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Ground-truthing the Site-based Survey at S'Urachi and Su Padrigheddu (West-Central Sardinia): Results of the 2016 and 2017 Seasons

Linda R. Gosner[1] – Jessica Nowlin** – Alexander J. Smith****

*Texas Tech University
**University of Texas at San Antonio
***The College at Brockport – State University of New York

The nuraghe S'Urachi and adjoining site of Su Padrigheddu are a monumental stone tower complex and settlement located in west-central Sardinia. The site has been subject to periodic excavations beginning in the 1940s and has been excavated since 2013 by the Progetto S'Urachi. These latest excavations have revealed new evidence for habitation at the site from the Bronze Age through the late Roman period, confirming that S'Urachi was an important regional center in antiquity. In conjunction with this work, a multi-phase site survey was carried out to explore wider settlement patterns and land use away from the immediate vicinity of the nuraghe. This included geophysical and microtopographical surveys (2014), an intensive survey using point-sampling (2015), and targeted excavation (2016-2017). This article details the final phase of the site-based survey: the excavation of a series of five trenches, the locations of which were selected on the basis of our survey results. We present the excavation results and their implications for understanding long-term settlement patterns and formation processes at S'Urachi and Su Padrigheddu. We also discuss the relationship between surface and subsurface finds and the methodological implications of these results for survey archaeology at the site and regional scales.

1. Introduction

The nuraghe S'Urachi is a monumental stone tower complex in the Upper Campidano region of west-central Sardinia. This monument, one of the largest examples in the region, is located c. 1 km west of the town of San Vero Milis in the province of Oristano (fig. 1). In antiquity, the tower itself was surrounded by a settlement site, which was partially excavated in the 1940s by Giovanni Lilliu[2] and has subsequently been the subject of ongoing excavations carried out by the Progetto S'Urachi. This project, a collaborative effort of the Comune di San Vero Milis and Brown University, has excavated two sectors outside of the nuraghe's surrounding tower walls since 2013 in order to better understand long term habitation from the Bronze Age to the late Roman period, and especially during the 1st millennium BCE, a period of intense socio-cultural change on the island[3]. Just southeast of S'Urachi is an adjoining site called Su Padrigheddu, which was discovered during deep plowing of

[1] Corresponding author: lgosner@ttu.edu.
[2] LILLIU 1949.
[3] STIGLITZ *et al*. 2015; VAN DOMMELEN *et al.* 2018; PÉREZ JORDÀ *et al.* 2020.

the area in the 1980s (fig. 2). This work brought to light Iron Age ceramics, though none from secure archaeological contexts. Su Padrigheddu was initially interpreted as a cemetery for S'Urachi[4], but subsequent analysis of the materials - including high portions of cookware and other domestic ceramics - suggests that it was a neighboring settlement[5].

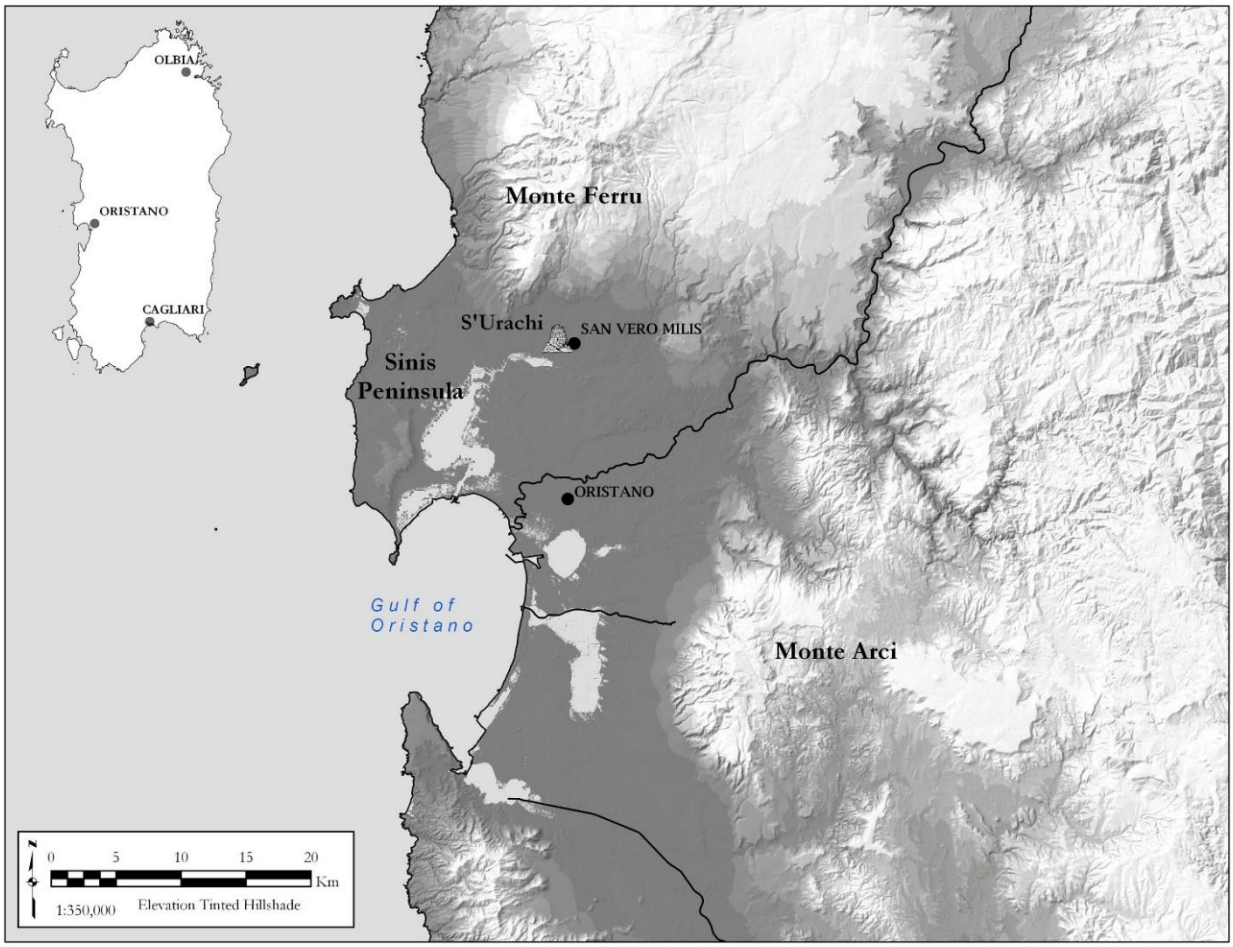

Fig. 1. The location of S'Urachi in west-central Sardinia.

In order to understand S'Urachi in its wider context, we conducted a site-based survey of S'Urachi and Su Padrigheddu between 2014 and 2017. Geophysical and microtopographical surveys (2014) were carried out followed by an intensive survey of the area (2015)[6]. In 2016 and 2017, we excavated a series of test trenches across the site, placed at locations chosen based on the results of our previous survey interventions[7]. We had two goals: first, to ground-truth the results of our experimental survey methodology employed in 2015 and, second, to test areas of the wider site for their suitability for opening a new excavation area with well-preserved stratigraphy. This article details the results of this second phase of our site-based survey. We first summarize our previous work and our rationale for ground truthing our results at select locations. We then detail the results of the excavations of our test trenches. Finally, we suggest based on these findings that our survey methodology can be used as a tool for deciding where to excavate, with the caveat that the chronological range represented by survey finds is more restricted than that represented by excavation in situations with deep, stratigraphically intact occupation layers. In the final section, we comment on how this site-based survey methodology can be integrated with regional survey.

[4] BERNARDINI 2011.
[5] ROPPA 2012; HAYNE, MADRIGALI, ROPPA 2015; GOSNER *et al.* 2020; MADRIGALI *et al*. 2020.
[6] STIGLITZ *et al.* 2015; GOSNER, SMITH 2018; ULLRICH, FREIBOTHE c.s.
[7] A complete dataset from the 2016 and 2017 seasons is available in open access format (GOSNER, NOWLIN, SMITH 2020).

Fig. 2. Map showing the location of the nuraghe S'Urachi and core archaeological site, which is bounded by two paved roads. To the southeast is Su Padrigheddu, which today is covered almost entirely by a eucalyptus grove.

2. Ground-Truthing the Site-Based Survey: Methodology and Results of the Test Trenches

Before turning to our 2016 and 2017 work, it is useful to explain the rationale for our site-based survey methodology and summarize the results[8]. S'Urachi is in a region used for agriculture and pastoralism, but the site itself is unplowed and enclosed by a fence. Although the nuraghe is routinely cleaned of vegetation for tourist visits, the areas away from the standing architecture are heavily overgrown. Su Padrigheddu, located southeast of S'Urachi is covered by a eucalyptus grove, save for a strip of land along its borders that is occasionally cut to prevent brushfires. These conditions impede visibility and make surface collection difficult. It is impossible to use Mediterranean-style pedestrian survey or gridded collection, which are better suited to agricultural fields, allowing collection to be carried out at a time in the crop cycle when visibility is high and when the plow has brought artifacts to surface[9]. We therefore adapted our survey methodology, using the point-sampling collection technique that has been employed for regional survey in areas with low visibility and involves clearing topsoil from small circular units set on a grid. This collection strategy recreates a shallow ploughing episode and produces artifact assemblages similar in quantity to what might be expected from a traditional survey in a plowed environment. In Sardinia, this method was used in the Terralba Survey and the Riu Mannu Survey[10]. Another successful example is the Tappino Area Archaeological Project in Molise in southern Italy[11].

[8] GOSNER, SMITH 2018. The survey dataset is available in open access format (GOSNER, SMITH 2017).
[9] See CHERRY 1983; ALCOCK, CHERRY 2004. On assessing visibility, see CASAROTTO *et al*. 2018: 177-192.
[10] VAN DE VELDE 2001. For the results of this survey see: ANNIS, VAN DOMMELEN, VAN DE VELDE 1995; VAN DOMMELEN 1998; VAN DOMMELEN *et al*. 2008.
[11] STEK 2018.

For our survey, we cleared 63 units across a preexisting 20x 20m site grid. At each unit, we cleared a circle with an area of c. 2 sq. m and a depth of c. 10 cm (fig. 3). We sifted the soil and collected all materials from each unit, most of which would not have been recovered if we had only collected visible surface remains[12]. All finds were categorized into chronological categories and mapped by weight across the site[13]. From this work, clear patterns of habitation and land use were visible. Figure 4 shows, for instance, that ancient ceramics are concentrated primarily in the northern sector of the site, the southeast area closest to the nuraghe, and in the northwest corner of Su Padrigheddu (fig. 4).

Fig. 3. A cleared unit in Su Padrigheddu in 2015 with team members collecting materials.

