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INDICE

THE EARLY NURAGIC SETTLEMENT SYSTEM OF THE SIDDI PLATEAU, SOUTH-CENTRAL SARDINIA: RESULTS OF THE PRAN'E SIDDI LANDSCAPE PROJECT 2019 FIELD SEASON

EMILY HOLT, JUAN AGUILAR, DAVIDE SCHIRRU

Riassunto: Nel corso dell'estate 2019, il Pran'e Siddi Landscape Project (PSLP) ha impiegato metodologie di survey intensiva rivolta ai siti, così come di fotogrammetria mediante drone, ai fini dell'analisi del primo insediamento Nuragico dell'altopiano di Pranu 'e Siddi (Siddi, Sud Sardegna). Tale insediamento fu oggetto di analisi da parte di Giovanni Lilliu nel 1941, con l'obiettivo di definire una classificazione generale dei suoi sedici nuraghi e della sua tomba di giganti. Il PSLP ha proceduto ad una nuova survey della tomba di giganti e di otto dei sedici nuraghi: il progetto ha evidenziato come la tipologia proposta da Lilliu richieda una significativa revisione, tale da avere importanti implicazioni relativamente allo sviluppo della civiltà Nuragica nell'area di Siddi. Il presente contributo presenta la metodologia e i risultati derivanti dal Pran'e Siddi Landscape Project e propone una revisione della tipologia del Lilliu.
Parole chiave: cultura Nuragica, Marmilla, Siddi, sistemi d'insediamento, ricognizioni archeologiche di superficie

Abstract: During summer 2019, the Pran'e Siddi Landscape Project (PSLP) used intensive site examination and UAV-based photogrammetry to investigate an early Nuragic settlement system on the Siddi Plateau (Siddi, Sud Sardegna). The Siddi Plateau settlement system was previously documented by Giovanni Lilliu in 1941 with the goal of creating a general classification of its sixteen nuraghi and one giants' tomb. PSLP surveyed the giants' tomb and eight of the sixteen nuraghi with the goal of evaluating Lilliu's typology. PSLP found that Lilliu's typology requires significant revisions that may have implications for the development of the Nuragic culture in the Siddi area. This article presents the methodology and results of the Pran'e Siddi Landscape Project and proposes revisions to Lilliu's typology.
Keywords: Nuragic Culture, Marmilla, Siddi, settlement systems, survey archaeology

Introduction[1]

In the past several decades, local and regional archaeological surveys have expanded our understanding of settlement dynamics on the island of Sardinia. Beginning with a handful of surveys in the 1980s and 1990s[2], survey archaeology has increasingly been employed to document archaeological landscapes[3] as well as to elucidate site-specific settlement histories[4], identify larger patterns of changing landscape use[5],

1 We would like to gratefully acknowledge Mauro Perra for his advice and observations; Alessandro Usai for his comments on Nuragic architecture; Jack Thomas and Irene Torreggiani for their help in the field; the Comune di Siddi for encouraging and supporting our project; Sa Corona Arrùbia Consorzio Turistico della Marmilla for kindly granting us access to the monuments; Miami University for organizing the field school that made this research possible and the students of Miami University who aided in the data collection; and the Ministero per i Beni e le Attività Culturali, Direzione Generale Archeologia, Belle Arti e Paesaggio, and the Soprintendenza Archeologia, belle arti e paesaggio per la città metropolitana di Cagliari e le province di Oristano e Sud Sardegna for their permissions (protocollo 8824 del 15 Maggio 2019) as well as their many efforts in support of this work, especially Maura Vargiu and Francesca Candilio. The preparation of this manuscript has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 839517.

2 ROWLAND 1982; RICCI 1990; TRUMP 1990; DYSON, ROWLAND 1991; ROWLAND 1992; ANNIS *et alii* 1995; ANNIS *et alii* 1996; BOTTO *et alii* 2003.

3 CAMPUS 2008; COSSU, PERRA 2008; LEONELLI 2008.

4 GOSNER, SMITH 2018.

5 VAN DOMMELEN 1998; VAN DE VELDE 2001; MIENTJES *et alii* 2002; CICILLONI *et alii* 2016; CICILLONI *et alii* 2018; CABRAS 2018; MURPHY*et alii* 2019.

or both[6]. Surveys on Sardinia have employed both extensive and intensive methodologies and include studies that focus primarily on structural remains[7] as well as studies that employ fieldwalking techniques and systematic alternatives to traditional fieldwalking[8]. Sardinian surveys have focused on a range of time periods, and intensive surveys generally seek to document evidence from all periods; however, due to understandable factors of research interest and the identifiability of diagnostic materials, the Punic and Roman periods on Sardinia have been documented in more detail than earlier or later periods.
The Pran'e Siddi Landscape Project (PSLP) is a new archaeological survey that aims to combine site-focused and landscape approaches to understand Bronze Age settlement patterns in the area of the Siddi Plateau in the Marmilla region of south-central Sardinia. The Siddi Plateau is the location of seventeen monumental structures built by Sardinia's Bronze Age Nuragic culture. The limited excavation that has taken place at some of these structures as well as some of their construction techniques indicate that they are likely to belong to the early development of the Nuragic culture. While early Nuragic sites have been excavated[9] and discussed as part of Nuragic landscapes[10], PSLP represents the first effort to study a specific early Nuragic settlement system in detail.

