the adjoining monastery, and the 20th century Regional Archaeological Museum. A part of the monastery was actually built into the museum which was designed by Franco Minissi. (Griffo, 1987)

An interesting orography surrounds the area and is characterised by substantial jumps in elevation, which have been resolved with a clever terracing system.

A three-dimensional survey campaign was carried out in this area integrating 3D laser scanning and GPS technology<sup>1</sup>.

<sup>1</sup> The survey campaign was implemented by Kore University of Enna's "Survey and Representation" Laboratory,



**Fig. 2:** *Upper Agora*. Planimetric orthoprojection of the point cloud model overlapped on the ortho-photo

A time of flight 3D laser scanner, Leica Scanstation C10 model, and a GNSS system Leica GS15 model with RTK (Real Time Kinematic) correction were used on a permanent nationwide network (SmartNet ItalPoS) in order to guarantee centimetric accuracy and complete integration with the laser scanner data.

The geo-referencing system used was the UTM-WGS84, with altimetry measured as heights above sea level.

The survey campaign focused primarily on the ancient urban section where the Bari's Politecnico has a digging site set up. The area is currently divided into two sections near the regional archaeological museum. The digging site of the so-called *Iseion*<sup>2</sup> as well as the adjoining area of the *Bouleuterion* is to the north of the museum, while its pertaining terracing system is towards the west. Instead, to the south of the museum is the site of the *Ekklesiasterion* and the so-called *Falaride Oratory*. (Fig. 1)

specifically by Sebastiano Giuliano, Salvatore Savarino, Egidio Di Maggio and Mariangela Liuzzo (coordinator).

<sup>2</sup> The survey took place in June 2015 and documented the current state of the sites before digging activity began in July of the same year.

This three-dimensional survey had as its objective the goal of connecting these archaeological discoveries in order to highlight the dynamics of spatial interactions, alignments and non-alignments. It also served to highlight the jumps in elevation, possible stratifications and the supposed logic of the subtended settlement that overcomes physical and perceptual obstacles represented by the most recent constructions and by the surrounding orography.

By conducting the survey with a 3D laser scanner, it was possible to group portions of 62 different scans, both environmental and detailed, within a single three-dimensional model. (Fig. 2)

Geographic coordinates were gathered with the GPS survey of various high reflectance targets scattered all around the studied area as control

points for the 3D laser scanner survey.

This type of anchoring to geographic data already made it possible to integrate the survey done on *upper Agorà* with a more extensive survey carried out along the remaining terraced sections from the ancient part of the city. It has also guaranteed the opportunity, during future work phases, to amplify, integrate and update ulterior portions of surveyed territory within a single and complex geo-referencing model.

A series of inspections at various levels of approach were carried out, and several two and three dimensional graphic representations were extracted (Fig. 3), which satisfied the need of providing basic documentation in support of further multidisciplinary investigations.