After the conclusion of our 2014 and 2015 campaigns, we selected three areas of interest across the site to place test trenches: the northern sector of S'Urachi, the southeast sector of S'Urachi, and the northwest corner of Su Padrigheddu (fig. 5). These selections were made on the basis of the combined results of the geophysical, microtopographical, and intensive surveys to verify chronological patterns revealed by these surveys and locate possible areas for future large-scale open excavations. Our first test trench (TT1) was placed in the northwest corner of Su Padrigheddu because of the high proportion of Iron Age pottery uncovered during the surface survey there. The geophysical team also reported a circular anomaly, suggesting there might be intact stratigraphy in the area. Our second test trench (TT2) was placed southeast of the nuraghe and just north of Su Padrigheddu in an area where a geophysical anomaly was revealed but few ceramics were recovered. Our goal was to verify whether the anomaly represented ancient stratigraphy or construction and - if so - why so few ceramics were present on or near the surface. Finally, we excavated a series of three trenches (TT3, Area F, and TT4) in the open field north of the nuraghe because of the promising survey finds related to the later phases of occupation of S'Urachi across this area. We wanted to confirm whether stratigraphy from the Punic through late Roman occupation of the site might still be present in this sector, since many of the later phases of occupation near the nuraghe were not well documented in earlier excavation campaigns. The excavations of the 1940s and 1980s targeted the earlier phases of occupation of the site as well as the nuraghe itself, but the northern sector of the

[12] A limited-scale surface survey was carried out at S'Urachi, which produced significantly fewer remains (see PANICO 2011).
[13] GOSNER, SMITH 2018: 8-10.

site was never excavated because it was used as a trash dump[14]. In the following sections, the stratigraphy and findings of each test trench are described. We return to the methodological implications for archaeological survey below.

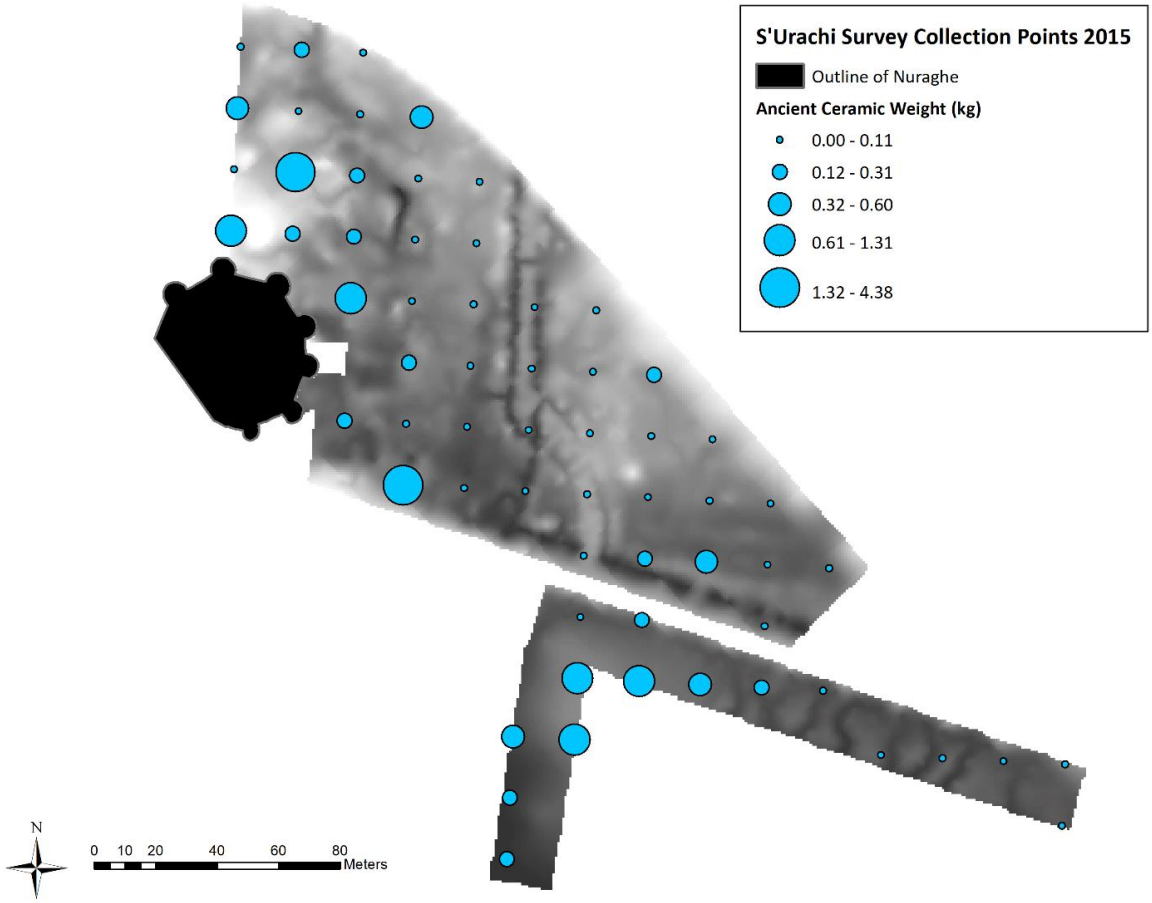

Fig. 4. Map of overall ancient ceramic distributions by weight overlaid on the microtopographical survey.

2.1. Test Trench 1: Iron Age Settlement in Su Padrigheddu

The first test trench was placed at the survey point SU 15 Z 108.92, which served as the trench's southwest corner. This survey point had revealed proportionally large quantities of Iron Age pottery during surface survey in 2015. Although Su Padrigheddu was deep-plowed in the 1980s in preparation for planting eucalyptus trees, we hoped that stratigraphy would be preserved along the edges of the trees where we placed the trench. This hope was fueled by the presence of a large, circular geophysical anomaly in this area[15]. In order to assess this, we laid out a 1.5x1.5m trench that incorporated a portion of the geophysical anomaly. Unfortunately, our excavations confirmed that the plowing had disturbed any possible stratigraphy down to a sterile alluvial layer. The excavation reached a depth of 96 cm and revealed only 3 stratigraphic layers with anthropogenic material: the topsoil (**000**), a thick layer rich with cultural material with completely disturbed stratigraphy as a result of plowing (**001**), and a compact, thin layer (**002**) that appeared to be untouched by the plow on top of sterile *alluvium* (fig. 6).

[14] See earlier full excavation reports: LILLIU 1949: 394-561; TORE 1984a: 203-220, 1984b: 703-24; STIGLITZ, TORE 1988: 453-476.
[15] GOSNER, SMITH 2018: 5-7; ULLRICH, FREIBOTHE C.S.

Fig. 5. Map of the locations of the four test trenches completed in 2016 and 2017 as well as the proposed outline of Area F, a new 20x20m sector for open excavation.

Fig. 6. Closing photograph of TT1.

2.1.1. TT1 Finds

The trench produced large quantities of Nuragic and Phoenician materials attesting to the Iron Age occupation of this area[16]. Despite only containing three stratigraphic units (**000**-**002**), the trench yielded 1,092 ceramics, totaling 12.40 kg. The highest concentration of finds was located in unit **001**, which produced 11.22 kg of ceramics (or 90.5% of all TT1's ceramics). 2.62 kg (or 23.3%) of the ceramics in **001** were classified as Iron Age Nuragic, a figure that is consistently higher than other survey units and test trenches, save for the deepest stratigraphic deposits of TT3 and Area F discussed below (fig. 7). 879 individual pieces of faunal bone were recovered, weighing 28.48 kg. 724 bones or 27.54 kg (96.7% by weight) of the test trench's bones were found in **001**, alongside 20 pieces of shell (0.12 kg) (tab. 1). The only other finds in this trench were 2 fragments of metal in **001** (0.03 kg), as well as 5 lithics from **001** (2 pieces totaling 0.02 kg) and **002** (3 pieces totaling 0.02 kg). The distribution of the finds indicates a rich but mixed deposit in **001**, followed by a comparatively small assemblage in the thin layer of **002** (15 ceramics weighing 0.13 kg, 24 bones weighing 0.30 kg) just above sterile *alluvium* .

Fig. 7. Examples of Nuragic fineware from TT3 ***001****.*

2.1.2. TT1 Interpretation and Recommendations

We were unable to determine what the geophysical anomaly was given the trench's small size, but even if elements of structures are preserved on the margins of Su Padrigheddu, this area is not large enough to warrant future excavation. Most of the finds have been displaced and stratigraphy obliterated by plowing. Nevertheless, the analysis of finds corroborates the more recent claims that this was a settlement[17]. Of the ceramic recovered, most forms are cookware, including tannur fragments and cooking pots, as well as various forms for drinking and dining. These include vessels of both indigenous Nuragic traditions as well as Phoenician styles made in local fabrics[18]. This assemblage, alongside the very high proportion of faunal bone - some with butchering marks - is

[16] GOSNER *et al*. 2020: 1705-1713; MADRIGALI *et al*. 2020: 107-126.
[17] ROPPA 2012: 1-25; HAYNE, MADRIGALI, ROPPA 2015: 1769-1779.
[18] MADRIGALI *et al.* 2020: 110-114.

characteristic of refuse from consumption at a settlement site[19]. This further shows the extent of settlement in the early Iron Age across the site and provide further evidence for the dynamic relationship between Nuragic and Phoenician traditions there[20].

TT1, TT2, TT3	**TT1 000**	**TT1 001**	**TT1 002**	**TT2 003**	**TT2 004**	**TT3 000**	**TT3 001**	**TT3 002 upper**	**TT3 002 lower**	**TT3 003**	**TT3 004**	**TT3 006**	**TT3 Cleaning Layer B**	**TT3 Cleaning Layer C**	**TT3 007**	**TT3 009**
Bos taurus	2	227	3	3	2	3	24	5	3	6	2		7		1	
Cervus elaphus	8	142	1	1	2	1	21	8	5	1		2	3			
Sus scrofa	5	115	7	1		2	19	5	2	7	2	1	4		1	
Caprine (total)	9	80		1	1	7	57	15	6		1		13		1	
Ovies aries		-1					-3									
Capra hircus																
Canis familiaris		6	1													
Equus sp				1												
Aves							3	1	1							
Osteichtes								1				1				
Vertebrae	7	221	3	1		4	22	8	2	4	1	1	2			
Ribs	11	234		1		4	55	19	7	7	12	3	13		2	2
Indeterminates	86	111	9	15	1	48	288	62	33	36	15	8	28		10	
Seashells		21				5	56	10						8		

Tab. 1. Faunal assemblage data from TT1, TT2 and TT3 (Damià Ramis).