The early Nuragic culture

The Nuragic culture of Sardinia developed out of the village cultures of the Eneolithic (Eneolitico, c. 3500–2000 BCE) and Early Bronze Age (Bronzo Antico, c. 2000–1700 BCE), periods that have long been identified as times of social transition on Sardinia. The beginning of the Eneolithic saw the breakdown of the island-wide Ozieri culture, indicated by the development of more regional pottery styles. By the late Eneolithic, new settlements were being founded inland, away from the coastal locations of earlier Neolithic villages, and often in upland areas. The Monte Claro culture particularly is associated with the development of fortified villages on plateaus with restricted access[11]. At the same time, changes in visual representations, such as the appearance of figural statue-menhirs that appear to be armed, have been interpreted as indicating the development of a warrior ethos that privileged conflict and - probably - male over female status[12]. Some isotope studies of Neolithic and Eneolithic human remains have been interpreted as showing increasing differences in protein consumption between males and females that could support the hypothesis of growing inequality between the sexes[13].
The first nuraghi appear sometime during the Middle Bronze Age. More than three hundred of these early nuraghi been identified, which are referred to variously as corridor nuraghi, proto-nuraghi, and pseudo-nuraghi[14]. Different researchers have categorized these early structures in different ways. Lilliu considers both corridor nuraghi and proto-nuraghi to date to the same period but distinguishes proto-nuraghi as having oval plans and pseudo-tholos vaults[15]. Bernardini takes the opposite stance: he dates proto-nuraghi (his preferred term) to the phase between the Eneolithic and the Early Bronze Age, considering them to be the antecedents of the corridor nuraghe[16]. Manca Demurtas and Demurtas refer to all early nuraghi as proto-nuraghi, but subdivide them into five categories, three of which include corridors[17]. Ugas uses the

6 BOTTO *et alii* 2003; BOTTO 2011; FINOCCHI 2005; FINOCCHI 2007.
7 RICCI 1990; MIENTJES *et alii* 2002; CAMPUS 2008; COSSU, PERRA 2008; LEONELLI 2008; CABRAS 2018.
8 VAN DOMMELEN 1998; VAN DE VELDE 2001; FINOCCHI 2005; FINOCCHI 2007; BOTTO 2011; GOSNER, SMITH 2018; MURPHY*et alii* 2019.
9 UGAS, SABA 2015.
10 UGAS 1998.
11 MORAVETTI 1998.
12 LILLIU 2002: 224–232.
13 LAI *et alii* 2011; LAI 2015.
14 MORAVETTI 2017.
15 LILLIU 2002: 237.
16 BERNARDINI 2010: 24.
17 MANCA DEMURTAS, DEMURTAS 1992.

term archaic nuraghe or protonuraghe and classifies them in terms of increasing complexity, taken as a broad indicator of their chronology[18]. Moravetti, while acknowledging the ample typological variability of early nuraghi, refers to them as protonuraghi[19]. Webster refers to all early nuraghi as corridor nuraghi[20].

While there is no consensus on how to categorize early nuraghi, the finds from those that have been excavated indicate that they were principally domestic structures. In addition, most archaeologists agree that their appearance in the landscape is evidence of the development or perhaps the codification of a type of social hierarchy that depended to at least some degree on inherited rather than ascribed status[21]. Not all scholars agree with this interpretation, however[22]. The social mechanisms by which this change came about are also debated. Some scholars emphasize the role that agricultural production and the control of plow animals may have played in allowing particular individuals or groups to establish a privileged position[23], a hypothesis that may be supported by the older ages of cattle in Eneolithic faunal assemblages and isotope analysis which suggests a more heavily plant-based diet than in the preceding Ozieri period[24]. The production of metals and the acquisition of metal prestige objects is also considered as a possible method of justifying the growing power imbalance[25]. This hypothesis may find support in the settlement patterns of the Eneolithic, with settlements being established closer to ore-bearing regions over time[26].

However, the relevance of Eneolithic social structures to the development of Nuragic social structures during the Middle Bronze Age is debated. While some scholars see continuity between the Monte Claro culture of the late Eneolithic and the Nuragic culture[27], many identify the Early Bronze Age as a period of serious social disruption, indicated by the disappearance of the relatively large Monte Claro settlements and the fact that the majority of the Early Bronze Age evidence comes from funerary contexts[28]. Perra has argued for an explicit symbolic rejection of earlier Eneolithic practices by Nuragic communities[29]. Whether the drivers of social inequality and intergroup conflict were continuous from the Eneolithic or specific to the social disruptions of the Early Bronze Age, they are likely to have been major influences on the appearance of early nuraghi, their layout and development, and their placement in the landscape.

The Siddi Plateau

The Siddi Plateau is a small, steep, irregularly-shaped plateau with a total area of about 5 km^2 located in the southern Sud Sardegna province of Sardinia in the area known as the Marmilla (Fig. 1, left). The Siddi Plateau consists of compact and vesiculated alkaline basalts deposited during the Plio-Pleistocene overlaying Miocene mudstones and sandstones[30]. It is similar in formation to other plateaus in the area, including the larger and better-known Gesturi Plateau, located to the northeast, and the Pranu Mannu-Pranu Picciu plateaus located to the west-southwest. The Marmilla basalt provided ample resources for the construction of monumental structures on the Siddi Plateau and the other surrounding plateaus.

Sixteen nuraghi are more or less evenly spaced around the circumference of the Siddi Plateau, and the well-known giants' tomb Sa Domu 'e s'Orku is found in the center-north part of the plateau (Fig 1, right).

18 UGAS 2005: 70–78.
19 MORAVETTI 2017: 27.
20 WEBSTER 2016: 47.
21 BERNARDINI 2010: 24–26.
22 WEBSTER 1996.
23 BERNARDINI 2010: 24–25; LEWTHWAITE 1986; LILLIU 1988a.
24 MELIS 2009: 93.
25 BERNARDINI 2010: 24–25; LILLIU 1988a.
26 MELIS 2009: 93.
27 DEPALMAS, DEIANA 2011.
28 MORAVETTI 2009; PERRA 1997; WEBSTER 1996.
29 PERRA 1997: 53.
30 BARCA *et alii* 2000.