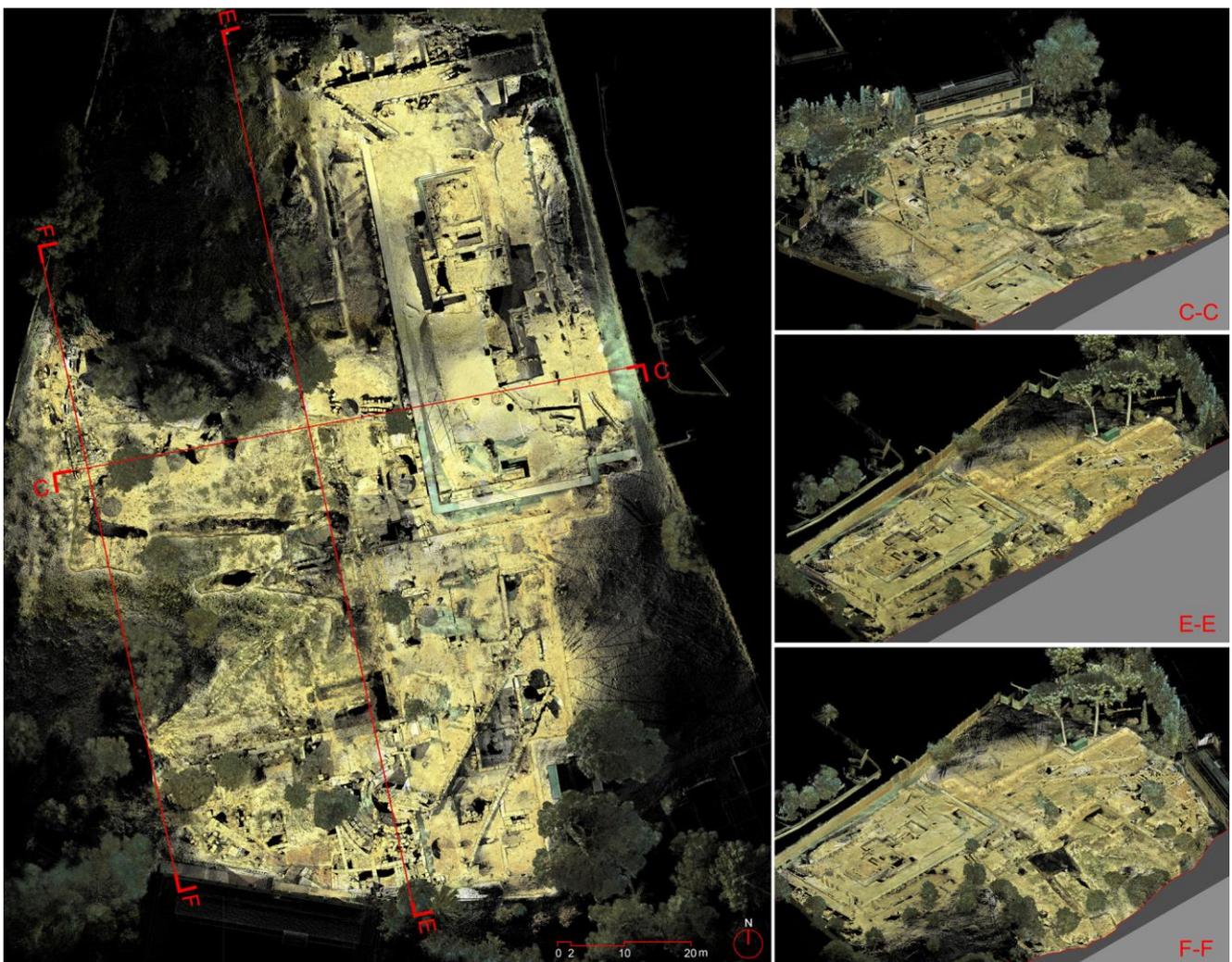
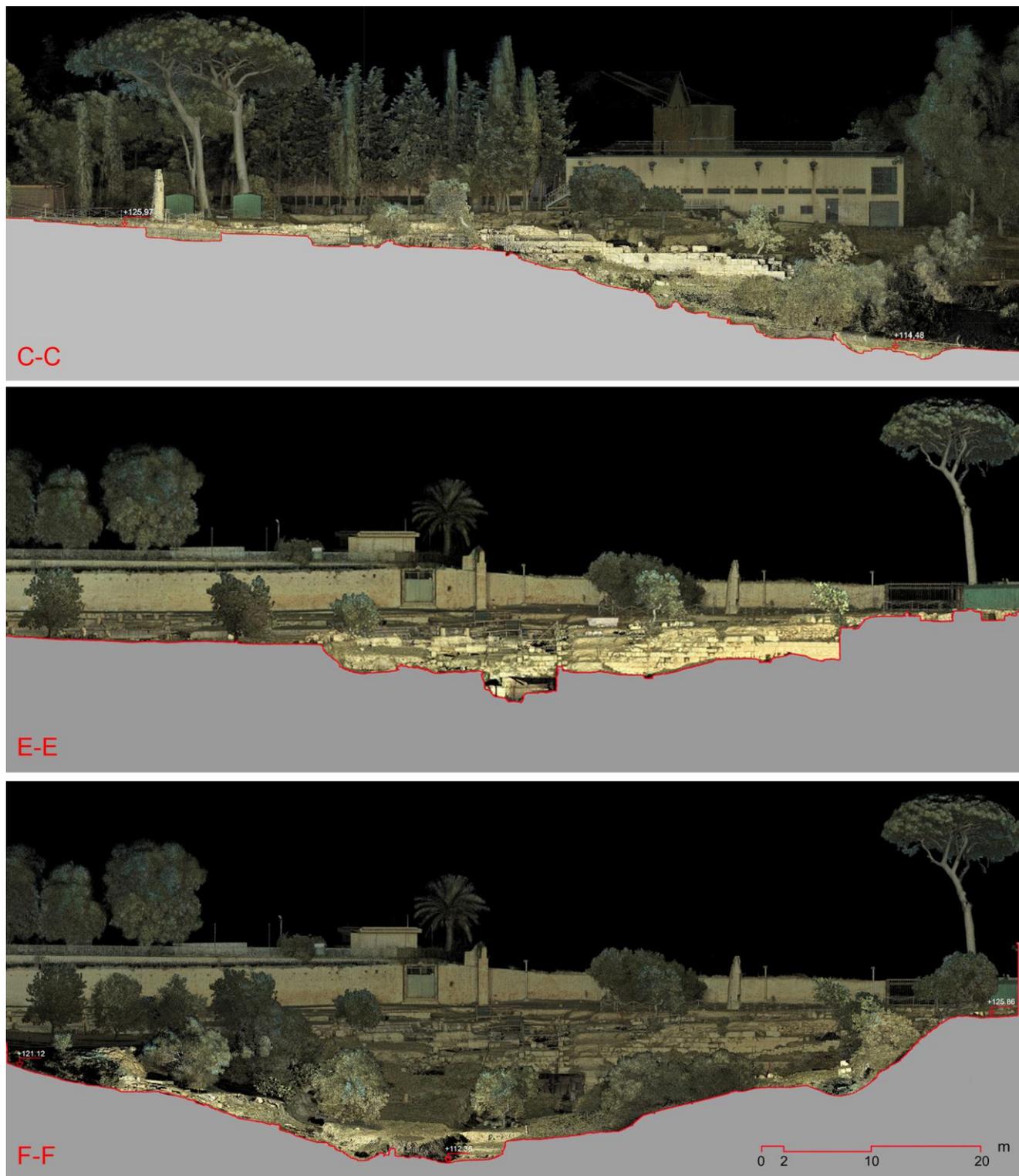


Fig. 3: Upper Agorà. Territorial readings of the site of the *Iseion* and of the *Bouleuterion*



**Fig. 4:** *Upper Agorà*. Territorial sections of the area. Above, frontal view from west to east. Middle and below, frontal views from north to south

This was all made possible because of the elevated amount of information gathered by the complete 3D digital model<sup>3</sup>.

The model, in fact, is made up of 350.814,953 points of which are known the three-dimensional coordinates, the reflectance value of the material and the chromatic information (in RGB) of the spherical photographic survey obtained coaxially by 3D laser scanner.

During the following classification phase of the stone, terrain and ground covering vegetation points, the chromatic data of both reflectance and photographic values were of utmost importance. It was therefore possible to put into place procedures for the selection of points relative to the vegetation that were considered ideal or otherwise removed during the following phases of data elaboration. The vegetation was kept during the graphic elaboration that was aimed at reading the site within the current landscape

setting and eliminated when its presence obstructed the reading of a significant part of the information. These were during the analysis of the site's elevation profile and during the detailed mapping of the areas where the vegetation hid from sight important archaeological remains.