2.2. Test Trench 2: An Ancient Flood Zone Southeast of the Nuraghe

We placed TT2 in an area where a geophysical anomaly was reported from the ground penetrating radar survey, but where very few materials had been discovered in the 2015 point-sampling survey[21]. This 1x2m trench was located 10m south of the midpoint between survey units SU 15 Z 104.98 and SU 15 Z 106.98, an area to the southeast of the nuraghe and north of Su Padrigheddu. The excavations revealed a shallow sequence of flood layers and hardpacked soils. In total, there were four stratigraphic layers overlaying sterile *alluvium*. These included topsoil (**000**), two distinct layers of densely-packed sand brought in by flooding (**001** and **002**), a dense layer of orangish brown clayey soil (**003**), which lay above the natural, dense, dark brown sterile soil (**004**) (fig. 8). The dense layers in this trench, which were especially difficult to excavate on the eastern extent, may be what was detected through geophysical survey at depths between 0.6m and 0.9m below the surface.

[19] MADRIGALI *et al.* 2020: 114-115.
[20] VAN DOMMELEN *et al*. 2018: 149; GOSNER *et al*. 2020: 1705-1713; MADRIGALI *et al.* 2020: 116.
[21] GOSNER, SMITH 2018: 7-13; VAN DOMMELEN *et al*. 2018: 149.

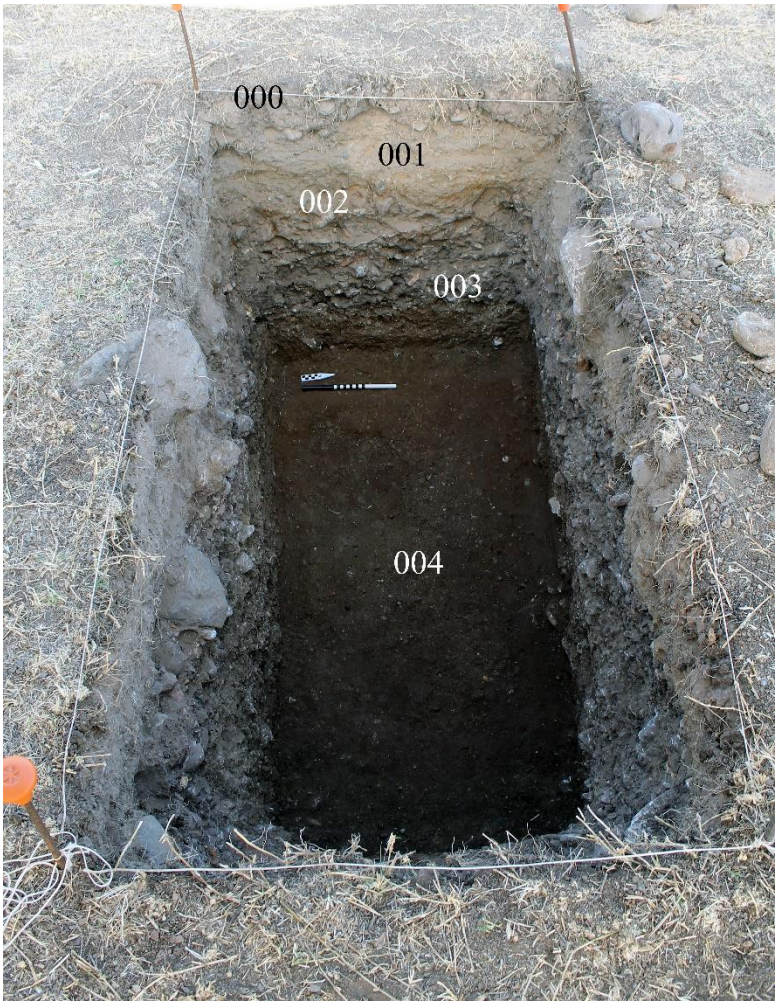

Fig. 8. Closing photograph of TT2.

2.2.1. TT2 Finds

In total, the trench produced 1,613 ceramics (19.19 kg). The surface layer (**000**) yielded a similarly modest number of ceramics as the closest survey units 104.98 and 106.98 with only 28 sherds weighing 0.14 kg (0.7% of total ceramic finds in the trench by weight). This trend continued in the underlying context (**001**) with only 31 ceramics (at 0.13 kg, again constituting just under 0.7% of the trench total). Context **002** produced 215 sherds at 1.50 kg (7.8% of the total count), though only two of those were diagnostic pieces, dated to the Punic-Early Roman period. The highest number of finds were discovered in **003**: 1,304 ceramic sherds weighing 17.12 kg and representing 89.2% of all ceramics from TT2. Most of the ceramics from this context fell into a relatively limited chronological range of the 4th through the 2nd centuries BCE - a period that is well represented in both the site-survey and S'Urachi excavations (fig. 9). The final layer of the trench (**004**) only contained 35 small ceramic finds (0.30 kg) of the same chronology. Faunal remains were few, only present in **003** (24 pieces at 0.30 kg) and **004** (10 pieces at 0.09 kg), for a total of 34 fragments or 0.39 kg (tab. 1). A metal piece was discovered in **001** (weighing 0.02 kg) and one piece of glass was discovered in **003** (only 0.001 kg).

2.2.2. TT2 Interpretation and Recommendations

TT2 revealed that the geophysical anomaly in this area was a natural, compact subsurface feature. The most notable characteristics of the ceramic finds were their uniform chronology and their worn, chalky condition. This, coupled with the compact stratigraphy, suggests that this area of the site was subject to periodic flooding and was not used for habitation. It is at a lower elevation than the land closer to the nuraghe and may have been a disposal area for domestic refuse of the 4th - 2nd centuries BCE away from the immediate habitation area in a zone which was impacted by changing watercourses and flooding in antiquity. As recently as 1952, a streambed cut through this area, as visible in historical imagery (fig. 10). Overall, the excavation supports the results of the surface survey, where few finds were recovered: neither indicated this would be a site of interest for excavation. The trench also provides additional evidence for changing water courses and flooding alongside other attestations of these phenomena uncovered in the S'Urachi excavations[22].

[22] In area E, for instance, a ditch was partially excavated that may surround the outer defensive walls of the nuraghe. Although this has been interpreted as a ditch with a defensive function, the excavators note that it may also "represent the canalisation of a natural stream" (PÉREZ JORDÀ *et al.* 2020: 3, fig. 2). See also: VAN DOMMELEN *et al*. 2018: 146-147. Today, many irrigation ditches have been carved across the site for similar purposes (GOSNER, SMITH 2018: 5).

Fig. 9. Selection of amphorae, storage and tableware sherds from TT2 ***003****. The poor condition of the surface of the sherds due to periodic water exposure is visible.*

2.3. Test Trench 3 and Area F: Deep Stratigraphy North of the Nuraghe

In 2016 and 2017, we excavated TT3, a 1.5x1.5m trench located north of the nuraghe, where high concentrations of Punic and Roman pottery were recovered in the survey at unit SU 15 Z 98.108 (which became the midpoint of the western border of the trench). In TT3, we uncovered a long stratigraphic sequence reaching over 2m below the surface with several layers of fill covering a Punic drain construction and a large basalt wall associated with Late Bronze Age and early Iron Age Nuragic pottery. Based on these promising results, we enlarged TT3 by adding a 1.5x3m extension to the south. We named this Area F, following the Progetto S'Urachi nomenclature, in anticipation of future open excavations in the area[23]. Area F revealed a complicated stratigraphic sequence reaching 2m in depth. This included a shallow stone wall built on top of an earlier phase of construction: the substantial subterranean drain that was partly visible in TT3. The drain was constructed by creating a large trench running roughly north-south and cutting through older occupation layers. Once the drain was in place, a large fill layer was added to raise the ground level to fill the construction ditch and cover the drain so that it would be a subterranean feature. Of interest for the early chronology of occupation were the layers cut by the drain during construction, a series of compact floor surfaces visible in the eastern balk of Area F. Finally, below the drain we discovered Late Bronze Age Nuragic ceramics, significant for being among the oldest sherds recovered from stratigraphic contexts at S'Urachi. These trenches are described separately below, pending further study of materials and integration of the stratigraphic sequence with ongoing excavations[24].

[23] STIGLITZ *et al.* 2015: 200-203; VAN DOMMELEN *et al.* 2018: 143-146.
[24] VAN DOMMELEN *et al.* 2018: 149-150.

Fig. 10. Imagery date to 1952 with streambed (dark line in center) running north-south and passing directly over the location of TT2.

2.3.1. Test Trench 3 Stratigraphy

The 1.5x1.5m trench produced a deep stratigraphic sequence. Under a shallow layer of rocky, grassy topsoil with mixed modern and ancient materials (**000**), we uncovered substantial fill layer of loose, chronologically mixed materials (**001**). Context **001** was filled with artifacts of a broad chronological range from Iron Age to Roman, though predominantly of the 4th - 3rd centuries BCE, intermixed with large quantities of faunal bones. Context **001** extended across the whole trench, covering another fill layer that was more compact, clayey, and dark (**002**). This layer may have been an intentional fill to level the ground surface, as it covered two stone-built features. The uppermost feature first appeared to be a roughly constructed but bulky stone wall extending SW-NE across the trench (**003**), which was packed in place with a compact, clayey layer (**004**). As we deconstructed the wall, we found that it was a stone drain cover, overlying a more ordered, linear drain constructed of two parallel lines of stones atop flat paving stones (fig. 11). Underneath the drain was a layer of dark soil with a high concentration of charcoal (**006**), showing that the drain was constructed on top of earlier occupation layers.

Running north-south in the western half of TT3 was a large stone wall (**005**), about 67 cm wide and 140 cm long, though the full extent was not uncovered in this small trench (fig. 12). The wall was constructed of large basalt stones with smaller rocks filling the spaces in between them. It could be the first course of a deconstructed large stone wall or the foundation for a mudbrick wall. The size and construction are consistent with other Bronze and Iron Age domestic structures at S'Urachi and other Nuragic sites of Sardinia[25]. Although, further investigation is needed, this wall could be part of the earliest phases of the Nuragic village north of the nuraghe S'Urachi. It clearly predates the drain construction.

[25] For general background on this topic, see: WEBSTER 1996 and 2016.