The first appearance of this settlement system in the literature is a publication of Giovanni Lilliu in 1941[31]. Since this foundational work, there have been brief mentions of the monuments of the Siddi Plateau in other publications[32], and Cuccuru Bingias, Molas, Genna Maiu A, Genna Maiu B, and Corruardu have recently been studied as part of a three-year survey project[33] leading to an undergraduate thesis[34] and a doctoral dissertation[35]. However, the primary appearances of the monuments of the Siddi Plateau have been in regional catalogs of archaeological sites[36] (Table 1). The aim of these catalogs is simply to classify the sites, and the names of the individual monuments are not always given, making it difficult to assess the accuracy of their classification. The later catalogs draw heavily from the earlier catalogs, and often the information is simply repeated. However, there are a few instances in which the classifications contradict each other: these cases are highlighted.

In addition to the references in the literature cited above, there have been several projects of excavation and restoration that have involved some of the monuments on the plateau: excavations and restoration at Sa Fogaia (1993–1994, 2003–2004) and Sa Domu ‘e s’Orku (1990), and excavations at Sa Conca 'e sa Cresia (2009–2011). However, apart from some brief reports and mentions[37], these excavations remain largely unpublished.

Lilliu 1941

The principal work on the Siddi Plateau to date has been Giovanni Lilliu’s foundational 1941 article. The objective of this preliminary study was to document and describe the monuments of the plateau and put them into a general classification system while also providing general remarks on the locational properties of Nuragic sites. Lilliu was inspired in this research by the work of Antonio Taramelli and Filippo Nissardi, who conducted a similar study and inventory of the monuments on the Gesturi Plateau, and by the fact that the Siddi Plateau was almost unknown to archaeologists at the time[38]. Lilliu describes his research as being conducted in the course of several days (“diverse giornate”) in July 1939 in the company of his brother and a scholar from Baressa[39].

Lilliu provides classifications of the Siddi Plateau structures both in terms of their architectural features[40] and the types of their construction[41]; the present article is most concerned with his architectural classifications. Lilliu divides these into two main types, elliptical structures and circular structures, and further subdivides circular structures into three sub-categories. The descriptions he gives for the categories are:

Elliptical type (Tipo ellittico): elongated curtain wall with two convexities in the short sides corresponding to towers not attached to the intermediate environment, and small chambers in the thicknesses of the walls.

Simple circular (Tipo circolare semplice): one tower containing one room with niches on the sides, a guard room off the entryway, in some cases a staircase to a terrace and a supporting buttress with a corridor in it.

Paired circular (Tipo circolare binato): one tower containing one room, with a semicircular courtyard in front of the tower’s entrance.

Polylobate circular (Tipo circolare polilobato): four corner towers connected by rectilinear bastions surrounding a central tower.

31 LILLIU 1941.

32 LILLIU 1988b: 355–357; COSSU, PERRA 2008: 126-127; SANTONI 2009: 118-119; VAN DOMMELEN 1998.

33 CICILLONI *et alii* 2016.

34 CONCU 2016.

35 CABRAS 2018; UGAS 2005.

36 LILLIU 1975: 139-142, n. 22, 23; VAN DOMMELEN 1998: 94-95, 268-269; KRIEK 2020.

37 BADAS 2001; BALMUTH 1992: 687; SANTONI 2001b; SANTONI 2001a; VANZETTI *et alii* 2014: 95–96.

38 LILLIU 1941: 130.

39 LILLIU 1941: 130.

40 LILLIU 1941: 154–155.

41 LILLIU 1941: 155–157.

Monument	Name(s) in Lilliu 1941	Lilliu 1941	Lilliu 1975	Badas et al. 1988	Van Dommelen 1998	www.tharros.info 2020
Sa Conca 'e sa Cresia	Sa Conca sa Cresia, *Tuvixeddu*	Elliptical type	Complex	Complex	Complex	Complex
Su Sensu	Su Sensu	Elliptical type	Complex	Complex	Complex	Complex
Pranu Strintu	*Su Sensu B*	Elliptical type	Single tower	Complex	Complex	Complex
Cuccuru Bingias	Cuccuru Bingias	Paired circular	Single tower	Single tower	Single tower	Single tower
Molas	Molas	Simple circular	Single tower	Single tower	Single tower	Single tower
Genna Maiu B	No name given	Simple circular	Single tower	Single tower	Single tower	Complex
Genna Maiu A	No name given	Simple circular	Single tower	Single tower	Single tower	Single tower
Corruardu	*Corti Pardu*	No classification given	Single tower	Single tower	Single tower	Complex
Liccu	No name given	Simple circular	Single tower	Single tower	Single tower	Single tower
Corona Arrubia	*Carona Arrubia*	Paired circular	Single tower	Single tower	Single tower	Single tower
Su Concali	Su Concali	Polylobate circular	Complex	Complex	Complex	Complex
Pranu Casti	Pranu Casti	Simple circular	Complex	Single tower	Single tower	Single tower
Sa Fogaia	Sa Fogaia	Elliptical type	Complex	Complex	Complex	Complex
Sa Gruxi	*Tres Nuraxis A*	Paired circular	Complex	Single tower	Complex	Single tower
Su Pardu	*Tres Nuraxis B*	Simple circular	Single tower	Complex	Single tower	Complex
Sa Mammonaia	*Tres Nuraxis C*	Simple circular	Single tower	Single tower	Single tower	Single tower
Sa Domu 'e s'Orku	Domu S'Orcu	Coursed-stone monumental tomb without tumulus		Giants' tomb	Monumental communal tomb	Giants tomb

