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Topographical Research and Geophysical Surveys at Naxos in Sicily 2012–2019

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Abstract. The collaborative project between the Archaeological Park of Naxos, the Finnish Institutes at Athens and in Rome and the GeoSat Research Lab at FORTH has over the years surveyed the whole urban area of the ancient settlement of Naxos in Sicily. The application of modern topographical survey methods and technologies, the multidisciplinary approach have both produced an insightful renewal of the research of the ancient city with the enhancement of the data previously collected in over 50 years of excavations. The measurement campaigns have been associated with geophysical surveys and short excavation campaigns including an environmental case study (2015–2016). This paper focuses on the results of both measurement campaigns and geophysical surveys. The measurement campaigns resulted in the first geo-referenced plan of the ancient city which can be used to analyse the grid design of the Classical city. The field seasons in 2014, 2015 and 2016 included a major element of geophysical survey. Initially, the main aim was to find out which methods work best at Naxos and then cover as much territory as possible. The fastest method, magnetic gradiometry, is not able to detect archaeological features at Naxos due to the magnetic bedrock. Therefore, the methods used in 2015 and 2016 included soil resistivity and ground penetrating radar (GPR). During all the years we covered approximately 10,000 square meters. The new areas covered in 2016 were concentrated on the outskirts of the town. The results of especially the GPR have been highly encouraging: in many sectors we can see the walls of individual Classical houses which follow the orientation of the fifth century BC city grid. In the same season new data were acquired on the eastern extent of the Archaic South-West Sanctuary. The GPR has thus shown to be effective even in detecting the oldest Archaic city.

This paper focuses on the results of the campaigns of measurement and geophysical survey conducted as part of the collaborative project between the Naxos Archaeological Park and the Finnish Institutes at Athens and in Rome. Reaching a more in-depth understanding of the urban landscape of ancient Naxos was the central objective of the project. The field research took place from 2012 to 2019. It produced a considerable range of new results and a better understanding of the ancient city compared to previous research. The application of modern topographic recording technologies and the multidisciplinary approach to the archaeological remains have been fundamental to obtaining these results. Equally important was building on the legacy of the in-depth and advanced research of the city reached in over sixty years of systematic excavations and fieldwork evident in the extensive range of publications on the site.

Naxos was the earliest of the Greek colonies in Sicily with a traditional foundation date of 734 BC (Thuc. 6.3.1). The settlers arrived from Chalcis in Euboea and Naxos in the Cyclades (Hellanicus *FGrH* 4 F 82). Its primacy and the special status of the altar of Apollo Archegetes at Naxos continued to be recognised by the later Greek colonies (Thuc. 6.3.1).[1] The site is located on the east coast of Sicily between Messina and Catania: all ships sailing west following the coastline of South Italy would have first landed at Naxos.

[1] On the altar of Apollo Archegetes and its importance for the Greek cities of Sicily, see Malkin 2001, 97-118, and more recently Murray 2014, 457-459, 468-473.

The fifth century history of Naxos was troubled and dramatic. It was first taken over by the tyrant of Gela, Hippocrates, in c. 492 BC (Hdt. 7.154) and in c. 476 BC Hieron of Syracuse forced the inhabitants to move to Leontinoi (Diod. Sic. 11.49.1-2). Even though the sources do not mention the establishment of the new regular layout of the city, it can be dated to soon after this date based on the material record. Therefore, it was highly likely a direct result of the establishment of the new Syracusan rule. The tyranny in Syracuse fell in 467 BC and the exiled Naxians were allowed to return in c. 461 (Diod. Sic. 11.76.3). The three Ionian cities of East Sicily, Naxos, Leontinoi and Katane were allies of Athens in the Peloponnesian War and supported the campaign against Syracuse in 415-413 BC (Thuc. 4.65.1-2; 6.20.3). After the Athenian defeat in 403 BC, Dionysios of Syracuse completely destroyed Naxos (Diod. Sic. 14.15.2). Naxos did not recover from this destruction and the new urban centre, Tauromenion, was established across the bay on the hills to the north of Naxos in the fourth century BC. The area of the port was inhabited until the sixth century AD and there are some traces of settlement until the eighth.[2]

The Classical city grid of Naxos is characterised by a system of three principal streets, *plateiai*, running approximately east–west with a series of north–south crossroads, *stenopoi*. The central *plateia* is named A, the one running in the southern section of the city is B and the northern one C. The *stenopoi* are numbered from west to east.