*Fig. 11. View of the stone drain cover (**003**) after the removal of much of the mud packing (**004**) surrounding the stone (left) and a view of the drain from above after it the cover was removed (right).*

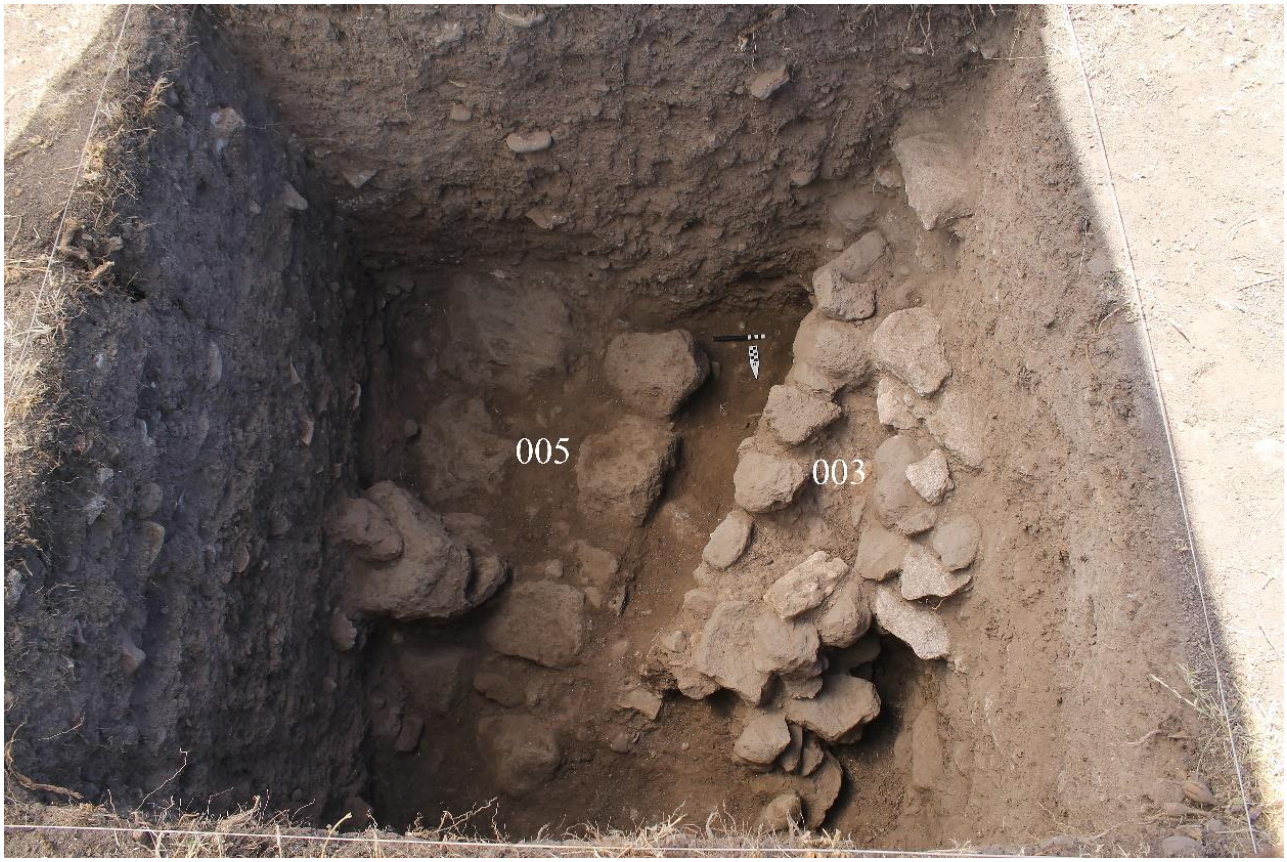

*Fig. 12. View of Test Trench 3 (SU 16 Z 98.108) at the close of the 2016 season. On the left, the east side of the trench, is the substantial basalt wall associated with the earliest pottery uncovered in the trench (**005**). On the right is a partially deconstructed stone cover of a drain (**003**). The drain postdates the basalt wall, but was left intact.*

2.3.2. Area F Stratigraphy

We expanded TT3 in 2017, adding a 1.5x3m extension (Area F) to the south to further investigate[26]. One of the goals of enlarging the trench was to determine whether the fill uncovered in TT3 layers **000**-**002** was consistent across the area, in which case mechanical excavation might be possible. These layers were loose and dense with ceramic of mixed chronology and faunal bone, but did not contain architectural features. However, we unexpectedly came down upon superficial architecture almost immediately after opening Area F. This architecture confirms that excavation in this spot would provide an excellent opportunity to study the later phases of occupation at S'Urachi.

Just below the topsoil (**000**) and a shallow fill layer (**001**) was a stone wall (**002**). This wall was partially robbed out in its northwest extent, but was preserved in two courses in its current state. These courses rested on top of another phase of construction, a substantial subterranean drain with a mix of basalt, sandstone, and fired tile cemented together with packed mud (**004**) (fig. 13). The layer of fill (**001**) that covered both the drain cover and the upper wall had a large quantity of ceramic from a mixed range of periods from the Iron Age through the late Roman period (fig.15). Significantly, we did not find any modern ceramics or other material below the topsoil, which suggests that the ancient stratigraphy was intact. The dating of the pottery surrounding the wall suggests that it was exposed during an occupation phase of the site stretching into the late Roman period, even if the construction of the wall itself was earlier.

This superficial wall rests on the subterranean drain construction. This drain was first identified in TT3, but very little of the architecture - which runs roughly north-south - fell within the confines of the trench. The extension into Area F allowed us to explore the construction of this water feature. The drain itself was made of small to medium-sized basalt and sandstone rocks as well as some broken fired tiles. These pieces were secured in place with mud between them and along the outside of the construction (this side packing was excavated as context **011**[27]). The drain was constructed by creating a large trench and cutting through older occupation layers. If the large wall in TT3 (**005**) once ran into this area, the stones were robbed out during this process. Once the drain was laid in place, a large fill layer (**003**) was added to fill the construction ditch and secure the drain underground.

Of particular interest for understanding occupation chronologies are the layers that were cut by the drain during construction and preserved in the eastern extent of Area F. These were a series of compact floor preparation surfaces, the best preserved of which (**008**) is visible in Figure 14 (fig.14). Above this was a poorly preserved floor preparation (**005**). There was little associated pottery, but these layers did contain a small number of Iron Age Nuragic and Phoenician sherds. Below **003** and **005**, we recorded two contexts (**006** and **007**), both of which were a continuation of the fill inside the cut (**009**) made during the construction of the drain.

Below the drain cut were two additional layers with anthropogenic material (**010** and **013**) (fig. 13). There were no features associated with either context, but the ceramic recovered from them is the oldest from the trench. These contexts only produced Nuragic sherds of the Recent and Late Bronze Age (fig. 16). Finally, **011** was the packing of the drain construction and **012** was a very small amount of rubble fill in between **010** and **013**. We concluded excavation when it became untenable to dig so close to the site's water table, as it was approximately 2m deep (fig. 13).

[26] For this article, we discuss the stratigraphy of TT3 and Area F separately until concordances with the later S'Urachi excavations are made in the future. Several concordances are clear, however: TT3 000=Area F 000, TT3 001=Area F 0001, TT3 002=Area F 003, TT3 006=Area F 006, TT3 004=Area F 007, and TT3 006=Area F 010.

[27] The materials from this layer appear to be Phoenician and Nuragic of Iron Age date. It seems likely that the fill excavated during the drain construction was then used to pack it.

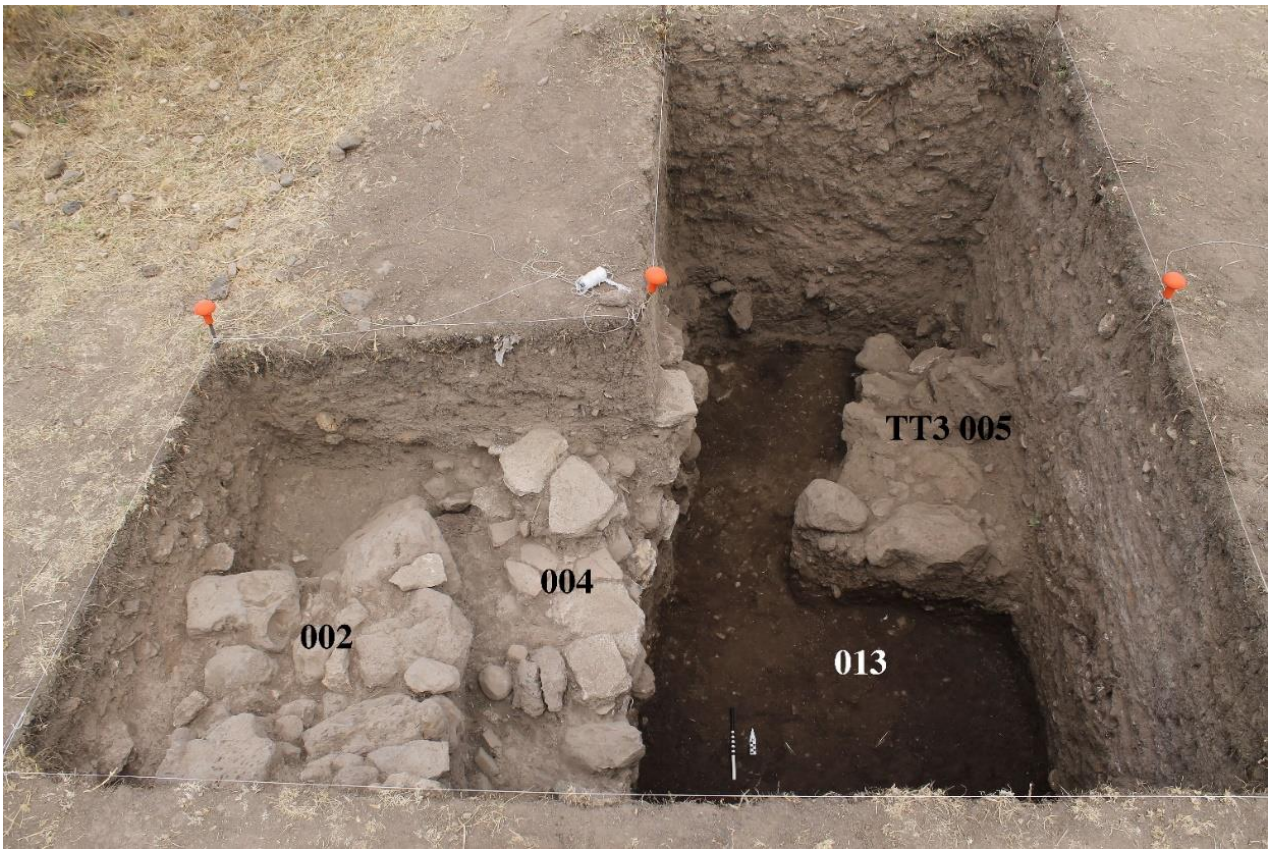

Fig.13 Closing photo of Area F (below) and TT3 (upper quadrant).