Table 1. Structural classifications of the monuments of the Siddi Plateau

Reading Lilliu's descriptions and classifications of the Siddi Plateau monuments gives the impression that he may have been simplifying the structures and exaggerating the regularity of their features, partially for the sake of fitting them into a classification system but probably also due to an understand able difficulty in documenting their forms more exactly, at least in such a brief study, and a complete inability to view the monuments from above. A comparison between aerial photography of Sa Domu 'e s'Orku (Fig 2) and Lilliu's drawing of the structure (p 137, Fig 7) shows Lilliu's exaggeration of the rectilinearity and circularity of the structure's components. The chamber is shown as rectangular and the forecourt as nearly semi-circular, suggesting that this tendency may also have affected Lilliu's pre-

sentation of the other monuments on the plateau. This tendency to simplify for the sake of classification may obscure important details and differences among the structures, making it difficult to use Lilliu's study as a basis for current research despite its foundational status.

The Pran'e Siddi Landscape Project

The Pran'e Siddi Landscape Project was founded to undertake a detailed study of the early Nuragic settlement system of the Siddi Plateau. The project will include three phases of research: first, photogrammetric documentation and architectural study of the known sites on the plateau and a reassessment of Lilliu's original descriptions and classifications; second, intensive survey around each of the sites to refine our understanding of their occupation history; third, a systematic survey of a stratified random sample of terrain types in a 7.5 km radius around the plateau to better understand changing patterns of landscape use relating to the Siddi Plateau settlement system. The results reported here represent the first half of the first phase of PSLP's research.

Between June 3 and July 12, 2019, the Pran'e Siddi Landscape Project undertook to conduct a new assessment of the Nuragic monuments of the Siddi Plateau settlement system, understanding and recording the structures in their current state and assessing their descriptions in Lilliu's 1941 publication. More specifically, the project set out to do the following:

1) Examine the collapsed structures intensively to understand their original forms and building episodes as accurately as possible.
2) Document the current state of the structures in detail using UAV-based photogrammetry.
3) Evaluate Lilliu's original classificatory scheme as a means of understanding the spatial and chronological relationships among the structures on the plateau.
4) If necessary, propose an alternative classificatory system that may prove more flexible and useful for grounding future research.

Project methods

The methods of the 2019 season of the Pran'e Siddi Landscape Project had two components. First, we conducted an intensive ground survey of the monuments on the plateau to understand their original forms and construction methods. The team used close examination of the collapsed structures to identify their original forms and number of building episodes, factors not systematically considered by Lilliu and earlier classification schemes. Team members noted the locations, directions, and articulations of visible walls, evidence of shaped blocks within the structures, and the presence of additional shaped stone elements in the vicinity of the structures to make inferences about their construction and development over time.

The second component of our methodology was to document the sites using an Unmanned Aerial Vehicle (UAV) equipped with a photo camera. Additionally, a Global Navigation Satellite System (GNSS) survey kit was used to measure Ground Control Points (GCP) at each documented site. The combination of these two procedures allowed us to generate georeferenced 3D models through digital photogrammetry. Digital Elevation Models (DEMs) derived from these 3D models can then be used in GIS-based applications.

Our project used a DJI Inspire 2 with 4 pairs of batteries allowing a total flight time over 80 minutes and with an X5S camera taking photographs at a resolution of 5272 x 3948 pixels and in RAW format. We were able to document at least two sites a day, or more if the sites were close together, running one flight in the morning and one in the afternoon. The GCPs were measured with an Emlid Reach RS+ Global Navigation Satellite System (GNSS) kit, with the base unit mounted on a tripod, the rover unit on a survey pole. All coordinates were captured in the WGS84 standard (EPSG: 4326) and later, during the data processing phase, converted to the Universal Transverse Mercator (UTM) system (UTM zone 32N, EPSG: 32632) to have all maps displaying meters as the basic unit of measurement. Prior to the data collection phase, all sites were studied in Google Earth to plan each survey according to the site's accessibility and archaeological importance. Unfortunately, due to the time constraints of the UAV team, it was impossible to photogrammetrically document all the structures during the 2019 season.

The data acquisition process started with placing 4 to 6 GCPs fast on the ground around the structure to

be documented, away from bushes and trees to guarantee full visibility from the air. The coordinates of the GCPs were then measured and, after repositioning the base unit by several meters, remeasured to detect possible GNSS reading errors. Depending on the time between the two measurements and the time of the day, the error could be up to 1 m, making all GCPs shift evenly and in one direction. Between 10:00 and 16:00, operating the GNSS kit became impossible because the ambient temperature passed 40° C, causing the device to overheat and have difficulties positioning itself. After measuring the coordinates of the GCPs, we flew the UAV over the site on a boustrophedon coverage path, once at an altitude of 25 meters above the ground in the direct vicinity of the Nuragic structure, once at 65 meters over the larger site area. Both flight altitudes were chosen to later have a combination of high Level of Detail (LoD) in areas of special interest and sufficient environmental data to put the Nuragic structures in their individual topographic contexts. Unlike the GNSS kit, the UAV had no difficulties flying at ambient temperatures above 40° C; however, the iPad used to display the picture coming from the X5S camera did sometimes overheat, resulting in occasional transmission delays or a temporary shutter malfunction. Depending on these error factors, our second and third steps could be swapped as long as the GCPs were included in the photographs taken by the UAV.

In the data processing phase, all UTM coordinates and photographs for each site, 250 on average, were imported into Agisoft Metashape (Version 1.5.5 build 9097) and processed to create 3D dense point clouds in High quality. With the Interpolation parameter set to Disabled during the generation of the DEMs, we produced high resolution data in geoTIFF format for GIS applications.