An initial elaboration phase included the creation of several planimetric orthoprojections of the point cloud model (Figs. 2, 3) which were compatible with the well known CAD and GIS software. This therefore made it easier to manage by all of the technicians involved in the investigation process.

Several elevation profiles (Fig. 4) were extracted along the main sections of the area with the aim of facilitating the research on the logic behind the settlement. This logic is thought to be the result of the mutual relationship between man's actions of the past, recent interventions and territorial topography.

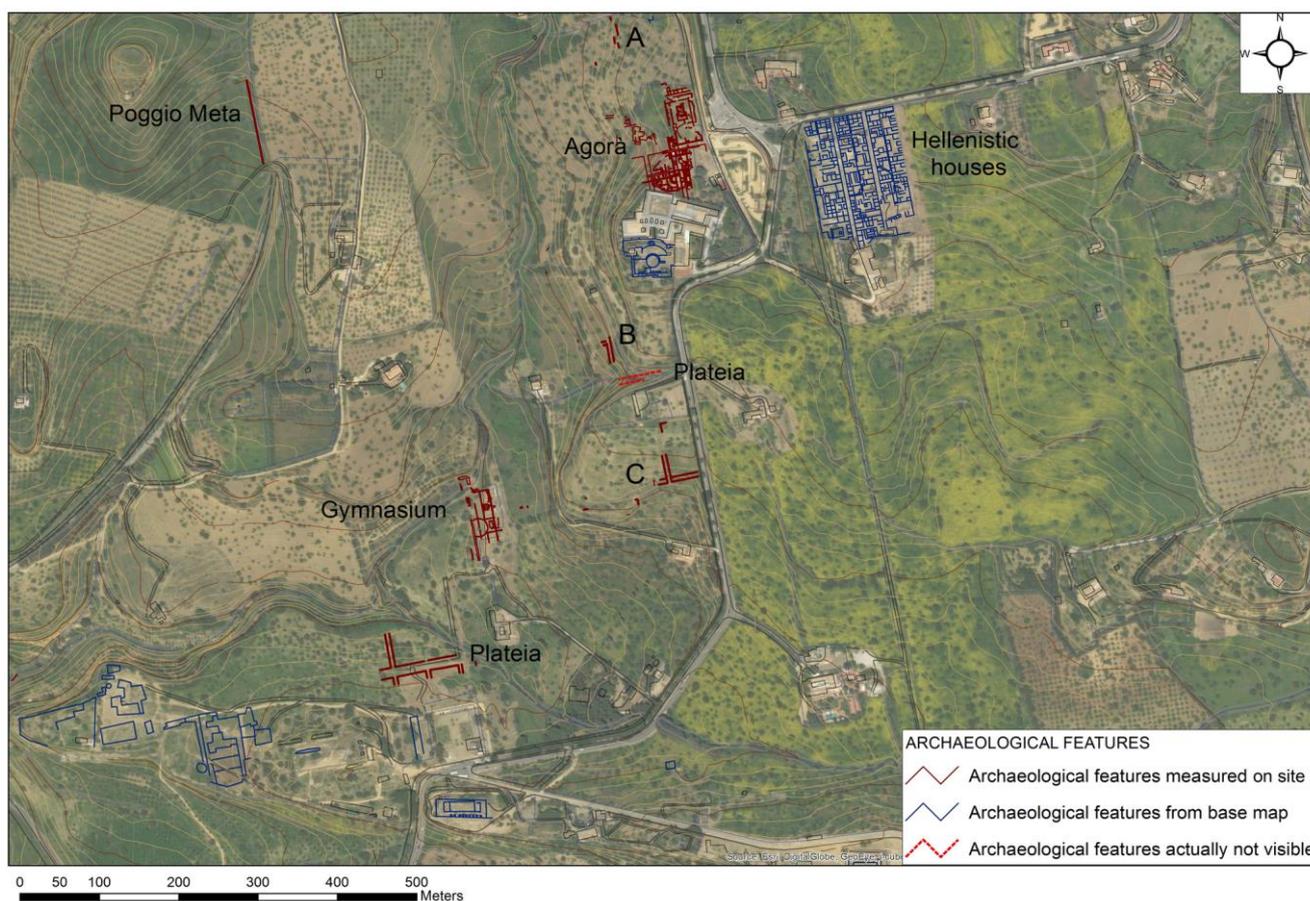


Fig. 5: General map of survey

<sup>3</sup> Cyclone and CloudWorx software from Leica Geostystems was used during the registration, processing, analysis and visualisation phases of the point clouds and coaxial photographs.

### 3. On site activity: initial results (E. Brienza)

All acquired data has been georeferenced on a general map drawn using ESRI ArcGis 10.2 software. Surveys and measurements were reported on a new vector base-map, scale 1:5000, within a new and official topographical network developed by Agrigento's Archaeological Park<sup>4</sup>. This map was enhanced with updated HD satellite images captured by GIS software: in addition layers are dedicated to aerial photos of the area taken during different years (1955, 1970, 1987, 1999). These images have been rectified using control points taken during the survey activity.

All archaeological features have been divided by information level: 1. Evidence measured on-site; 2. Features reported in Agrigento's base map; 3. Elements drawn from published detailed plans (De Miro & Fiorentini, 2011); 4. Features not actually visible but located using previous documentation (Schubring, 1980).

During the on-site survey we found archaeological evidence. The first piece of evidence are two parallel walls made of local stone blocks with a SE/NW orientation (Fig. 5, A). The first wall is 13 m long and the second one is 7 m long. Both of the walls belong to the same city block with a facade that was built on different levels to follow the sloping road. The building techniques used are different for each wall. One shows blocks laid in alternate courses of "headers and stretchers" while the other one is made in *opus africanum*<sup>5</sup> (Fig. 6).