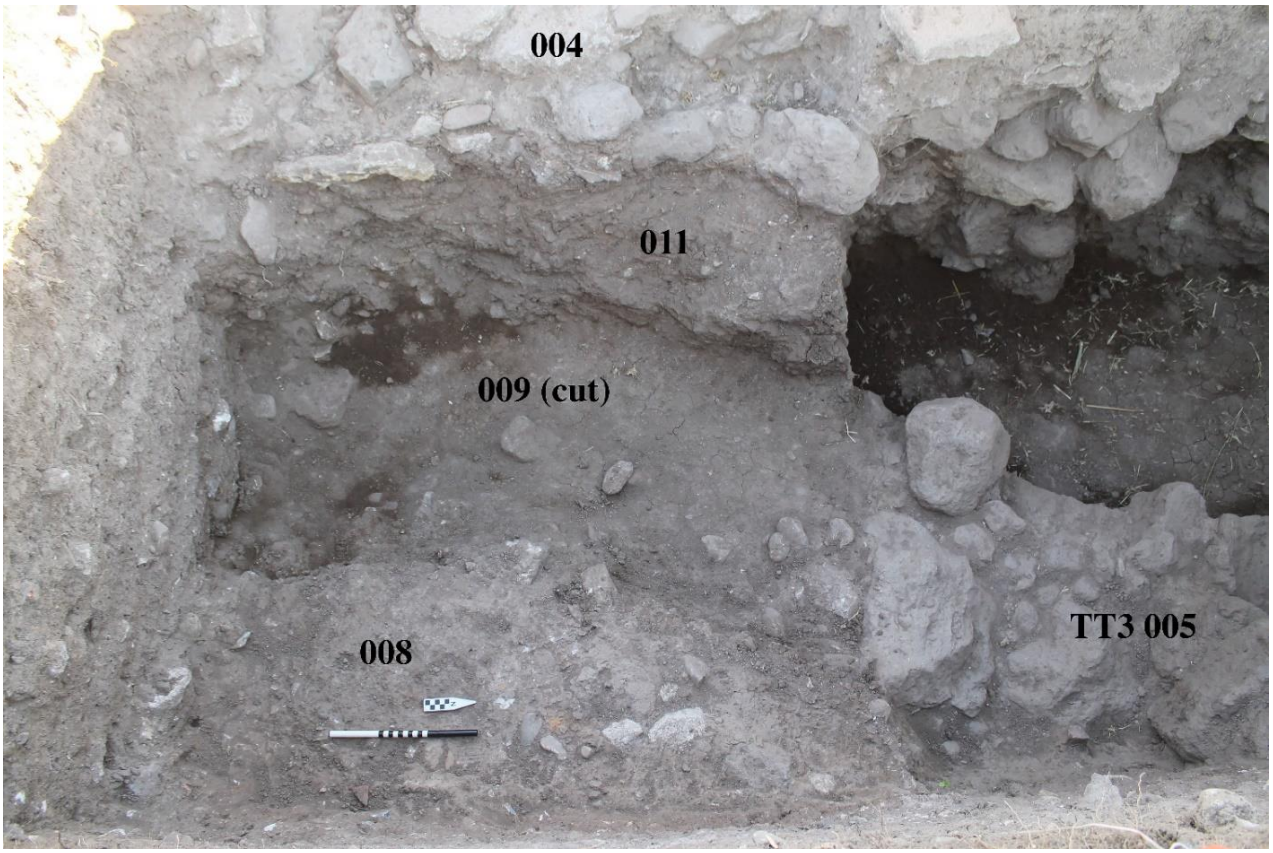

*Fig.14 Progress shot showing the floor preparation surface on the eastern extent of the trench (**008**), the cut (**009**) made during drain construction, and the mud packing against the drain (**011**).*

*Fig.15 Fineware from Area F **001**, which indicates the wide range of material associated with the upper layers of the trench and the superficial wall. From left to right: bucchero, black gloss pottery, terra sigillata Italica, and terra sigillata Africana.*

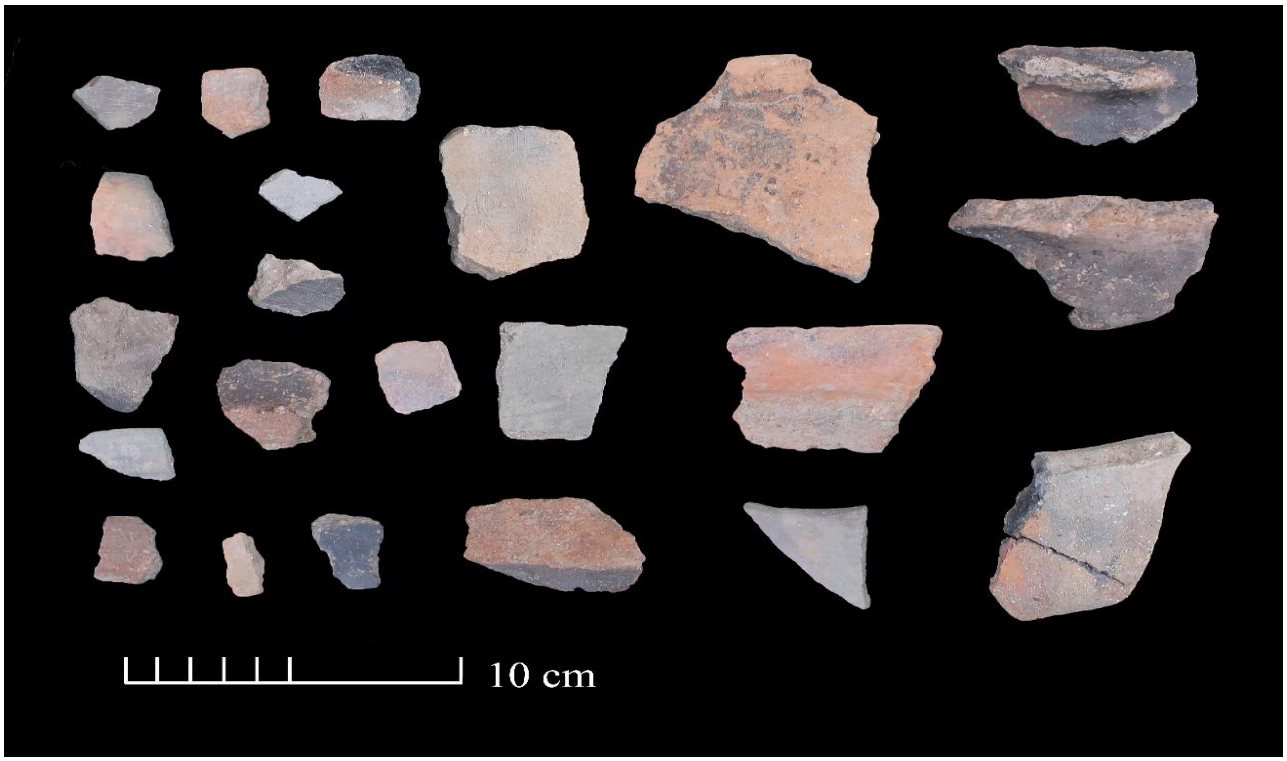

*Fig.16 Bronze Age Nuragic sherds from the deepest layer of Area F **013**.*

2.3.3. Test Trench 3 and Area F finds

TT3 produced 1,935 ceramics weighing 33.67 kg, with 322 diagnostics (8.30 kg of the total). Additional finds included 6.06 kg of animal bone, 0.18 kg of shell, 5 lithics (0.80 kg), 2 pieces of plastic (0.01 kg), and 32 pieces of plaster (5.28 kg). The surface layer **000** contained 566 ceramics (13.38 kg), roughly matching the quantities of the ceramics observed from the survey. Context **000** contained ceramics from the Iron Age Nuragic through Roman Imperial periods, with the greatest number dating to the Phoenician phase (9th - 6th centuries BCE) slightly earlier than the most prominently represented Punic-Early Roman phase (6th - 1st centuries BCE) from the survey. Although no modern ceramics were found in this layer, there were two pieces of plastic. The largest quantity of finds came from context **001**: 1,023 ceramic sherds (169 diagnostics), 3.20 kg of faunal bone, 0.12 kg of shell, 2 lithics (0.03 kg), and 1.58 kg of plaster. This fill has a wide chronological range, with most ceramics dated between the Phoenician and Punic-Early Roman periods. The finds associated with the upper most wall, **003** and **004**, contained a much smaller number of ceramics (29 at 0.32 kg and 13 at 0.10 kg respectively), dated to the Punic-Early Roman period. The final context, **006**, produced 30 ceramics at 0.52 kg, with only 6 diagnostic sherds, 5 of which were Nuragic. Faunal remains appear throughout TT3 with the majority in **001** and the upper level of **002** at 71% of total bone weight and 88% of total shell weight combined (tab. 1). Shells are not present in the lower levels of the trench, but bone appears within each context, particularly in **003** where there were 0.67 kg of bone likely associated with the construction of the rough stone wall and its fill. The faunal remains in **004** and **006** are fewer in quantity and weight.

Area F produced 2,820 ceramics (approximately 38 kg), including 440 diagnostic ceramics (11 kg). 11.30 kg of animal bone were recovered, along with 0.27 kg of shell, 13 lithics (0.43 kg), and 0.24 kg of plaster. By far, the largest context for ceramic, bone, shell and stone was **001**, which produced 1,091 ceramic sherds (167 diagnostic), 4.35 kg of faunal bone, 0.13 kg of shell, 6 lithics (0.01 kg), and 0.01 kg of plaster. The faunal assemblages from the various contexts are relatively consistent in size, save for the large **001** context, which produced roughly 38% of the total bone weight (4.35 kg) and 47% of the shell weight (0.13 kg) (tab. 2). The remaining contexts were evenly distributed in terms of bone, as even our final context, 013, was still statistically relevant for the total bone weight produced by the trench (1.09 kg or 9.6% of the total trench). Shells were collected in **003**, **006** and **007**, but do not appear in any of the older contexts. The bone deposition is indicative of intentional fill using domestic trash, as noted in various layers in Trench E[28]. This is logical considering our hypothesis regarding the drain construction and subsequent fill. Layers **010** and **013** may also be ancient trash deposition.

2.3.4. TT3 and Area F Interpretation and Recommendations

There are several main takeaways from this trench. First, the presence of layers and architecture likely dating to the Late Bronze Age is significant since they represent the only evidence of a Nuragic village so far discovered at S'Urachi. This village is of local interest and more work on these levels would be welcomed enthusiastically by the community in San Vero Milis. Next, the presence of the drain shows a careful attention to water management at S'Urachi in antiquity. As the ditch in Area E has also indicated, the high water table and the changing course of the ancient stream were issues with which the inhabitants of the site contended. Likewise, water continues to be a concern today: the deepest levels of this trench were approximately 30 cm above the present water table, making the soil extremely muddy. A final point is that the surface collection from the survey point SU 15 Z 98.108 (at which TT3 is placed) contained primarily Punic/Early Roman materials but also some Nuragic pottery. The presence of this Nuragic material on the surface may be the result of the construction process of the ancient ditch that was excavated into the earlier layers to construct the drain. This explanation provides greater detail than what could have been made through the point-sampling alone and demonstrates how survey and excavation carried out in tandem can complement one another and reveal complex taphonomic processes.

[28] STIGLITZ *et al*. 2015: 201-202; VAN DOMMELEN *et al.* 2018: 145-148.