A problem we encountered while conducting our research lay in describing the structures of the Siddi Plateau using the terms frequently encountered in the literature. Many of the structures on the plateau are what have variously been called proto-nuraghi, pseudo-nuraghi, and corridor nuraghi to distinguish them from nuraghi that include chambers roofed with a corbel vault, called tholos nuraghi. Nuraghi without corbel chambers are generally considered to be older than tholos nuraghe, and different methods of classifying them exist[42]. However, these methods tend to subdivide the structures in ways that are not readily comparable to tholos nuraghi, making it difficult to evaluate tholos and non-tholos nuraghi as parts of the same settlement systems. For example, the term 'simple nuraghe' is generally used to describe any nuraghe with only one tower containing corbel vaulted chambers, while 'complex nuraghe' is generally used for any nuraghe with more than one tower containing corbel vaulted chambers. However, nuraghi without corbel vaulted chambers are usually categorized using very particular architectural descriptions, which can have the effect of underrepresenting their size and/or complexity with respect to tholos nuraghi.

Ugas is an exception to this practice. His work on settlement patterns in the area of the Guspinese, as well as his first synthesis on early nuraghi, differentiates simple and complex 'protonuraghi' and suggests different functions for them, which he sees as corresponding to the different functions he hypothesizes for simple and complex tholos nuraghi[43]. An important example of a complex 'protonuraghe' in the literature is Su Mulinu in Villanovafranca (also located in the region of Marmilla), which was a multi-storeyed, multi-chambered monument since its first foundation[44]. Another example of a corridor nuraghe that is specifically referred to as being complex and having multiple building episodes is the nuraghe at the site of Tamuli in Macomer[45]. These examples are similar to the situation in the Siddi Plateau settlement system, where two of the structures that would traditionally be classified as 'protonuraghi' are the largest and most architecturally complex on the plateau. However, Foschi Nieddu and Paschina do not offer a classification scheme for complex corridor nuraghi such as the one at Tamuli, and while Ugas provides a comprehensive classificatory system that differentiates between simple and complex early nuraghi[46], his

42 MANCADEMURTAS, DEMURTAS 1992: 176.

43 UGAS 1998; UGAS 1999.

44 UGAS, SABA 2015.

45 FOSCHI NIEDDU, PASCHINA 2003.

46 UGAS 2005: 70–78.

system is highly subdivided and not readily applicable in our study area. Spanedda and Cámara Serrano offer a multivariate analysis method for grouping both early and later nuraghi using architectural features[47]; however, this method requires clear floor plans to apply and cannot be used effectively with collapsed structures.

For the purposes of the Pran'e Siddi Landscape Project, we are therefore proposing a new, more flexible classification system. We follow Perra[48] in rejecting the terms proto- and pseudo-nuraghi as teleological, implying that Nuragic builders already had the idea for tholos nuraghi in their minds but were unable to realize them. We also avoid the term archaic nuraghi because, although many non-tholos nuraghi for which dating material is available do predate the classic tholos nuraghi, some non-tholos nuraghi such as Albucciu in Arzachena are contemporary with tholos nuraghi[49]. Instead, we agree with Webster in using the term 'corridor nuraghe' for any nuraghe that includes corridors and non-corbel vaulted round, subround, or elliptical chambers[50]. The term 'tholos nuraghe' is used to describe any nuraghe that includes round chambers likely to be corbel vaulted. Because of the collapsed nature of the nuraghi on the plateau, the likelihood of a chamber being corbel vaulted had to be ascertained from the visible and accessible remains and was evaluated by two characteristics: 1) a very circular shape indicated by the UAV photography, and 2) the presence of features indicating an intramural staircase winding around the central chamber. The presence of stone 'mensole', which are taken to indicate that a parapet in stone or wood once surrounded the tops of the towers, may also be considered to suggest a tholos structure due to the fact that they are a common feature of tholos nuraghi. However, mensole are also known from corridor nuraghi, such as Albucciu in Arzachena[51], and so are not used here to argue for a tholos structure.

Many early nuraghi include chambers with construction techniques intermediate between those used to build corridors and small chambers and those used to build true tholos vaults. We therefore considered the possibility of identifying structures of this type while conducting our survey, which we have termed pseudo-tholos chambers. In other words, we use pseudo-tholos as an umbrella term, comprehensive of the variously shaped chambers normally found in early nuraghi. The term would include ample 'naviform' chambers as well as markedly subcircular ones, while excluding corridors (which can be found in similar shapes in 'classic' nuraghi) and the roughly circular chambers found in 'classic' nuraghi. Differentiating between pseudo-tholos chambers and classic tholos chambers presents a difficulty when the remains being evaluated are badly collapsed and the chambers cannot be entered. Evidence for large but subround stone-roofed chambers and non-standard construction techniques was therefore taken to indicate pseudo-tholos rather than tholos chambers.

In the classification system proposed here, architectural type (corridor, pseudo-tholos, tholos) and level of complexity (simple, complex) are considered separately. 'Simple' indicates a single building episode with stone-roofed chambers and 'complex' indicates multiple building episodes with stone-roofed chambers. It is therefore possible to have a complex corridor nuraghe as well as a complex tholos nuraghe. It is also possible to have a structure that includes more than one architectural type, for example, a corridor nuraghe that includes a pseudo-tholos chamber. Where multiple types of chambers are present in the same structure, an attempt is made to prioritize them based on building episode. In this scheme, a structure where corridors are present in the first building episode and a pseudo-tholos in a subsequent episode would be a complex corridor nuraghe with a pseudo-tholos (Sa Fogaia), whereas a structure with pseudo-tholos chambers in the first building episode and corridors in a subsequent episode would be a complex pseudo-tholos nuraghe with corridors (Sa Conca sa Cresia). Additional architectural elements that do not include stone-roofed structures - here courtyards, platforms, refacing walls, and walkways - are noted separately. The goal of this classification scheme is to reflect accurately the size of the structures and the