The second piece of evidence is made up of a pair of parallel, SE/NW facing walls (Fig. 5, B). These walls are made of local stone blocks. The northern most wall is most likely a retaining wall as it flanks the 98m level contour line. The walls are thought to belong to the same urban planning project as the direction, function and building technique used are all the same.

The third piece of evidence is an ancient crossroad. The intersection is made up of a street that runs from northeast to southwest and is visible for 51m. The street is characterised by a raised footpath and behind this, roughly 5m, runs a limit wall made by local stone in isodomic masonry. The intersecting street runs orthogonal

and is visible for about 35 m. The road itself is 5 m wide but its pavement is not visible (Figs. 5, C and Fig. 7).

All of this archeological evidence pertains to the ancient town's road network; the roads are all parallel and orthogonal to each other as well as to the ancient roads known from previous investigations.

In 1958 Griffo and Schmiedt, after having consulted aerial photos, suggested the existence of a standard urban scheme of ancient Agrigento made up of 6 NE-SW oriented main roads (*plateiai*), which divided the town into 300 m long main strips that were intersected by orthogonal 5 m wide streets (*stenopoi*). This intersecting of streets created city blocks that were between 280 and 330 meters long and 35 meters wide (Schmiedt & Griffo, 1958). For the NW area of the city, a strong rotation of the roads was suggested because of the site's morphology.



Fig. 6: Zone A, the wall in *opus africanum*



Fig. 7: Zone C, the ancient crossroad

<sup>4</sup> The other participants to the survey are L. Calì, G. Fucas and M. Anzalone.

<sup>5</sup> This building technique is certified in Agrigento only for a group of ancient structures found in the north-east zone of the city called the *Punic District*: cfr. Deorsola, 1991.

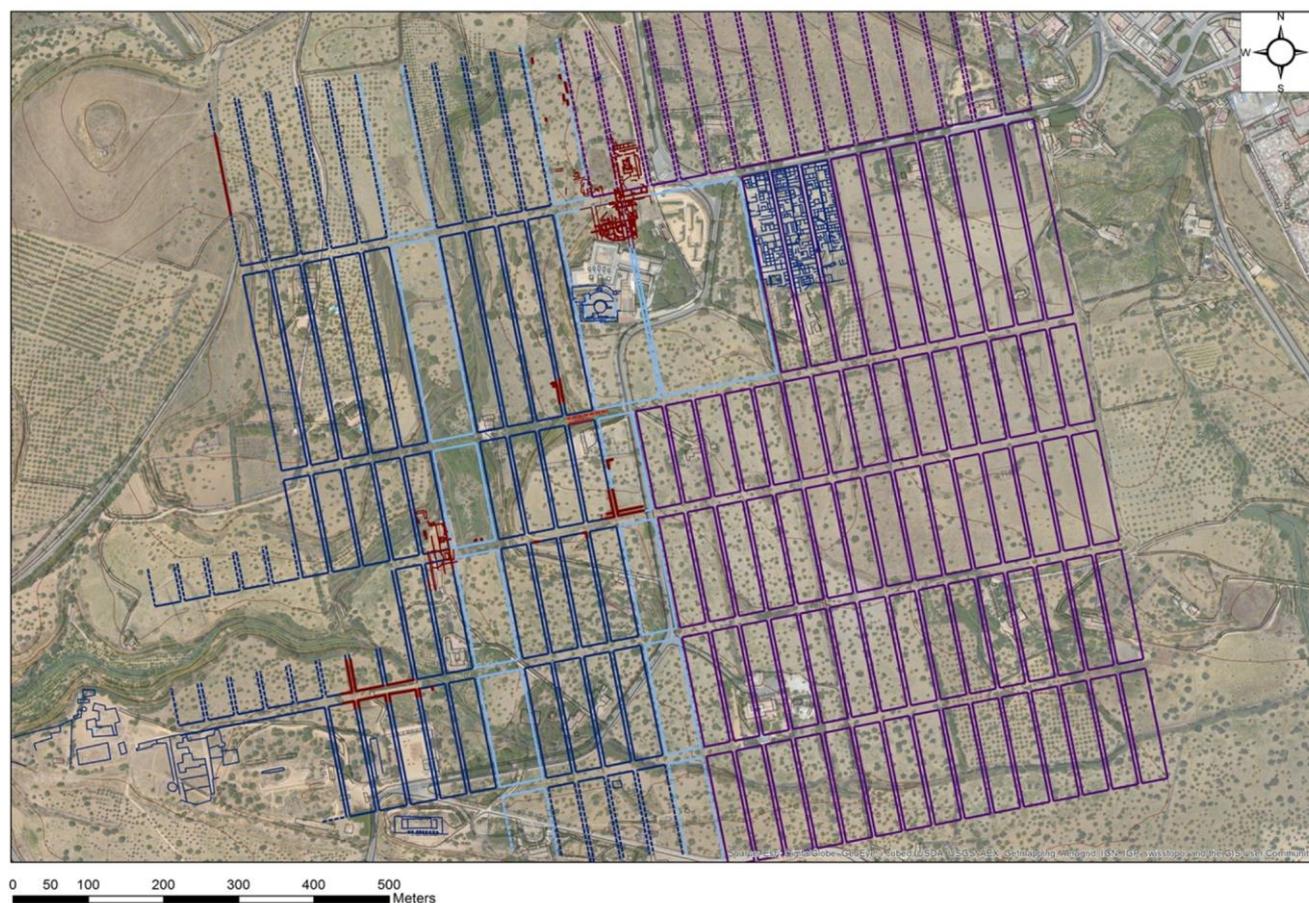


Fig. 8: Reconstructive map of the ancient city planning scheme

It must be said, with regards to the first group of structures found during our survey (A) that they don't appear on the Schmiedt-Griffo map (they weren't visible on the 1955 aerial photos).