Area F and TT4	**Area F 000**	**Area F 001**	**Area F 003**	**Area F 005**	**Area F 006**	**Area F 007**	**Area F 008**	**Area F 010**	**Area F 011**	**Area F 013**	**TT4000**	**TT4001**	**TT4002**	**TT4003**	**TT4004**	**TT4005**	**TT4006**
Bos taurus	12	26	6	1	12	10	2	11	4	7		30	7			1	
Cervus elaphus	8	33	11		10		1	3	2	2	2	36			1		
Sus scrofa	1	21	17	2	12	3	2	13	7	13	1	45	9	1		1	
Caprine (total)	21	69	29	1	24	16	2	24	7	11		63	21		1	5	
Ovies aries	-2	-6	-4		-2			-2				-5					
Capra hircus		-1			-1							-3					
Canis familiaris								1									
Equus sp											1	1	3				
Aves		3			2							4	1				1
Osteichtes							1									3	
Vertebrae	7	36	11	2	12	4	1	8	7	21		26	10	2		4	
Ribs	8	72	38	3	28	21	11	13	6	7		71	45	1		6	1
Indeterminates	139	499	138	18	163	76	36	54	26	105	2	341	111		1	23	
Seashells	7	57	1	29	11	7											

Tab. 2 Faunal assemblage of Area F and TT4 (Damià Ramis).

2.4. Test Trench 4: Punic Habitation North of the Nuraghe

TT4 was placed north of the nuraghe with point SU 15 Z 96.106 as the southeast corner of the 2x2m trench[29]. From the perspective of our pedestrian survey, this collection point was of particular significance because it produced a large number of surface remains of the Punic-Early Roman period. Further, Lilliu conducted excavations north of the nuraghe in the 1940s, and based on the geo-rectified plan drawings of Enrique Días, our survey point intersected with the limits of these previous investigations[30]. The placement of the trench allowed us to investigate Lilliu's intervention, particularly the extent of his trenches and back dirt pile. We also chose this location in order to ascertain the depth and preservation of stratigraphy at this spot, which is closer to the nuraghe than TT3/F.

After removing the topsoil (**000**), we quickly encountered a loose deposit filled with ceramics that was consistent across the trench (**001**). We interpreted this as Lilliu's back dirt pile, since the loose soil and exceptional quantities of materials from the Punic-Early Roman period suggest that this dirt had been excavated and transported from a different location on site (perhaps from the excavations located just to the south). We did not find evidence of Lilliu's trench limits in this particular sondage and assume that TT4 was just north of the previous excavation limits, with his project's back dirt placed outside his excavation. Dirt piles from the excavations may account for some of the variations in elevation in this area north of the nuraghe observable in the microtopographical survey[31].

At the bottom of this thick layer of back dirt (**001**), the soil color changed from light brown to orange, though it remained loose (**002**). This layer appears to have been an ancient fill, with fewer ceramics than **001** and numerous small pieces of charcoal mixed into the matrix. We believe **002** was probably an ancient fill deposit,

[29] VAN DOMMELEN *et al.* 2018: 150.
[30] LILLIU 1949: 349-561.
[31] GOSNER, SMITH 2018: 4.

uniform across the trench with no distinctive features or architecture. Under this fill, we encountered the first evidence of a floor surface (**003**), a compact layer of clayey soil with frequent small pieces of decaying limestone, which are characteristic of Punic floor preparation[32].

Below this floor deposit (**003**), fill (**002**), and back dirt (**001**) were several phases of construction associated with the long-term occupation and modification of a Punic domestic structure. The original structure consisted of a substantial stone wall (**004**) constructed of medium-large basalt and sandstone blocks, running north-south along the eastern border of the trench (fig. 17). A remarkably preserved plaster floor (**009**) covered the rest of the trench and was clearly constructed in association with the wall. Because the plaster sloped toward the stone wall and a negative space was left between the two, it was clear that the wall had been covered with a mud plaster surface before abandonment. This floor also was modified at the time of construction with two small, round holes (c. 5 cm in diameter), the purpose of which eludes us. They may have been small post holes for some sort of interior architectural modification. After this initial phase of construction, the plaster floor was covered by a packed dirt floor ranging in thickness from 3 to 7 cm. This appears to have been added when parts of the plaster floor had begun to wear down in order to provide uniform surface. During the addition of this secondary floor, another architectural modification was added in the form of a small wall (**008**), partially visible in the trench's northwest corner.

Following these two initial stages of occupation, the structure was abandoned for a period of time. The mud plaster fell off the walls and other material accumulated on top of the floor surfaces forming an abandonment layer (**005**). Part of the principal wall (**004**) was robbed out at this time, as the abandonment layer covered portions of the southern half of the exposed wall. Following this period of disuse, the structure was modified with the addition of a new cut stone block (**007**), which formed a corner with an existing block of the original wall (**004**) (fig. 18). There was no formal floor visible on top of **005**, but in parts of the trench's southern and western sections, pieces of plaster and clay floor remained (**003**).

*Fig.17 Closing photos of Test Trench 4 showing the defined wall (**004**) and a plaster floor (**009**).*

[32] DOCTER 2019: 433-452.

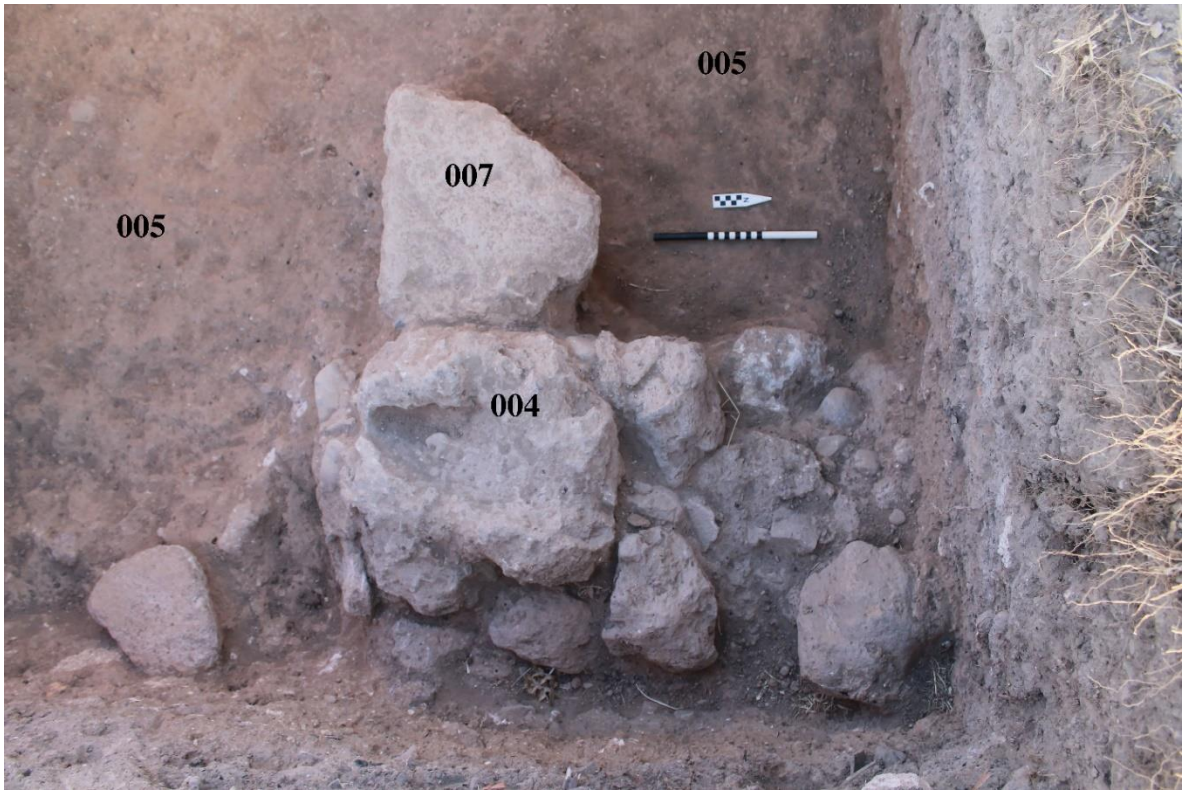

*Fig.18 Wall uncovered in Test Trench 4 with hard-packed dirt floor (**005**) surrounding a wall feature (**004**) and later wall modification (**007**).*

2.4.1. TT4 Finds

TT4 produced a very large quantity of ceramics (fig. 19). In total, 3,275 ceramics (approximately 63.40 kg) were recovered, 613 of which were diagnostic sherds (20.5 kg). The trench also produced 6.37 kg of faunal bone, 0.18 kg of shell, and 30 lithics (5.25 kg). Portions of the mud floor (**005**) were also collected for further analysis. The difference between the quantity of materials in TT3/Area F and TT4 is striking. TT4 produced nearly 60% more ceramics than Area F, but 60% less faunal bone. This is most likely a result of material from **001**, which probably represent Lilliu's back dirt from the excavations of the 1940's. This context produced 2,545 ceramics (47.50 kg), including 468 diagnostic sherds, all consistently dating to the 6th, 5th and 4th centuries BCE. Context **002** may have been an ancient refuse deposit, with 565 ceramics (12.40 kg) and 101 diagnostic ceramics of roughly uniform date. Context **003** has only 15 ceramic sherds, consistent with our interpretation of this layer as an ancient packed floor surface. 95% of the faunal bones from TT4 remains were discovered in **001** and **002** (4.95 and 1.10 kg respectively). The majority of shells (85%) were also recovered from these two contexts (0.09 kg in **001** and 0.07 kg in **002**) (tab. 2). Both of these numbers align with the interpretation of **001** and **002** as a back dirt pile without full collection of artifacts and a refuse deposit. The layers beneath **002** had fewer animal bone or shell remains since this was an indoor space with various phases of occupation. Interestingly, one of the few pieces of bone recovered from the abandonment layer (**005**) was a modified fish vertebra bead, an object associated more with domestic life than animal consumption and refuse. This situation is different from Area F, where each layer had a consistent amount of faunal bone and shell deposition.

2.4.2. TT4 Interpretation and Recommendations

We concluded excavating TT4 when we had fully exposed the plaster floor (**009**). Because this is the best-preserved floor in association with a wall found at S'Urachi to date, we left it intact until the structure can be explored further. This trench provides additional insight into the use and reuse of space north of the nuraghe. It revealed more about Lilliu's previous work at S'Urachi and how his excavations impacted the landscape. Secondly, this trench shows that despite previous archaeological interventions, the occupation layers below Lilliu's back dirt are intact. The construction, abandonment, and reuse phases of the domestic structure attest to

the later phases of occupation north of the nuraghe. Based on evidence from this trench and the upper levels of Area F, the likelihood of finding more intact occupation phases from the Punic and Roman periods in this area of S'Urachi is high. This hypothesis is further supported by the elevated number of finds from these periods recovered through survey. Further, that these later layers are preserved suggests that, if indeed a Nuragic village existed in this part of the site in the Bronze and Iron Ages, it will likely also be preserved or, at least, remains undisturbed by any modern interventions.