Updating the Topography of the City

The ancient city of Naxos is located to the south of the modern town of Giardini Naxos. Based on recent topographical fieldwork, the area inside the city walls can be estimated as 36 hectares on the promontory of Schisò bordered on the west side by the Santa Venera river and in the north extending to the north of shipshed complex and comprising the Larunchi Hill (figs. 1-2).[3]

The systematic excavations at Naxos were started in 1953 soon after the ones at Megara Hyblaia and Leontinoi.[4] P. Pelagatti was the director of the excavations in 1961-1981 resulting in the discovery of the two superimposed urban plans. The Archaic layout was polycentric (mid-seventh century BC) and the Classical one was an orthogonal grid with elongated *insulae* (c. 470 BC).[5] The city plan with both urban phases drawn up by Pelagatti – plan that is the basis of the new geo-referenced map – has provided a very valuable tool for planning of further fieldwork as well as for safeguarding the site which in 2007 became an archaeological park. The regularity of the later plan has made it possible to reconstruct the city layout also in the unexcavated zones, as has now been verified in the geophysical surveys of 2014-2016.

[2] Blackman & Lentini 2003, 388.

[3] The Larunchi Hill is the most likely location of the acropolis of the city, so we have included it inside the city wall as well the area of Ceramico. Due to modern constructions in the area it is unlikely that this hypothesis can verified on the ground. The area of 36 hectares inside the city walls is based on this extension and its size is based on the automatic calculation in AutoCAD.

[4] Pelagatti 1993, 274

[5] Pelagatti 1976-1977, figs. 3-3b. Martin (1974, 314-316) reported the discovery in advance. On the reconstruction of polycentric layout, see Pelagatti 1981, 302-304, fig. 3 (plan).

The recent fieldwork has greatly enhanced our knowledge of Naxos from the beginning of the first Greek settlement to its destruction in late fifth century. The late Archaic Shipshed Complex (*neoria*)[6] is located to the north of the most probable location of the agora at the northern edge of the city (fig. 2).[7] The archaeological work in this sector has been critical for establishing the design pattern of the city of Naxos. It has made possible establishing where the public hub was located in antiquity, emphasising the importance of the northern part of the city for civic and military functions and the link between the harbour and the agora. The bay must have played a central role in the ancient landscape of Naxos. The area north of the harbour is also the most likely location of the famous and never discovered altar of Apollo Archegetes.[8]

The extensive excavations in the central part of the Schisò promontory at the crossroads of *plateia* A and *stenopos* 11 have resulted in a large range of new data on the urban layouts and changes, from the first Greek settlement through the Archaic plan – which was only arranged *per strigas* in the early sixth century BC – to the highly regular Classical layout of the city (fig. 2)[9]

The topographical field seasons concentrating on the whole urban landscape of Naxos were carried out in 2012 and 2013. Since 2014, total station measurement campaigns have largely concentrated on the area of the intersection A11 and on the Shipshed Complex as well as on the south-west sanctuary. Photogrammetry has been used for documentation of the archaeological remains since the 2014 season and aerial photogrammetry with a drone was used in 2017. The three-dimensional block-by-block line-drawing documentation using total stations can now be combined with textured photogrammetry models for large sections of the archaeological site (fig. 2).[10]

The principal aim of the geophysical survey conducted from 2014 to 2016 was to verify the extent of Classical buildings inside the ancient city walls and to test whether Archaic structures could be identified. During the 2014 explorative fieldwork season the quality of the collected signals was tested and it was determined that the fastest method, magnetic gradiometry, cannot give significant results at Naxos. The noise levels resulting from the magnetic bedrock and lenses created by the eruptions from Etna are too high. However, the results from soil resistivity and especially ground penetrating radar (GPR) were discovered to be highly effective in picking up the signals from the house foundations, and these two methods were used in 2015 and 2016 to cover as much ground as possible.