The second group (B) is reported and properly refers to an ancient road even though its orientation and position is different from our measurements. The interpretation of the third group (C) was quite difficult for Griffo and Schmiedt because at that time the area was covered by dense vegetation. Regardless, our crossroad is visible in the 1970 photographs as well as from current satellite images, with the same shape and position as our measurements.

The new *Sistema Informativo Territoriale Archeologico e Paesaggistico del Parco della Valle dei Templi di Agrigento* has produced an updated archaeological map of Agrigento and its surroundings (Belvedere & Burgio, 2012). By means of a comparison carried out between the structures drawn by Schmiedt-Griffo and the current evidence, only 52% was found to exist or be visible. The first group of evidence described

by us (A) was not represented on this new map while there is a large discrepancy with regards to the position of (B) and (C).

The structures found during our work, inside a new reconstructive framework, can change the scheme of ancient Agrigento's urban planning. These changes are in the number of the *plateia* and their orientation (Fig. 8). Currently our reconstruction is concentrated only to the city centre, excluding the surrounding areas which still need to be investigated. Furthermore, our interpretation is about an ideal-modular urban plan, that could be changed during real building activity.

In our reconstruction the first two main strings, beginning from the north, have the same shape of those proposed by many scholars<sup>6</sup> as they are 270 m long and divided by orthogonal *stenopoi* in 35 m wide blocks. In previous reconstructions the west side of this area was rotated towards the east while in our

<sup>6</sup> In addition to Schmiedt & Griffo 1958, see De Miro 2009, Tav. B and Fiorentini 2010, Tav I.

reconstruction the blocks have similar orientation. The *stenopoi* create *insulae* of equal width except in the areas where the *ekklesiasterion* and the *agorà*, where we hypothesised a larger area. A wider block was also imagined for the area immediately to the east of the *gymnasium*, which is characterised by the morphology of the urban river.

Changes are much more drastic as you progress towards the south. The crossroads we found give evidence of the existence of a new *plateia* that divides into two parts the string that is generally proposed with a length of 313m. In our reconstruction we consider two different strings, each 150 m long and divided by a main road that is 13 m wide and that has the same orientation as the upper roads.

The south side of the lower string was defined by the *plateia* flanking the *olympieion*, with the same width. The *gymnasium* that was later built had to have change the original urban scheme as it did in the *agora* area.

It is most likely that the last string, on the south-side, was divided in two different sectors by another *plateia* that was 13 m wide. This assumption is made based on the regular and symmetrical ancient planning as well as from the need for a NE-SW road that connected the *Herakles Temple* and the *Olympieion* to the *Gate IV* of the ancient city walls (Fig. 9).

4. A new image of ancient Agrigento (L. Calìo)

The analysis and survey of the central quarter of Agrigento allows us to provide a new image of the ancient city. The shorter city blocks and the extensive public areas link the urban plan to several analogous cities built in Sicily during the same time period. Agrigento will no longer be isolated due to grave misunderstandings of its previous reconstruction plan. The new city image gives the possibility to associate it to a well-defined group of poleis founded by tyrants who, starting from 480 BC, transformed the Sicilian urban landscape. The urban patterns of Naxos