47 SPANEDDA, CÁMARA SERRANO 2012.

48 PERRA 1997: 54.

49 FERRARESE CERUTI 1962: 201; RUJU, FERRARESE CERUTI 1992: 56.

50 WEBSTER 2016: 47.

51 FERRARESE CERUTI 1962: 182–183, 197.

Site	Minimum number of building episodes	Structure type as determined by the Pran'eSiddi Landscape Project	Methods
Sa Conca 'e sa Cresia	3	Complex pseudo-tholos nuraghe with corridors, includes platforms and a courtyard	ground survey, UAV-based photogrammetry
Su Sensu	1	Simple corridor nuraghe	ground survey
Pranu Strintu	1	Simple corridor nuraghe	ground survey, UAV-based photogrammetry
Molas	2	Simple pseudo-tholos nuraghe, includes a refacing wall with a walled entryway	ground survey, UAV-based photogrammetry
Su Concali	2	Complex pseudo-tholos or tholos nuraghe	ground survey, UAV-based photogrammetry
Sa Fogaia	5	Complex corridor nuraghe with pseudo-tholos, includes platforms and a courtyard	ground survey, UAV-based photogrammetry
Sa Gruxi	2	Simple pseudo-tholos nuraghe, includes a courtyard	ground survey, UAV-based photogrammetry
Sa Mammonaia	1	Simple corridor nuraghe	ground survey, UAV-based photogrammetry
Sa Domu 'e s'Orku	3	Coursed-stone giants' tomb with side niche	ground survey, UAV-based photogrammetry

Table 2. Results of the Pran'e Siddi Landscape Project 2019 field season

comparative effort that went into producing them while providing an at-a-glance understanding of the remains present.

Results

The 2019 season of the Pran'e Siddi Landscape Project was able to complete intensive ground examination of eight of the sixteen nuraghi on the plateau as well as the giants' tomb; UAV-based photogrammetry was conducted at seven of the eight nuraghi and the giants' tomb. The results are summarized (Table 2) and discussed below.

Sa Conca sa Cresia

Sa Conca 'e sa Cresia is also called Conca Sa Cresia by Lilliu (1941), who records the additional name Tuvixeddu for it[52], a name that one of the authors has occasionally heard used by acquaintances in Siddi. Lilliu classifies Sa Conca 'e sa Cresia as an elliptical structure, perhaps linking it conceptually to corridor nuraghi structures such as Brunku Madugui on the Gesturi Plateau. More than 'elliptical', however, we found Sa Conca 'e sa Cresia to be irregular, with multiple construction episodes (Fig 3, left). It is possible to distinguish two towers at the heart of the structure: an east tower with a false-tholos construction and a southwest tower whose construction could not be determined. To the north of these towers are the remains of what was probably a platform. The pattern of collapse here suggests that the platform may have contained corridors and/or chambers.

Further to the west, there are the remains of a small tower or large hut linked to the southwest tower by two walls, forming a small courtyard. From this courtyard, it is possible to trace the remains of a corridor

52 LILLIU 1941: 135.

that curves around the southwest side of the monument, leading to a naviform room to the south of the central tower. In addition to the entrance which originates in the courtyard, there is a second entrance at the east end of the room that leads to a corridor. Although it is difficult to reconstruct this corridor, it seems to lead parallel to the south side of the primary structure, toward what appears to be a platform. We did not see obvious evidence of corridors and/or chambers in this platform, but they may have existed, and it seems safe to assume that at least the corridor leading into it continued to either an internal chamber or an exit.

It is possible to organize these architectural features into at least three construction episodes: 1) the east and southwest towers, which appear to be part of a single construction episode, 2) the north platform that may have included corridors and/or chambers, and 3) a large complex of structures that includes the small tower or hut, the walls that link this hut to the north platform and to the naviform room, the naviform room itself, and the south platform that probably included corridors and/or chambers (Fig 3, right). It is possible that these three building episodes were separated by substantial periods of time, and that the structure grew slowly, in a sequence at least partially comparable with Su Mulinu, where circular towers and huts were added to the original "protonuraghe," arranged around a courtyard[53]. Six sequential radiocarbon dates from the east side of Sa Conca sa Cresia's naviform room, performed on carbonized grain seeds excavated by Progetto Pran'e Siddi, show a range of dates beginning around 1750 cal BCE and lasting until around 1480 cal BCE[54]. While the earliest radiocarbon dates are from the lowest layers of the excavation, below the walls, and may predate the construction of the naviform room, a connection with the very first frequentation phases of the site cannot be categorically excluded. While speculative at the moment, such a possibility would suggest the dating of the first construction episode to the mid-18th century BCE, and a Nuragic occupation at the site lasting for at least around 300 years.

Whether the three construction episodes occurred close together or spread out in time, our survey results in conjunction with the radiocarbon dates indicate that the Nuragic inhabitants of the Siddi Plateau were fully capable of constructing large, complex monuments with embryonic tholos chambers from the earliest beginnings of their culture.

Su Sensu

Lilliu describes Su Sensu as having a rectangular plan with long straight sides, rounded ends, and a likely chamber or chambers; he notes that one can only follow the structure in outline and that excavation would be required to know more[55]. More recently, Cabras has interpreted the nuraghe as a complex structure, based on the interpretation of satellite imagery[56]. Although we were not able to apply UAV-based photogrammetry to Su Sensu, our ground examination confirmed Lilliu's description. The nuraghe is a subrectangular shape, its long axis oriented slightly east of north following the contours of the plateau, which is very narrow at this point. We were able to trace the long, rectilinear walls on both sides, with the wall on the northwest side incorporating the natural outcroppings of the rock. The south end of the structure was difficult to distinguish due to its collapsed state and the thick overgrowth covering it, but the north end containing the remains of a large room or possible tower could be traced. The rest of the structure appears to have been a platform, perhaps including corridors, but this is impossible to determine without excavation. It is likely that the structure was built in a single construction episode, or in two at the most.