*Fig.19 Red painted pitcher from the fill (**001**), the best preserved of a very large quantity of Punic domestic pottery.*

3. Point-Sampling Survey Method: A Comparison of Above and Below Ground Assemblages

These excavation results allow for an assessment of the degree to which artifacts recovered through survey are representative of the material preserved below the surface, a question of broad relevance for the interpretation of point-sampling survey findings. We have compared the sum weight of ceramic within each test trench, divided by broad chronological period, with its associated survey collection unit to track overall similarities and divergences and to better understand the underlying taphonomic processes that produced them. To facilitate comparison between above and below ground materials, we use the same classification system that we employed for categorization of survey ceramics for the excavated ceramic finds from each trench. These are: Nuragic (Late Bronze Age-Iron Age, or 12th - 8th centuries BCE), Phoenician (9th - 6th centuries BCE), Punic-Early Roman (6th - 1st centuries BCE), and Imperial Roman (1st - 5th centuries BCE)[33].

Of course, many of the excavated ceramics can be dated more precisely than this because they are often better preserved than survey materials and come from stratified contexts. Ongoing work at S'Urachi is considering the excavated materials from our trenches from other angles[34]. For the purposes of comparison, we have

[33] GOSNER, SMITH 2018: 11-13.
[34] E.g., GOSNER *et al.* 2020 and MADRIGALI *et al*. 2020.

assigned excavated ceramics to the same broad categories as surveyed ceramics. It is also important to note that Phoenician material might be underrepresented in the survey[35]. Several factors are at play: the continuity of forms across the 1st millennium BCE could mean that some sherds were identified as Punic that were produced earlier. Additionally, locally-produced sherds found in fragmentary condition in survey are difficult to place chronologically, so some 9th - 6th century BCE materials may have been misidentified[36]. Phoenician materials have been easier to identify in excavated contexts, and these factors might have contributed to the divergences seen in the trench data presented below.

For TT1, the associated collection unit SU 15 Z 108.92 produced both Iron Age Nuragic material (0.26 kg) and material from the Punic-Early Roman period (0.67 kg), as well as ancient and modern construction material (fig. 20). While TT1 produced a small quantity of Punic-Early Roman material, the vast majority of the ceramics dated to the Iron Age and were categorized as Phoenician (0.45 kg) and Nuragic (2.82 kg). Modern construction materials were absent. The differences in representative chronological periods can be explained by the disturbance of deep plowing, which brought a large amount of later Punic-Early Roman material to the surface with only a small amount of the more prominent Nuragic finds. Further, the more detailed study of ceramic material from excavated contexts identified Iron Age Phoenician pottery, which could have been present in surface collections, but simply not recognized because of the similarity of ceramic form or fabric with that of Punic and Early Roman chronologies.

TT2 was located between two survey collection units, SU 15 Z 104.98 and 106.98, both of which produced few ceramics or construction material (fig. 21). Alongside the modern construction material, both collection units produced 0.06 kg of Punic-Early Roman ceramics respectively, which was the highest represented period within TT2 at 15.86 kg. The location of the test trench and collection units underneath the stream visible on the 1952 imagery helps to explain the lack of surface finds. The deep stratigraphy of both TT3 and Area F provided a greater chronological representation that was only partially apparent in the finds from survey in SU 15 Z 98.108 (fig. 22). The survey collection unit produced a large quantity of Punic-Early Roman (3.03 kg) and Nuragic sherds (0.11 kg) and some ancient construction material (1.23 kg), which appears to be representative of these ancient materials that were located close to the surface. Phoenician and Nuragic materials, which represent the majority of the finds within these trenches, are lacking in the survey unit finds, a result which can easily be explained by the intact and undisturbed nature of the stratigraphy in these trenches.

TT4 and its corresponding survey unit SU 15 Z 96.106 have finds similar in chronology above and below the surface (fig. 23). The most prominent survey finds from the Punic-Early Roman period (1.20 kg) are matched by the largest number of excavated finds of the same period (7.34 kg). The association of these finds with the back dirt of Lilliu's nearby excavation can explain their presence within the surface survey. Since TT4 contained intact stratigraphy beneath this fill, this accounts for the lack of Phoenician and Nuragic materials within the surface collection.

The finds from the survey collection and excavation clarify the relationship between the representation of chronological phases on the surface and the stratigraphy preserved below. For survey units that contain a greater chronological range of material in greater quantities, excavation has shown that this is, in large part, due to the disturbance of subsurface layers, making it less beneficial to conduct excavation in these areas. While these units may be helpful for identifying the chronological phases of occupation for the site, they are less fruitful for planning future excavation. However, for those survey units that have primarily later chronological phases represented, this may be an indication that earlier layers have been left intact. These units do not provide a complete picture of the chronological occupation of the site, but likely indicate more productive areas for future exploration.

[35] GOSNER, SMITH 2018: 15-16.

[36] The difficulty of assigning secure chronology to survey material is well known in the Mediterranean. Foxhall, for instance, has commented on the overrepresentation classical and late Roman material in Greek contexts because it is easier to see and identify than material from earlier and later periods (FOXHALL 2010: 251).

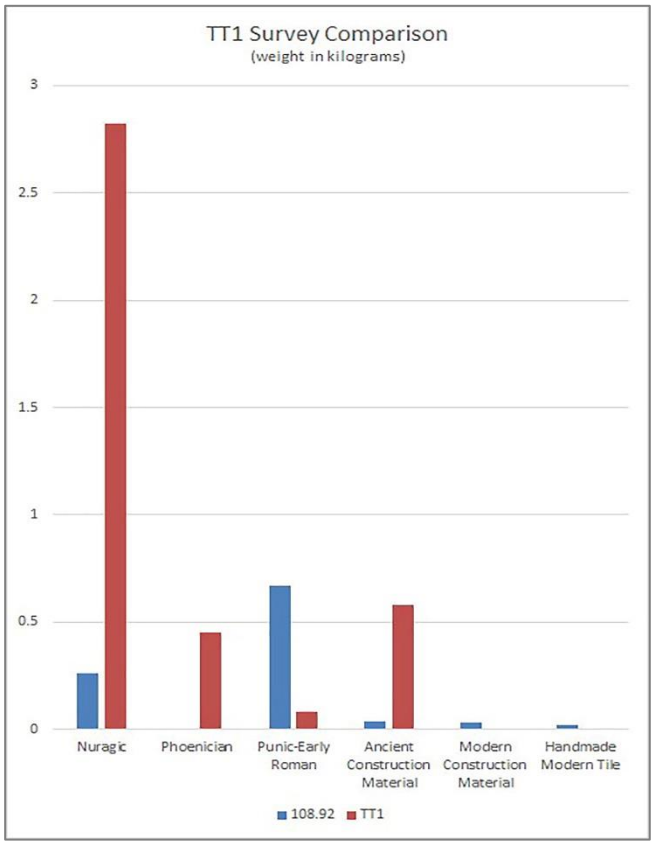

Fig.20 Comparison of finds chronologies between the surface collection at point 108.92 and Test Trench 1.

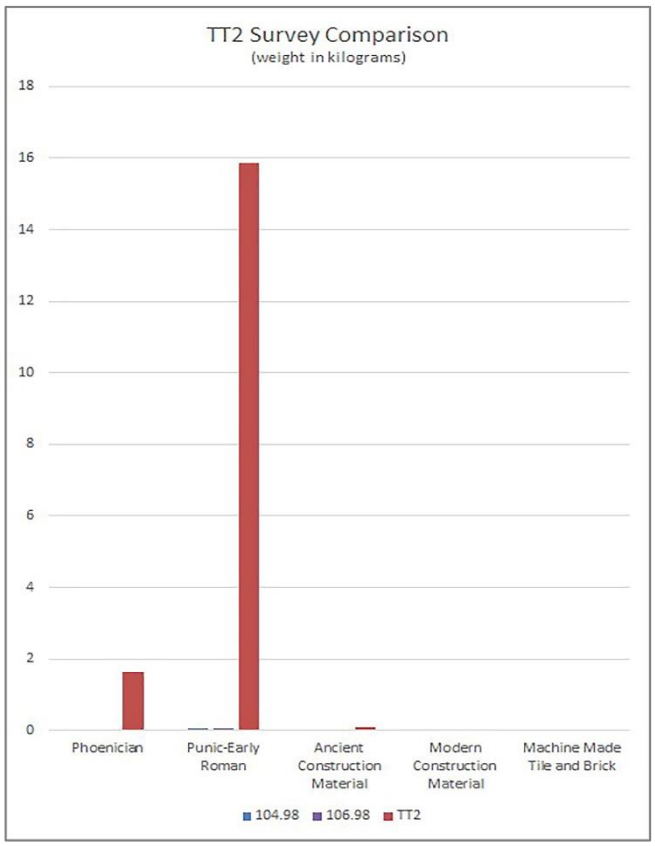

Fig.21 Comparison of finds chronologies between the surface collection at points 104.98 and 106.98 and Test Trench 2.

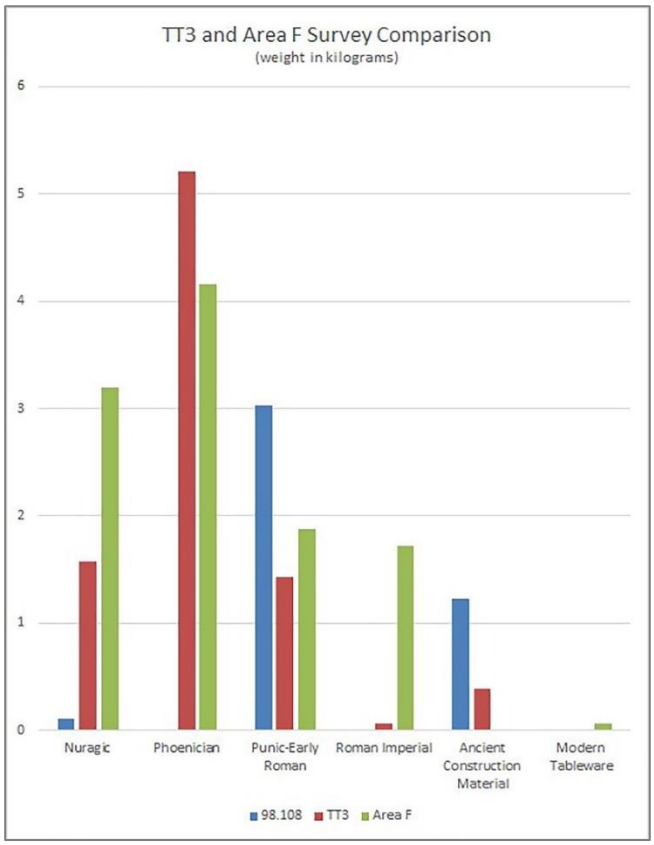

Fig.22 Comparison of finds chronologies between the surface collection at point 98.108 and the excavations of TT3 and Area F.