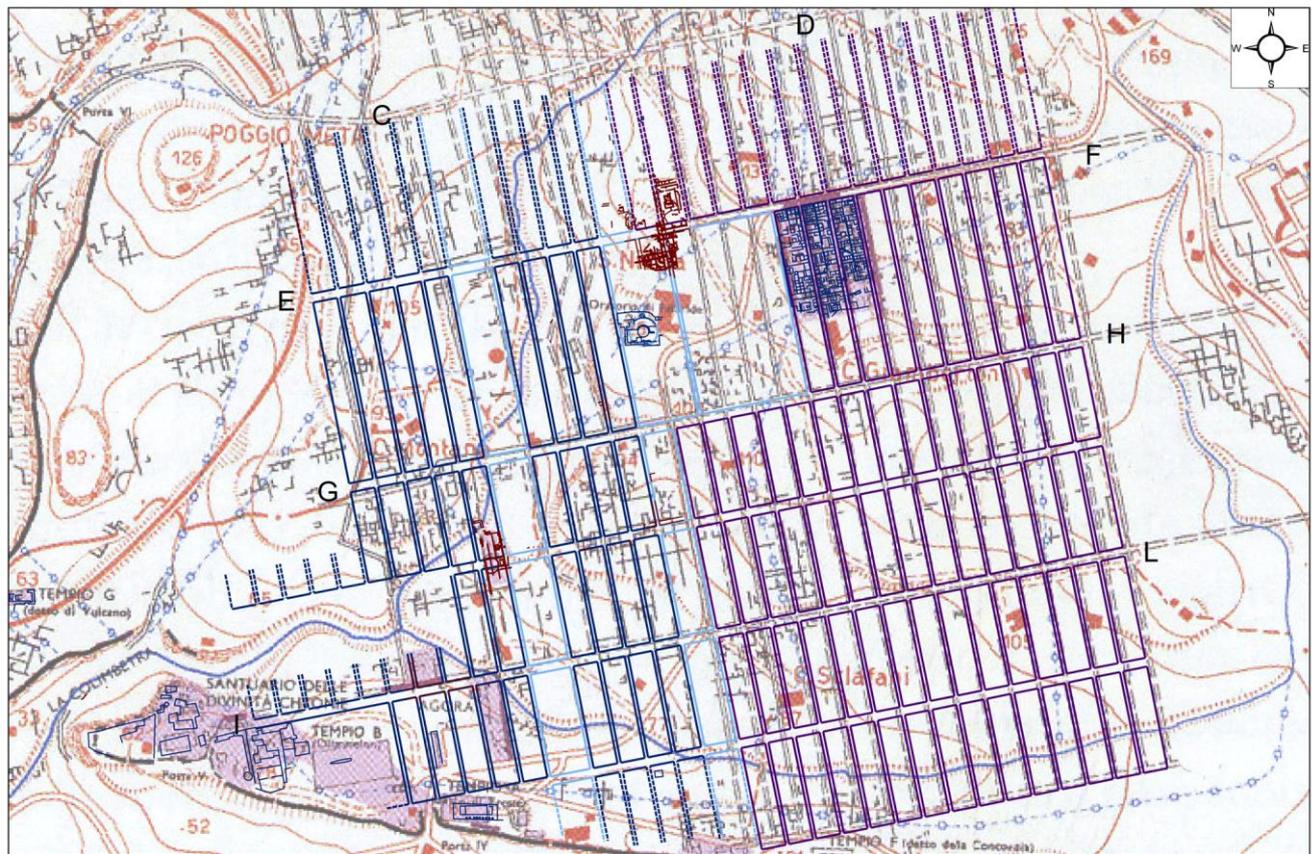


Fig. 9: New urban layout proposition based on Schmiedt-Griffo 1958 reconstruction

(Lentini, 2009), Camarina (Uggeri, 2015), Catane (Branciforte, 2010), Casmenai (Mertens, 2006), and Megara *Hyblaea* (Anzalone, 2012) combine two principal features: the orthogonal street patterns, which draw regular blocks of 35 m in width and 150 m in length, and the monumental terracing (Fig. 10).

Research on Agrigento also aims to restore a virtual image of the city, primarily an image of the central district, as well as its transformations from the late Archaic period to that of the Romanization.

Several problems concerning the understanding this first phase remain from carrying out diachronic reading of the system. Some aspects, in fact, must be clarified. First of all, we need to understand what shape the classical city had in comparison to the Hellenistic and Roman Ages, in order to understand the evolution of the urban system.

The new urban grid was not only determined by the defining of the city blocks, but also by the complex system of terraces from its earliest

stages. The road system has most likely not be altered in the later stages if not marginally.

The city block of the new plan hypothesis makes the urban grid more penetrable. In this first phase we had to focus our attention on solving some issues related to the difference in altitude which consequently conditioned the urban construction before the creation of large terraced system.

It is currently not possible to determine how much urban space has actually been achieved and if the city quarters occupied the urban area without interruption or were instead markedly separated. The problem seems especially evident in the eastern area of the city, east of the *agorà*, where the terraces that adjust for the slope are dated between the third and second centuries BC and hide the structures from previous periods. The urban scheme presented shows, however, that the few remaining fragments of the 5th century city, such as the neighbourhood east of the *Olympieion*, were fully inserted into the urban pattern.