Lilliu classifies Su Sensu as an elliptical type nuraghe, the same category in which he places Sa Conca 'e sa Cresia. The comparison between these two monuments can serve as an example of how misleading Lilliu's classification scheme can sometimes be. Su Sensu is one of the smallest and simplest structures on the plateau, while Sa Conca 'e sa Cresia is one of the largest and most complex. Placing them in the same category obfuscates the very different significance of the structures in terms of the investment of

53 UGAS, SABA 2015: 98 and following.

54 VANZETTI *et alii* 2014: 95–96.

55 LILLIU 1941: 135.

56 CABRAS 2018.

labor and materials it took to build them, the number of people likely to have inhabited or frequented the sites, and therefore their social, economic, and political meanings.

Pranu Strintu

Pranu Strintu was called Su Sensu B by Lilliu because there was no name for it on the map he was using and he could not find a local name for it[57]. A 1981 map given to the one of the authors by the local tourist consortium Corona Arrubia lists Pranu Strintu as the name of the nuraghe[58]. The 1968 Istituto Geografico Militare Carta d'Italia alla Scala di 1:25.000 and the 2006 Piano Paesaggistico Regionale both give Pranu Strintu as the name for this area of the Siddi Plateau without indicating the presence of a nuraghe[59].

Pranu Strintu is indeed similar to Su Sensu as far as can be understood from its current state, which is extremely collapsed (Fig 4). Additionally, there are many piles of stacked stones surrounding Pranu Strintu, suggesting that the collapse from the structure was later reorganized, further complicating interpretation. Lilliu notes the similarity in construction between Pranu Strintu and Su Sensu, («ripete la planimetria della precedente, avanzata in un lato lungo rettilineo») as well as the large amount of collapse around the structure («Un gran crollo è al suo piede, confuso con la rovina dei blocchi naturali cui sembra intimamente connaturata la base della fabbrica»)[60], and like Su Sensu, Lilliu classified Pranu Strintu as an elliptical type.

Neither ground survey nor UAV-based photogrammetry allowed us to add to Lilliu's description. We found the structure to be as described: a corridor nuraghe that probably originally included at least one room. It could have been built in a single construction episode.

Molas

Lilliu provides an extremely brief description of Molas, comparing it to Cuccuru Bingias and calling it a simple tower with a room full of collapse («una torre semplice…con una camera ripiena»)[61]; he classifies it as a simple circular nuraghe.

Our project was able to add somewhat to this description. Molas is a single tower structure. UAV-based photogrammetry shows the structure to be extremely though not perfectly round in plan (Fig 5, left); the circular shape is matched by the remnants of the chamber's interior wall, visible in both the southern and north-western sectors of the tower.

We found a visible architrave on the south side of the structure, which is followed by an entrance corridor. This is indicated by the presence of its upper slabs covering a space now mostly filled with collapse. On the left side of this corridor, an intramural staircase can be found. Most of the interior chamber is filled with collapse, with the exception of its north-western sector, where we found a niche (probably emptied by looting activity). The niche entrance terminates with an architrave, and part of its interior seems to extend under the intramural staircase.

We were also able to identify a refacing wall built around the structure. The remains of the refacing wall are clearly visible from the north to the southeast. Additional structures can be found in front of the tower's entrance, where at least one clearly recognizable wall is stacked against the circular tower. However, this wall probably represents a much later reuse phase of the site, given its unclear functional relation with the entrance and its construction technique; at the same time, the construction of this wall could have taken advantage of a preexisting - and now mostly collapsed - platform, traces of which may be constituted by courses of stacked stones found under the later wall.

While we were able to confirm Lilliu's interpretation of Molas as a simple tholos nuraghe, it is also clear

57 LILLIU 1941: 136.

58 TUVERI 1981.

59 Istituto Geografico Militare, Ussaramanna 217 II SE, Carta d'Italia alla Scala di 1:25 000, Series M 891, 1968; Regione Autonoma della Sardegna, Provincia di Medio-Campidano. Provincia di Oristano. 539, Scala di 1:50.000, 2006.

60 LILLIU 1941: 136.

61 LILLIU 1941: 140.

that Molas was created in at least two distinct Nuragic building episodes (Fig 5, right), with a third Nuragic building episode possible but not likely, as it could simply have been a platform constructed as part of the refacing activity.

Su Concali

Su Concali is the only nuraghe on the Siddi Plateau that Lilliu identifies as a polylobate circular structure. He considers Su Concali to be of primary defensive importance because the gentler hills sloping toward the south provide easier access to the plateau than is possible at some other points, such as the extremely steep cliffs at Corona Arrubia. Lilliu attributes Su Concali's size and complexity to its defensive function («La sua importanza di posizione e di funzione spiega la complessa planimetria») and describes it as having four towers around a central bastion (see p 143 Fig 12)[62].

Our project was able to identify only the central tower and two additional towers, the east and north towers (Fig 6), Lilliu's towers D and C[63]. It is perhaps possible that the west tower (Lilliu's tower B) is present, but intense vegetation made it impossible to identify. If this is the case, the west tower is quite small and located much closer to the north tower than the north tower is to the east tower. We found no evidence of a south tower, whose presence Lilliu assumed, probably due to the perceived regularity of the structure.While a west tower could not be identified, the area indicated by Lilliu does show the presence of some wall remnants. When observed from the aerial images, these remnants appear to be connected to the central part of the building, possibly forming an elliptical platform with them. This platform - instead of the simple tower identified by Lilliu - may have been the original core of the monument, to which the east and north towers were later added.