The Intersection A11 and the Evidence for the First Colonial Settlement

[6] Blackman & Lentini 2003; Lentini et alii 2008; Lentini et alii 2013; Pakkanen 2018, 133-136, figs. 6.11a (orthomosaic of the complex) and 6.11b (reconstruction of north-west part of the complex).
[7] On the reconstruction and the larger space of the agora, see Lentini & Pakkanen 2012, 155-158, fig. 3; Lentini et alii 2015, 3-4, figs. 6, 8.
[8] Murray (2014, 471) underlines the continuity of the cult and places the altar 'beneath the modern town of Giardini Naxos, and perhaps in the immediate vicinity of the church of San Pancrazio'. On the location, see also Pelagatti 1993, 281 (with previous bibliography), and most recently Muscolino et alii 2014, 238-240.
[9] Lentini 2012, 310; Lentini et alii 2015, 25-26, figs 4, 7.
[10] Pakkanen 2018; Pakkanen et alii 2019.

At the crossroads, the discoveries relating to the earlier phases of the colony have a particular importance and we focus on these. The data from the excavations carried out at *plateia* A, the nearby area to the north and the area just to the south of intersection A11 below a very large Byzantine landfill, give a surprising insight into the early landscape of the settlement after the phase of its establishment.

Two curvilinear buildings ('g', 'd')[11] were uncovered south of crossroads A11, just below the floor of a sacred or civic enclosure which occupies the south-west corner of the Archaic crossroads of streets Si and Sh (fig. 3). Their construction technique and oval-shaped plan allow us to recognize the buildings as remains of huts similar to earlier ones found at Metapiccola of Lentini and at Cittadella of Morgantina (fig. 4).[12] Significantly, their contexts show Greek Late Geometric pottery (in clear prevalence) associated with impasto pots of the Late Iron Age Finocchito Culture.[13] The evidence sheds light on the initial phase of the settlement during which the Greek newcomers found temporary shelter in huts possibly shared with the indigenous inhabitants, Sicels in our case.[14]

The huts were soon replaced by the long Building f which is located just east of them when they were no longer in use. Already around 700 BC, Building f was abandoned and the pebbled floor of the enclosure was extended over it. The building was more likely rectangular than apsidal in plan and it consists of three rooms. The construction technique used is comparable to that of the coeval buildings found below *plateia* A. Its recorded size (c. 10.3 m long x more than 2.5 m in width) is notable: [15] it is larger than any other coeval building discovered so far in this area (figs. 3, 5). Remains of a gravel floor found outside along its western side could be related to an adjoining open-air area. Unlike the other buildings discussed below, it has a north–south orientation and is apparently isolated. Although the excavations were conducted over a limited area, all data point towards a non-domestic or non-exclusively domestic function. Both the pottery (mainly fine tableware) and the amount of animal unburned bones from the adjoining open-air area can be interpreted as remains of common ritual-sacrificial feasting. The practice is common in Greece from the Early Iron Age to the seventh century in sanctuaries and also in domestic elite dwellings which served as places for communal drinking as at Eretria (Building Ed 150)[16] and Oropos (Buildings Θ and ΣT).[17]

In addition to the layout of the first settlement, the excavations have revealed a new Archaic road, Street Si, adding to the already known road network from this period. The excavation data shows that the street dates back to 700 BC. The chronology of the city plan at least in this area is earlier than has been previously thought. Its orientation is from east to west and it crosses the northern side of the