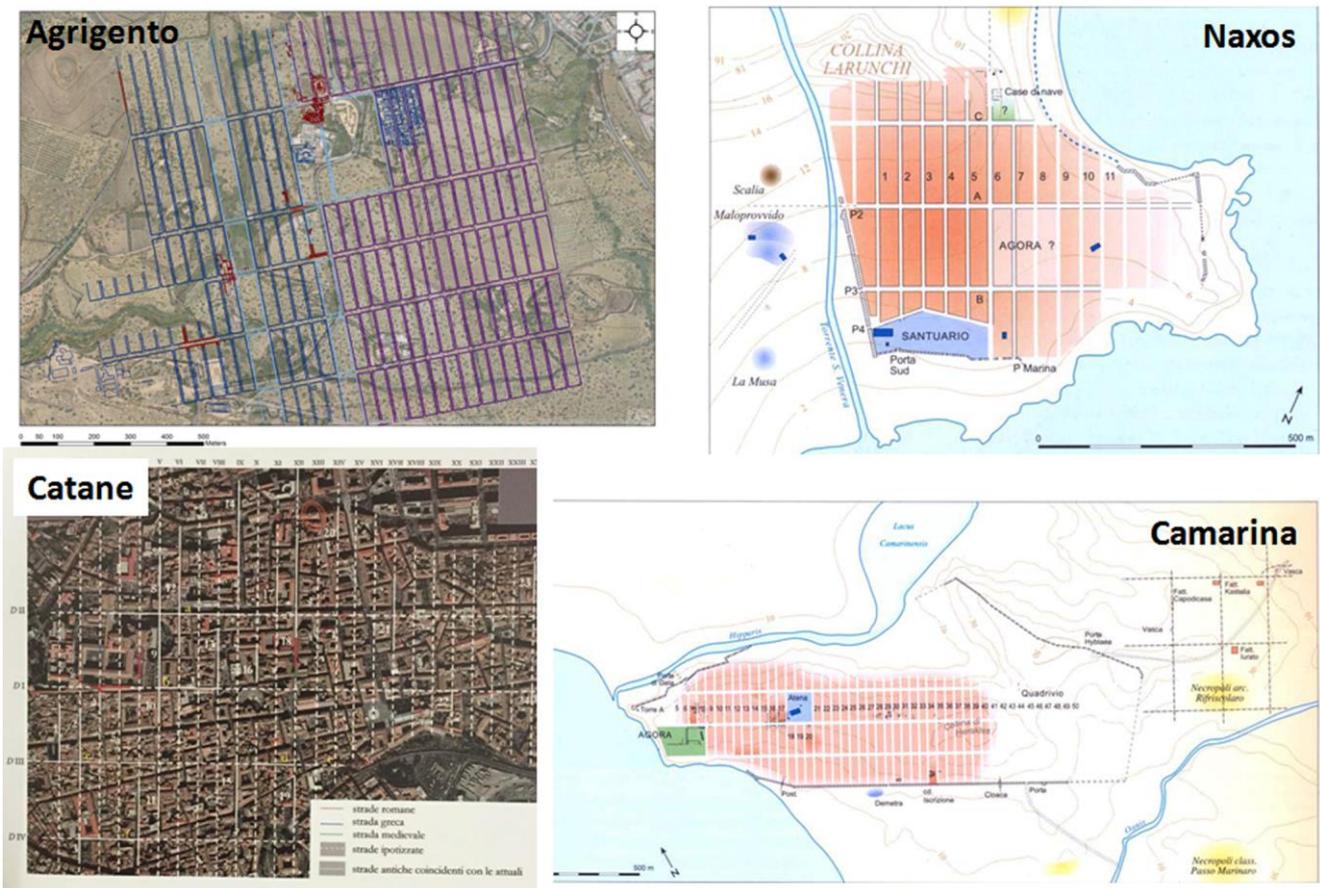


Fig. 10: Comparison with similar greek cities planning schemes

Its importance must also be evaluated in relation to the aspects of the monuments and architecture of the oldest phases, which unfortunately, we can only know from ancient sources. The most important urban structures attributed to Theron are related to the water grid, with all the political and social meanings that bind the function of tyranny to water management. In this direct relationship between polis and tyrant it is also possible to recall the agora; the public square was probably not exactly as wide as it would have been during the Hellenistic period, but regardless had to be quite large and it traditionally constituted a privileged space for tyrant propaganda.

The founding of the "tyrannical" city in Sicily reminds one of the system of kingship which, in some cases, can be followed by carefully reading the sources and archaeological remains of the time. The interest of these cities lies within their monumental apparatus on which they were founded, and which is expressed not only in the construction of individual buildings, but also in the terracing system. The management of the terraces at different altitudes indicates a considerable constructive effort placed on the management of water. Even in this case, the construction of the artificial lake, the Kolimbethra, positioned in relation to the tyrant's palace, confirms publicly and without a doubt the control of the city's water supply.

The new urban plan for Agrigento can give some insight into issues related to the organisation of the Hellenistic city and in particular to the monuments in the central quarter. The first issue deals with identifying the agora east of the Poggio S. Nicola and the analysis of its altimetric organisation. The public square occupies an area of 280m x 170 m between the Hellenistic-Roman Quarter and the *bouleuterion* and *ekklesiasterion* zone on the western side. Little information is known regarding the archaic agora but it is possible to find a new definition of the Hellenistic and Roman phases. Since the Third century BC two porticoed squares were added to the main areas to the west and to the north: the so-called *Oratorio di Falaride* and the Hellenistic Roman Sanctuary. The agora is positioned in the large space between these sanctuaries and the Hellenistic Roman Quarter, up on a terraced system in order to overcome the height difference between the western and eastern edges. A deep depression is present on the southern most edge

of the square. The new plan of the city includes this zone inside the area of the agora. A circular wall that was detected during a survey and initial excavation seem to organise the architectural pattern in this area. The work concerning this area is still in its preliminary stages but it offers a general idea of the agora being a focus of the urban monumental landscape.

## 5. Conclusion

The research is not finished but should be further amplified and expanded. The surrounding areas that were not subject to the preliminary investigations need to be inspected; specifically the so called *Punic Distric* to the east, or the area in the opposite direction west of Poggio Meta. The same holds true for the northern urban section.

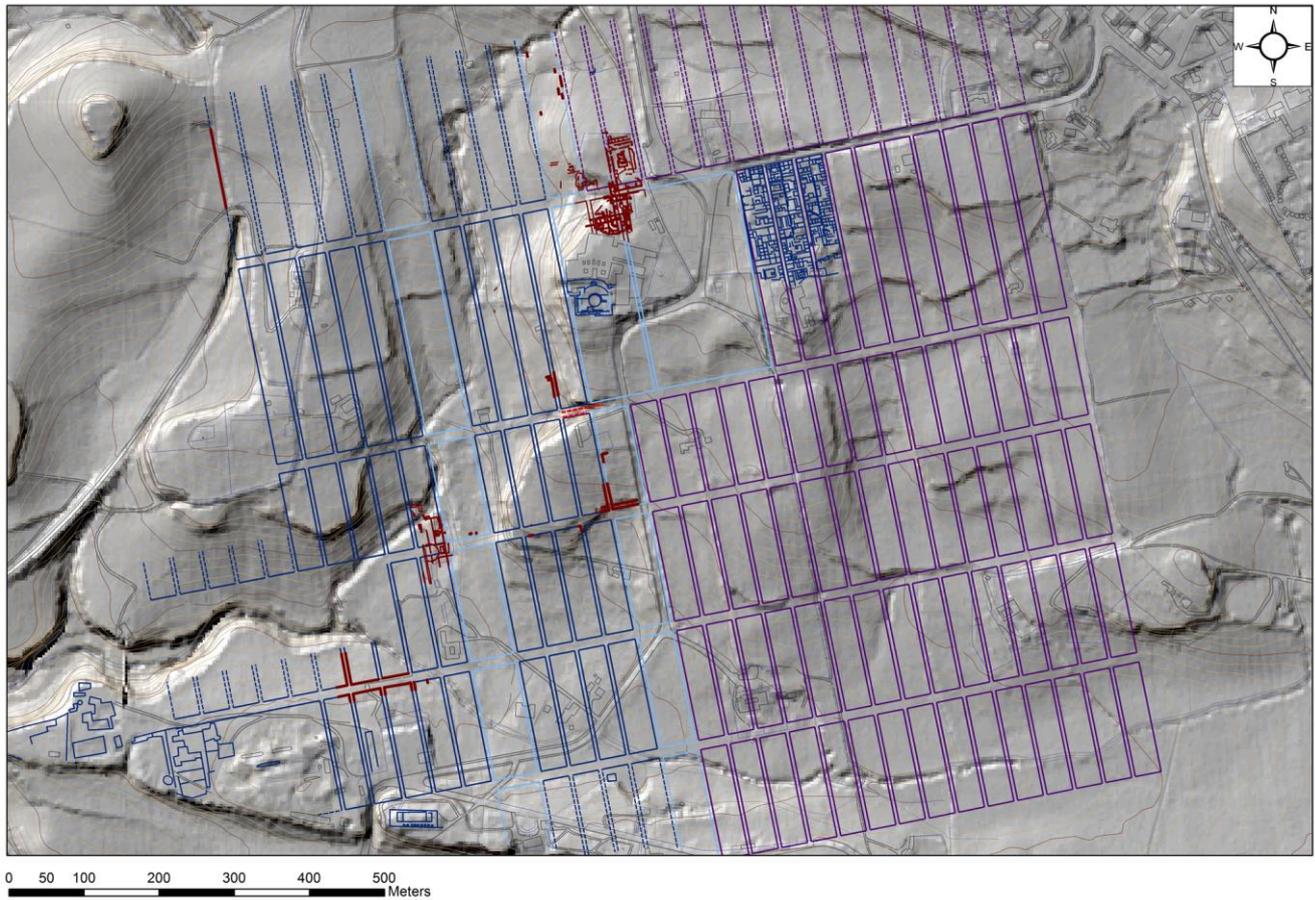
It will be necessary in the future to create graphic, written and photographic detailed documentation that provides evidence of the archaeological discoveries. On the basis of this kind of documentation a chronological and typological in-depth study can be carried out, aimed at discerning the characteristics of the ancient construction sites.