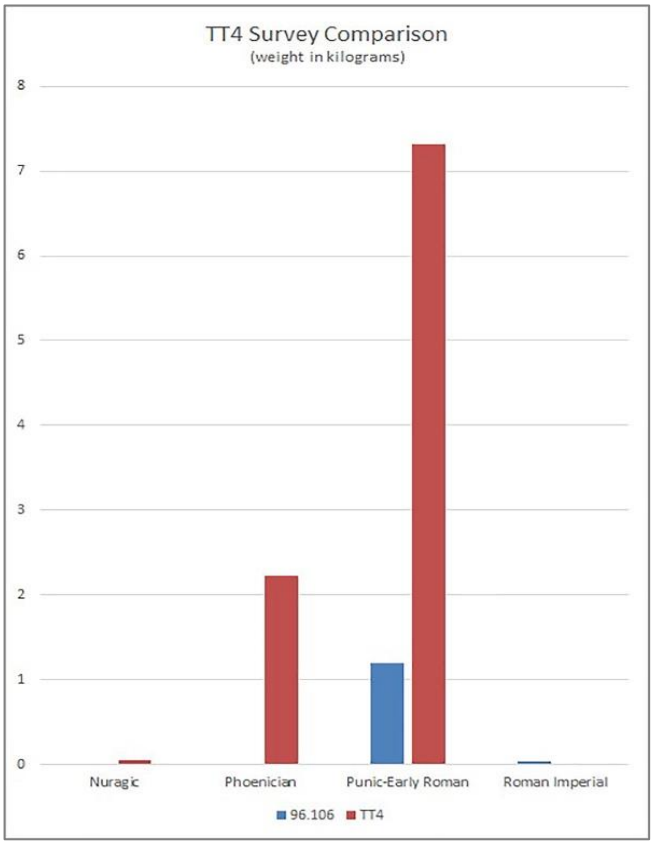

Fig.23 Comparison of finds chronologies between the surface collection at point 96.106 and the excavations of TT4.

4. Conclusions and Methodological Implications of the S'Urachi Site-Based Survey

4.1. Long-Term Habitation at S'Urachi

The combined results from both TT3/F and TT4 suggest that the area north of the nuraghe will be promising for investigation of domestic life at S'Urachi from the Bronze Age through the Roman period. Lilliu only excavated the Punic/Early Roman houses abutting or very close to the external wall of the nuraghe, leaving the majority of the land between the nuraghe and the modern road to the north untouched. Contemporary activities that have impacted the landscape in this area include trash disposal alongside the modern road and in several large mounds across the site's northern extent as well the use of the area as pasture. Because this area has not been plowed or excavated, the potential for preservation of multiple phases of settlement is high, and the results of both trenches support this. In particular, our discovery of a superficial stone wall with associated Punic and Roman materials in TT3 and the remarkably preserved plaster floor and wall in TT4 indicate that the later phases of settlement are much better preserved here than in Areas D and E. Likewise, the recovery of Nuragic ceramics dating to the Final Bronze Age and Iron Age in TT3/Area F as well as the deep basalt wall in TT3 suggest that it may be possible to uncover intact stratigraphy and structures from this early period of habitation at S'Urachi, perhaps contemporary with the tower itself. Given that early occupation phases are of keen interest to the community and to archaeologists focused on Nuragic Sardinia, further archaeological work here would be welcome. Based on the results of the 2015 site survey and these two test trenches, it is clear that a larger open excavation of this area is worthwhile. While both trenches produced a material from undisturbed stratigraphic levels, their small size made it difficult to fully understand the architecture that was uncovered and the patterns of deposition across the area. It will therefore be essential to excavate a much larger area, which will provide the opportunity to map structures that are uncovered and to better understand patterns of deposition. Following this recommendation, Progetto S'Urachi expanded Area F beginning in 2018 to a 20x20m open excavation. Future explorations building on the results of our test trenches in this area will help clarify questions about daily life at S'Urachi and long-term settlement and land use patterns from the Bronze Age to the present.

The site-based survey program, as a whole, can also be a lesson for work on Nuragic sites in Sardinia. Because of the remarkable preservation nuraghi and the focus of archaeological research questions concerning the use of these monumental structures, investigations of nuraghi have traditionally concentrated on study of the large-scale architectural remains, particularly the excavation and restoration of the interior of the towers for tourism purposes. Surveys have been much less common[37]. By contrast, our research program, including the surveys and the excavation of small test trenches, investigated the landscape beyond the immediate vicinity of the standing architectural remains of the monumental structure. This work has illuminated wider patterns of settlement and landscape use that were centered on - but physically distant from - the nuraghe and have provided a complement to work on the nuraghe and the S'Urachi excavations near the defensive towers. Additional work in this vein at other nuraghi will help archaeologists better contextualize their use and history.

4.2. Methodological Implications for Archaeological Survey

Beyond its practical function of informing the excavation plan at S'Urachi and providing a more expansive view of ancient settlement patterns surrounding the nuraghe, this site-based survey at S'Urachi also has wider methodological implications for archaeological survey at both site and regional scales of analysis. Although point-sampling has been carried out as part of regional and site-based survey methodology on other projects[38], the relationship of results produced using this technique and excavated contexts has not been thoroughly tested or ground-truthed. Our multi-phase survey provided an opportunity to test the quantitative and chronological relationship between surface finds collected using point-sampling and underground excavated contexts. Overall, there is a connection between the results of surface collection methodology and the likelihood of uncovering materials underground. This suggests that this method can be beneficial - especially combined with other methods such as geophysical survey - for the selection of new excavation areas at sites and for interpreting the distribution of artifacts in regional surveys that use point-sampling. Predictably, however, there is less of a link

[37] However, see notable survey work in Sardinia, in addition to that mentioned on p. 2: DYSON, ROLAND 1991, 1992; DYSON 2008; MURPHY *et al.* 2019; ROPPA, LEPPARD, MURPHY 2019.
[38] See discussion on page 2.

between the chronology of surface layers and the chronology of underground material and stratigraphy, particularly in areas where plowing has not taken place and deeper layers are preserved. Artifacts from the earlier contexts do not make it to the surface, so point-sampling cannot reliably determine the full chronology of occupation at each locale.

These results have implications for the interpretation of survey finds collected using point-sampling, whether they be from site-based or regional survey projects. Simply put, they suggest that the earliest phases of occupation will not be represented in the chronology of survey finds unless the site stratigraphy has already been disturbed. This possibility needs to be stated explicitly and considered in any interpretations of survey evidence. Nevertheless, the method has proven a useful methodology for certain landscapes, especially those that have never been plowed and for which traditional survey methodologies for collecting surface material were less effective. Although point-sampling is much more labor intensive and covers a reduced area as compared with other surface survey methods, it produces a much larger quantity of materials that can shed light on settlement patterns and landscape use under certain conditions.

This work on the survey of unplowed fields complements existing studies that consider the interpretation of surface sherds recovered from plowed agricultural fields, most notably the experimental work of Reynolds at Buster Ancient Farm and of Ammerman in Acconia (Calabria)[39]. The former study tracked sherd movement in plowsoil after yearly plowing episodes in the 1980s, showing that sherds moved about 2.04 m horizontally from their original positions after five years of cultivation. Reynolds suggests that modern plowing is less disruptive to surface artifact location than was ancient or medieval plowing, and results in artifacts being tossed back and forth but not moving too far from their original positions[40]. Ammerman's team tracked small tiles placed in fields between 1977 and 1983. They found that the ratio of surface and plow-zone material was 1:18 under normal conditions in fields without ground cover. This work had the significant implication that, even under the best conditions, a very small proportion of the overall material present in the plow-zone is ever visible on the surface[41]. Here, Reynolds' work on the vertical position of Iron Age sherds at the same site is also relevant. He suggests that plowing brings 16% ± 5% of the material evidence to the surface after each cultivation[42].

In the unplowed contexts at S'Urachi, these yearly agricultural disturbances from plowing and planting are absent and sherds are not churned up regularly. Because of this, the point-sampling method, which involves excavating down c. 10 cm below the surface, was a particularly useful way to gather enough material for chronological and quantitative analyses of survey materials. However, we observed multiple other formation processes - particularly trash deposition, the digging of irrigation channels, and previous excavation - that did impact the placement, condition, and visibility of survey finds. Archaeologists using point-sampling, therefore, should be attuned to how such processes have impacted ground surface and immediate subsurface. With this caveat, we suggest that this method is effective for study of unplowed or uncultivated landscapes, whether these are at the site or regional scale.

For site-based survey, our study indicates that the excavation of test trenches in conjunction with point-sampling can be used effectively to investigate the deeper layers that cannot be targeted in the survey. Because this site-based survey was designed in close discussion with the team carrying out open excavations through the Progetto S'Urachi, we were able to easily add test trenches to our research program and to study our materials in conjunction with the larger body of material found close to the nuraghe. While this kind of link between survey and excavation is not always practical, especially given permitting procedures in different countries, our initial results underscore the advantages of linking site-based survey with open-excavation strategies whenever possible.

Beyond the site level, this intensive method can also be integrated effectively with regional survey projects that encompass areas with unplowed or densely vegetated landscapes. Our future work will investigate strategies for doing so. We initiated a regional survey in 2018, the Sinis Archaeological Project, with an explicit goal of integrating these methodologies at multiple scales in a region that contains both agricultural fields and mountainous and coastal non-agricultural landscapes. Point-sampling allows us to target low-visibility sites for intensive study, as we have done at S'Urachi, but can also be used at a larger scale with units placed farther apart in areas of our survey region that have not been plowed or otherwise cleared, as has been done with point-

[39] For general summary, see: TAYLOR 2000.
[40] REYNOLDS 1998: 209-212.
[41] AMMERMAN 1985: 37-39.
[42] REYNOLDS 1998: 211.

sampling in other regional surveys[43]. We are also carrying out traditional Mediterranean-style pedestrian survey of plowed agricultural fields, walking in transects at 10 m spacing and collecting diagnostic ceramic and other artifacts. These small and intermediate scale survey methods are being integrated with larger-scale reconnaissance using an Unmanned Aerial Vehicle, satellite imagery, and, eventually, LiDAR[44]. Our work combining daily NDVI-satellite imagery and pedestrian survey has been published[45]. Future work will continue to address best practices for the integration of these methods at various scales. In the meantime, our point-sampling site-based survey at S'Urachi has proved effective for integration with excavation and as a means of providing detailed site data for integration with regional survey.

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