[11] Lentini 2009, 27, fig. 26; Lentini 2011; Lentini 2012, 310-312, pls. 36-37.
[12] Leighton 1993, fig. 39.
[13] Lentini 2015, 315-319, figs. 12-13.
[14] Lentini forthcoming.
[15] Lentini 2012, 312. The overall length of the building was ascertained in 2013, but not its width (it extends further on the east side than was possible to excavate)
[16] Verdan 2013, 182,186 (Eretria); Mazarakis Ainian 2016, 22, fig. 2.4 (Oropos).
[17] Mazarakis Ainian 2012, 133, figs. 4-5. On the development in the seventh century BC of Building Θ compound into a 'Heroon' and of Building ΣT into a domestic shrine devoted to the nymph Halia and the Telchines, see also Charalambidou 2017, 140-143, fig. 14.20 ('Heroon'). On the relationship between sacred, civic and domestic space during the LG period, see especially Mazarakis Ainian 2012, 131-133. For the practice of communal consumption of meals and drink, see also Morgan 1999, 319-320 (Isthmia, ritual meals in open-air space); more recently Morgan 2017, 202-203 (Isthmia).

peninsula. It is 3.40–3.80 m wide and has been investigated for a length of about 30 m. Its intersection with Street Sh was discovered just below *stenopos* 11 (fig. 6),[18] while the remains of the buildings discovered under *plateia* A and in the neighbouring area to the north correspond with an east–west orientation. These buildings are arranged next to each other, separated by narrow passages. With the exception of Building 10, a warehouse (?), they can be identified as dwellings.[19] Their grouping may recall the cluster system of the LG Cycladic urban centres.[20] House 5 fits well with this urban landscape: it is rectangular in plan (7.80 x 3.50 m) and consists of two rooms, the largest with remains of π-shaped bench, so its features are very similar to Cycladic architecture (fig. 7).[21]

The sacred or civic enclosure vividly complements the cityscape sketched above. It is located at the northwest corner of the crossroads of Streets Si and Sh (figs. 3, 6). Its cobbled floor dating from c. 700 BC is coeval with the earlier level of Street Si.[22] It has a recorded surface area of 15.20 m x 9.10 m: its overall dimensions are unknown as well as its shape. Some small enclosures found at Megara Hyblaia may offer a good parallel.[23] The large number of unburnt bones collected together with tableware on the cobbled floor shows its ritual use. The 'bothros' occupying the northwest corner of the area confirms this function (figs. 3-4). This feature could be associated with ritual activities in chthonian or ancestral cults.[24] The unburned animal bones recovered inside it, together with a small amount of ash and pottery, indicate that the use of the area as a place of ritual banquets was continued from the end of the eighth century until the beginning of the sixth century BC.[25] The depiction of an orientalising spouted krater recovered in the fill layer of Street Si also fits with chthonian and ancestral cults: a hoplite head facing left rises from the ground between the paws of the two felines. It may be a very early representation of an *anodos* scene with its symbolism related to the heroic and funerary sphere, and so to the cult of heroes and to that of ancestors.[26]

Building H provides further evidence for the ceremonial use of the area. It is rectangular in plan (9.70 m x 2.40 m) (fig. 3) and it was built on the pebble floor in c. mid-seventh century BC, clearly replacing the Building f and coinciding with the restructuring of the area as is also evident in the filling layer of Street Si.[27] The discovery of a bench along its southern side reinforces the hypothesis that it may have been a dining room for common banquets (fig. 8). Its orientation perpendicular to the street Si, together with the plan and size of the building, fits the function as a rectangular dining-room with an entrance on the long side of the building.[28] It is interesting to observe that its room dimensions are very close to those of the rooms of the 'Heroon' at Megara Hyblaia which has been proposed to be a