This new geographic framework of the ancient urban structure has nevertheless brought forth new archaeological ideas with clear and evident advantages. The framework was obtained by having a single system and instrument on which to report the findings documented.

The analysis of the newly obtained planimetry was linked to the recent lidar prospecting (easily acquired as they referred to the same geographic system). The reading of the subterranean shape of the city, which is apparent in the modern morphology of the territory, was therefore made possible. From the investigations and preliminary essays carried out this summer by the Archeological Park of Agrigento, together with Bari's Politecnico and the University of Catania, it was possible to identify a very clear and evident area. Its geometrically curved shape brings one to believe that it is the ancient theatre. (Fig. 11)

## 6. Acknowledgement

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**Fig. 11:** Reconstructive map of ancient Agrigento on LIDAR analysis made by Prof. Giliberto Pambianchi and Dr. Fabio Pallotta, Camerino University

## REFERENCES

- Anzalone, R.M. (2012). Eraclea Minoa. In *Magna Grecia. Città greche di Magna Grecia e Sicilia* (pp. 226-229). Roma, IT: Istituto dell'Enciclopedia Italiana Fondata da Giovanni Treccani.
- Belvedere, O., & Burgio, A. (Eds.) (2012). *Carta Archeologica e Sistema Informativo Territoriale del Parco Archeologico e Paesaggistico della Valle dei Templi di Agrigento*, Palermo, IT: Regione Sicilia-Assessorato dei Beni culturale e dell'Identità siciliana.
- Benedetti, B., Gaiani, M., & Remondino, F. (2010). *Modelli digitali 3D in archeologia: il caso di Pompei*, Pisa, IT: SNS press.
- Bertocci, S., & Parrinello, S. (2015). *Digital survey and documentation of the archaeological and architectural sites. UNESCO world heritage list*, Firenze, IT: Edifir.
- Branciforti, M.G., (2010). Da Katane a Catina. In M.G. Branciforti, V. La Rosa. (Eds.), *Tra lava e mare. Contributi all'archaiologia di Catania* (pp. 135-258), Catania, IT: Le Nove Muse.
- Clini, P., Nespeca, R., & Bernetti, A. (2013). All-in-one laser scanning methods for surveying, representing and sharing information on archaeology. Via Flaminia and the Furlo tunnel complex. *Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci.*, XL-5/W2, 201-206.
- De Miro, E., (2009). *Agrigento IV. L'abitato antico*, Roma, IT: Gangemi.
- De Miro, E., & Fiorentini, G. (2011). *Agrigento VI. Gli edifici pubblici civili*, Pisa – Roma, IT: Fabrizio Serra.
- Deorsola, D. (1991). *Il Quartiere di Porta II ad Agrigento*. In *Quaderni di Archeologia - Università di Messina*, 6, pp. 71-105.
- Fiorentini, G. (2010). *Agrigento V. Le Fortificazioni*, Roma, IT: Gangemi.
- Griffo, P.(1987). *Il Museo Archeologico Regionale di Agrigento*, Roma.
- Guidi, G., Remondino, F., Russo, M., Menna, F., Rizzi, A., & Ercoli, S. (2009). A Multi- Resolution methodology for the 3D modeling of large and complex archaeological areas. *International Journal of Architectural Computing*, 7(1), 39-55.
- Lentini, M.C. (Eds.) (2009). *Naxos di Sicilia. L'abitato coloniale e l'arsenale navale. Scavi 2003-2006*, Messina, IT: Sicania.
- Mertens, D. (2006). *Città e monumenti dei greci d'occidente. Dalla colonizzazione alla crisi di fine V sec a.C.*, Roma, IT: L'Erma di Bretschneider.
- Remondino, F., & Campana, S. (2014). *3D Recording and Modelling in Archaeology and Cultural Heritage - Theory and Best Practices*. Series 2598. Oxford, UK: Archaeopress BAR Publication.
- Schmiedt, G., & Griffo, P. (1958). Agrigento antica dalle fotografie aeree e dai recenti scavi. *L'Universo*, 38, 289-308.
- Schubring, G. (1980). *Topografia storica di Agrigento*, Translated from German with notes and additions of W. Toniazzo, Sala Bolognese, IT: Forni.
- Uggeri, G. (2015). *Camarina. Storia e topografia di una colonia greca di Sicilia e del suo territorio*, Galatina, IT: Congedo.