[18] Lentini 2009, 20, figs. 21- 22.
[19] Lentini 2009, 23-25, figs. 15 (general plan), 25-27 (Houses 10 and 5).
[20] In general, on LG Cycladic urban system, see most recently Mazarakis Ainian 2012, 126-128.
[21] Lentini 2011, 530-531, fig. 3.
[22] Lentini forthcoming.
[23] de Polignac 1999, 216; Gras et alii 2004, 521, fig. 467.
[24] Mazarakis Ainian 1997, 281.
[25] On the pottery from the 'bothros', see Lentini 2009, 30-32, figs. 36-42.
[26] Lentini 2017, figs. 29.1, 7-9.
[27] Lentini 2017, 349.
[28] Bergquist 1990, 39-44, pl. 3, fig. 2 (broad-room shape).

banqueting hall.[29] The enclosure may have been part of a large sacred area which included also Tempietto C a short distance to the south.[30]

The layout of the area during the sixth century BC is uncertain because these layers have been destroyed by the Byzantine trench. It would seem, however, that it was occupied by a building (c. 9 x 6.50 m) potentially of sacred character: the early fifth century BC *gorgoneion* found in the area probably belongs to its roof.[31]

A regular housing block of the city grid plan (Block A11) occupied this area in the fifth century BC. In 2015-2016, environmental excavations were carried out here inside a well discovered in the courtyard of a fifth-century BC house (fig. 9). The research was part of the collaborative project on the cityscape of Sicilian Naxos. The environmental data are currently being studied, but it is already very clear that the archaeological finds from this sealed context are of great interest, especially those from the bottom of the well: forty complete vessels, many of which have an intentionally pierced base or body, and the presence of knucklebones used for divination are evidence of ritual closure of the well chronologically very close to the destruction of the city by Dionysios I of Syracuse in 403 BC.[32] This discovery provides an unexpected closure to this specific area: it preserves vestiges linked to the social identity of the city from its first Greek origins to the very end.

The Orthogonal Grid System: Measurement Campaigns and Analysis

The Classical urban space, confined inside the Archaic walls, is traversed by three wide streets or *plateiai* (A, B and C) running from northeast to southwest. They are of different widths and at regular intervals intersected by a series of narrower streets (14 altogether). The street network delimits the housing blocks of circa 39.2 x 156.7 m. Square bases, very probably altars, are systematically placed in the south-eastern corners of the intersections.[33] Further excavations of *plateiai* B and C were conducted in 1983-1996 (fig. 2).[34] The excavations of *plateia* A, the principal east-west axis of the system, were started in 1998 and they continued with little interruption until 2014, uncovering the area between the intersections 11 and 12 (fig. 10).[35] As part of the initial preparations for laying out the Classical city plan the sixth-century structures were dismantled and levelled. *Plateia* A has two superimposed fifth-century street surfaces: the destruction layers of 403 BC were discovered on top of the final street surface. Similar phases were discovered in *insulae* A10 and A11: the first one can be dated to about 470 BC and the second to post-460 BC. The latter phase of adjustments and

[29] Bergquist 1992a, 141-142. de Polignac (1999, 224) argues that the identification is perfectly compatible with a hero cult such as that of the Prodomeis ('founders') at Megara Nisaia.
[30] Tempietto C was also constructed over earlier houses of the initial eighth-century settlement; Pakkanen et alii 2019, 419-423.
[31] Lentini 2009, 27-29, figs. 29, 33.
[32] Pakkanen & Lentini forthcoming.
[33] In 1973, the Classical grid city plan was discovered by Pelagatti (1976-1977, 537-542, figs. 3-3b, 1981, 297, fig. 3). On the suggestion of a Doric foot of c. 0.325 m being used in the grid plan, see Pelagatti 1998, 52; for the statistical analysis of the layout, see Pakkanen 2013, 56-59; on the identification of the design unit being based on a foot standard of 0.327 m, see Lentini et alii 2015, 28; on the square bases as altars and starting points of the city grid layout, Pakkanen et alii 2019, 428-431; for other interpretations of the corner bases, Pelagatti 1998, 53, 68, nn. 44-46.
[34] Lentini 1998, 73-76; Lentini et alii, 2015, 30, figs. 2-3
[35] Lentini 2009, 10-17, figs. 3-5.

modifications to the house plans is most likely to be attributed to the return of the Naxian exiles after the Deinomenid tyranny fell at Syracuse (Diod. Sic. 11.76.3). As at the Shipshed Complex, the changes only modified existing infrastructure: the street network was left as it was, but property boundaries and internal divisions of the houses were adjusted.[36]

The Classical orthogonal grid is best interpreted as a re-foundation of the ancient city: the original plan of the settlement was cancelled and all vestiges of earlier urban properties were removed. Even sacred areas could suffer the same fate: Tempietto C was likewise erased. Only the Archaic city walls and some temple precincts escaped, as did the monumental Shipshed Complex which was fitted into the new layout.

The topographical campaigns in 2012 and 2013 at Naxos combined what was known about the topography of the ancient city and the existing plan of the modern city with a systematic centimetre-precise 3D total station survey of the archaeological remains: the result was the first integrated and georeferenced plan of the archaeological park at Naxos (fig. 2).[37] Since 2015, fieldwork campaigns combining photogrammetry and intensive reflectorless 3D line-drawing with total stations have been carried out at the archaeological park.[38] In 2017, aerial photography for photogrammetry was carried out over the archaeological park using a drone. In fig. 1, the measured archaeological remains, the reconstruction of the ancient grid and the plan of the modern city are superimposed on top of the orthorectified mosaic image.[39]

Quantitative analysis of 48 direct measurements of the main dimensions of the city layout reveals a strict modular design at Naxos. The statistically highly significant peak corresponds to a design unit of 1,633 metres or five feet of c. 0.327 m (the 'Doric-Pheidonic' foot). The dimensions of the *insula*, c. 39.2 x 156.7 metres, can be expressed in terms of this unit as 24 x 96 modules. The designed width of *plateia* A (circa 9.50 m) is six units, *plateiai* B (circa 6.40 m) and C (circa 6.30 m) and *stenopos* 6 (circa 6.40 m) are four units and most *stenopoi* (4.94-5.19 m) are three units (fig. 2). The distances between the centres of the altar bases set in the south-east corners of the intersections support the hypothesis that they are the starting point of the city layout: the north-south distance between the bases is 100 design units and the east-west distance 27 units.[40] Besides functioning as monuments of the Classical city layout, constructing altars at the starting points of the new design turned the whole territory inside the city walls into a sacred area.[41]

Agora and Shipshed Complex and Its 3D Reconstruction

The excavation campaigns at the Shipshed site were conducted by M.C. Lentini in collaboration with D.J. Blackman in 2001 and 2003-2006 resulting in uncovering of the whole upper western half of the

[36] Lentini 2009, 15-17, figs. 10-14.
[37] For the accuracy of the survey and the plan of Naxos, see Pakkanen 2013, 56.
[38] On the methodology of combining reflectorless total station line-drawing with photogrammetry, see Pakkanen 2018; Pakkanen et alii 2020.
[39] The orthomosaic was produced using 430 aerial images (taken at an altitude of c. 75 m) in PhotoScan; see also Lentini & Pakkanen 2019, 90-91; Pakkanen et alii 2019, 417-419.
[40] Pakkanen 2013, 56-58; Lentini et alii 2015, 28.
[41] Pakkanen et alii 2019, 428-431.

complex which is not currently under modern houses (fig. 2).[42] The structure is at the northern edge of the city and to the north of the agora. The excavated part of the *proteichisma* for the city wall c. 20 m north of the shipsheds indicates shows that the complex was protected by the wall.[43] No progress has been made on defining the southern edge of the agora (fig. 2). Recent excavations carried out at the intersection of *plateia* A and *stenopos* 9 (the 2019 campaign) have, however, highlighted some anomalies which could be significant: the rectangular base is half of the normal size and it is located further to the south with respect to the corner of the intersection and the other bases (fig. 11). It should also be pointed out that the ambiguous structure to the south of Temple E could be interpreted as the propylon leading into the agora from *stenopos* 9.[44]

The dimensions of the shipshed complex are c. 28 by 40/48 metres. It consists of four slipways with ramps to support the keels of the triremes.[45] Based on pottery from ramps 3 and 4, the first phase can be dated from late sixth to early fifth century BC. This date is also supported by the Silenus-mask and gorgoneia antefixes of the earlier roof of Sicilian type.[46] After 460 BC, the complex was underwent significant alterations and it received an undecorated Corinthian-type roof. The numerous different types of fifth-century Silenus-mask antefixes are most probably linked to the maintenance of the roof.[47]

A full 3D resurvey of the Shipshed Complex was carried out in 2016. During the documentation it was realized that the diagonal back wall of slipways 3 and 4 is not part of the Classical Shipsheds but of the late Roman phase of the site. The backwall of slipways 1 and 2 was constructed further to the east than the wall behind slipways 3 and 4, as presented in fig. 12: they are a little staggered probably following the orientation of the coastline. The post-460 BC rebuilding did not change the plan of the backwall of the late Archaic building (orange colour in fig. 12). Therefore, the previous reconstruction of this part of the building[48] needs to be modified and its relationship with the neighbouring urban road (*stenopos* 6) reconsidered. The street to the west of the shipsheds must have maintained its Archaic route.

The partial 3D reconstruction presented in fig. 13 shows the northwest corner of the complex covering the top section of slipways 1 and 2.[49] The point cloud derived from photogrammetry, the line-drawing from the total station survey and the reconstruction were combined in AutoCAD. The new reconstruction is georeferenced making the future use of the digital model straight-forward.

Southwest Sanctuary and Temple B: 3D Documentation and Reconstruction

[42] Blackman & Lentini 2003; Lentini et alii 2008 ; Lentini et alii 2013.
[43] Lentini & Blackman 2009, 46, figs. 9-10.
[44] Lentini et alii 2015, 26, fig. 8 (3D reconstruction).
[45] Lentini et alii 2008, 310-322.
[46] Lentini et alii 2008, 323- 349, 360-362, fig. 56 (reconstruction of the roof, first phase).
[47] Lentini et alii 2015, 27.
[48] Lentini et alii 2008, 356, plan 2; Lentini et alii 2013, 400, figs. B14.3a-b.
[49] Pakkanen 2018, 133-135, figs. 6.11a-b.

The area was first investigated by Pelagatti who carried out several seasons of excavations in 1961-1972.[50] New documentation campaigns in the sanctuary have been conducted in 2012, 2015 and 2017, and the later field seasons concentrated on photogrammetry. The architectural terracottas of Temple B were documented in the site storerooms in 2017.[51] Geophysical survey in the southwest part of the city was carried out in 2019.[52]

The high city walls blocked the view into the sanctuary both from the south and the west. Walls separated the sanctuary also from the city on the north and probably east sides while the South Propylon (Porta Marina) linked it directly with the outside of the city, giving an extraterritorial dimension to the sanctuary. The geophysical survey identified the continuation to the east of Archaic Street Sc which runs along the north wall of the temenos. Even though the late sixth century Temple B has an *oikos* plan without a surrounding colonnade, its size matches typical peripteral temples. It is the largest sacred building at Naxos and the anthemion sima of the roof shows direct Ionic influences.[53] The similar features in the roof details of the temple and the contemporary North Propylon to the sanctuary point towards a large late Archaic building programme in the area.[54]

The roof revetments of Temple B were modelled several fragments at a time in the storerooms. By placing them into correct position in relation to each other it was possible to speed up the post-processing of the photogrammetry models and directly compare them with previous work based on the same fragments (fig. 14).[55] The height of the temple in the reconstruction is tentative (fig. 15), but combining the 3D model of the site with the wireframe model of the temple gives an idea of the scale of the structure compared to the size of the sanctuary. Even though it was not possible to see the temple when approaching the city because of the high surrounding walls, the visual impact on anyone entering the sanctuary through the South and North Propylon must have been impressive.

Geophysical prospections

Three geophysical survey campaigns were conducted in 2014–2016. The aim of the fieldwork was to locate the subsoil structures of the city and, if possible, try to determine whether they were part of the Classical or Archaic phase of Naxos. In the first campaign it was determined that the fastest method of geophysical prospection, magnetic gradiometry, cannot detect subsoil structures because of the igneous bedrock which is also used to construct the shallow foundations of the houses. In addition, the signals are masked by layers of volcanic debris from Etna. The material has created a magnetic lens covering the architectural remains. Soil resistance measurements were also affected by these lenses. GPR provided the most consistent data. Post-processing by removing background noise and band pass filtering was able bring to light interesting features in most surveyed areas. Most linear

[50] Pelagatti, 1964, 140-162, fig. 4; Pelagatti 1972, 215-218, fig. 2.
[51]Lentini & Pakkanen 2019, 90-91.
[52] Pakkanen et alii 2019, 425-428.
[53] Pelagatti 1964, Pelagatti & Lentini 2011, 394; Lentini & Pakkanen 2019, 96-97.
[54] Ciurcina 1977, 76, no. 11, pl. V, 2-3, and lastly see, Lentini & Pakkanen 2019, 93, fig. 4 (North Propylon front raking revetment).
[55] Lentini & Pakkanen 2019, 90-91, 96, figs. 2, 6 -7; Pakkanen et alii 2019, 427, fig. 9. For previous reconstruction, see Ciurcina 1977, 70-72, pl. 8.

anomalies follow the alignment of the Classical grid. The detected features were mainly 0.6–1.0 m and in places up to 1.5 m below the current surface.[56]

During the three campaigns, a total of approximately 10,000 square meters were surveyed annually in the Schisò peninsula. The full range of geophysical anomalies detected during the 2014–2016 campaigns is presented in fig. 16. In many sectors it is possible to detect the distinct walls of the Classical houses. The few blank zones in the GPR data very likely reflect robbed areas from the Roman and Byzantine periods, but also modern destruction of the archaeological remains.[57] The geophysical survey data demonstrates that the Classical orthogonal *insulae* extend to the currently unexcavated parts of the archaeological park. The different orientation of the Archaic and Classical layouts has made it possible to detect structures of the earlier phase at two distinct areas: the currently buried western half of Tempietto C and continuation of the Street Sc at the north edge of Southwest Sanctuary are both very clearly visible in the GPR depth slices.[58]

Final Note

The collaborative project between the Archaeological Park of Naxos, the Finnish Institutes at Athens and in Rome and the GeoSat Research Lab at the Foundation for Research and Technology, Hellas (FORTH) was undertaken when the very fertile and extended period of fieldwork and scholarship at the site was drawing to a close. The summary of results presented here shows how positive the final balance is, how much our work has improved the knowledge of the ancient urban landscape, renewing how it can be viewed from multiple perspectives and at the same time making the most out of the fragmentary archaeological data. We have often returned to the obtained data to reflect them from different points of view. To obtain these results in such a short time, frequent discussions and φιλία between the participants have been the key. However, these results would have been difficult to achieve without the application of new investigative technologies and methods, and without interdisciplinary research. These components point towards new lines of research: perhaps the next generation of equipment for geophysical survey will be able to give a more detailed in-depth picture of the still imperfectly known Archaic city below the Classical one. For all of this, we regret that our collaborative project on the cityscape of ancient Naxos is now nearing its conclusion.

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[56] For further technical details of the geophysical survey, see Lentini et alii 2015, 27-28.
[57] After the 2014 season, the geophysical anomaly in intersection A8 was excavated and a large Roman limekiln was discovered – the limestone used in the kiln was from the Classical structures (Lentini et alii 2015, 25, fig. 5). Recent use of archaeological material is evident in the modern aqueducts built for agricultural purposes.
[58] Pakkanen et alii 2019, 419-428, figs. 2, 8.

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