Our ground examination did not bear out Lilliu's hypothesis of a very regular reconstruction. We were able to trace only two towers and the elliptical platform or possible central bastion with confidence, and we were unable to find sufficient evidence to assume either the west or south tower. Our conclusion is that it is more likely that Su Concali was always an elliptical platform with two added towers or possibly a central bastion with two flanking towers that may have been part of a larger platform built to encircle the central bastion. We conclude that Su Concali would have been built in a minimum of two construction episodes: the elliptical platform/central bastion in the first episode and the surrounding towers and possible platform in a second episode.

It is difficult to tell from the state of the collapse whether the circular tower structures of Su Concali are pseudo-tholos or tholos vaults. Their regular, round shapes - as well as their recto-curvilinear arrangement, typical of 'classical' nuraghi - suggest tholos structures. Their external diameters are 7.7 m (east tower) and 6.7 m (north tower), and on the east tower it was also possible to measure an internal diameter of 4.5 m. These two external measurements and one internal measurement are within the averages for tholos chambers when we take into account that we are not measuring them at ground level: in a sample of 25 nuraghi, Lilliu gives the average external diameter of tholos towers as 11.24 m with the average internal diameter of the tholos chamber as 4.08 m[64]. The ratio between the external and internal measurements for the east tower seems rather small for a classic tholos, however, particularly for a point midway up the tower. It is worth considering that these structures may have been neither pseudo-tholos nor tholos chambers and were perhaps roofed in perishable materials.

Sa Fogaia

Like the giants' tomb Sa Domu 'e s'Orku in the north of the plateau, Nuraghe Sa Fogaia is one of the Siddi Plateau's better known monuments. However, despite being much visited by school groups and tourists, Sa Fogaia's mentions in the scholarly literature are fairly brief[65].

62 LILLIU 1941: 143.

63 LILLIU 1941: 143, fig. 12.

64 LILLIU 2005: 64.

65 LILLIU 1941: 145–146; SANTONI 2001b; SANTONI 2001a.

Sa Fogaia, like Sa Conca 'e sa Cresia, is a case where Lilliu's description and classification system do not provide an adequate understanding of the structure. His basic description of Sa Fogaia provides a reasonable starting point: he describes an undulating wall to the west, a rectilinear wall to the north, other rectilinear walls to the east, and a curvilinear part to the south that includes the remains of a tower that is not organically connected to the rest of the structure (Fig 7, left). Additionally, he identifies the main entrance as being in the southeast part of the courtyard, marked by a partially remaining vault. He does not attempt to describe the additional walls, rooms, and corridors inside the monument; these structures were substantially clarified by the excavation and reconstruction work that took place in the 1990s and early 2000s.

Brief publications of the results of the later excavations of Sa Fogaia are available[66] and include an excellent plan of the site that shows the full structure also captured by our aerial photography. Two chambers are indicated on this plan, c and d in the east arm of the structure[67], that are difficult to identify on the ground, making it a particularly useful resource.

Our project was able to complement the previous work done on Sa Fogaia by identifying and describing distinct construction episodes. The Nuragic structure was built in at least five construction episodes (Fig 7, right). The first two make up the heart of the structure and include the south and north arms that curve around to enclose the courtyard; these episodes were undoubtedly planned together and executed in rapid succession. The third and fourth episodes were probably also planned together and executed at roughly the same time. Episode 3 is a small addition to the southeast side of episode 1 and episode 4 is a construction opposite episode 3 that includes an entry leading into a room, articulating with a room in episode 1. The space between episode 3 and episode 4 creates a corridor that also articulates with a corridor in episode 1. It is entirely possible that episodes 1-4 were all planned and built in a short period of time.

We would also agree with Santoni[68] in identifying the main entrance to the courtyard as being a corridor located in the northeast of the monument, formed by the ends of the arms of building episodes 1 and 2. Santoni does not explicitly engage with Lilliu's previous interpretation; however, Lilliu identifies the primary entrance to the courtyard as a small opening in the southeast marked by the remains of an architrave, while on Santoni's plan this architrave marks the entrance to chamber c, which is hypothesized as a small circular room. We found that the current remains do suggest rounded walls; however, not enough of these walls are preserved to distinguish with confidence between a small chamber and a slightly irregular entrance corridor. It is probable, however, that more of the structure was standing when Santoni's plan was drawn.

A final building episode that may date to the Nuragic period, though later than episodes 1-2 and possibly later than episodes 3-4, is a refacing wall built onto the interior, east faces of episodes 1 and 2. Functionally, this fifth building episode creates a platform that contributes additional raised living and working space to the area provided by episode 1 and episode 2. It also deepens the entrances to the complex of small chambers and corridors in the ground level of episode 2 and to the stairway leading from the courtyard to the upper level of the structure in episode 1. The date of episode 5 may coincide with another, smaller intervention that filled the first steps of the episode 1 stairway with stacked stones (Fig 8). This change to the structure could be interpreted as limiting access to the upper level; however, if this was the motive, it is difficult to understand why the inhabitants left the entrance to the pseudo-tholos chamber, which also provides access to the upper level, open and free from obstacles. Defensively, it would have made more sense to limit access from the outside-facing door of the pseudo-tholos rather than from the courtyard, which was already protected by a large encircling wall. Perhaps the intention of this change was symbolic, meant to accentuate the difference between those who had access to the upper level and those who could only access the ground level.

66 SANTONI 2001b; SANTONI 2001a.

67 SANTONI 2001b: 103.

68 SANTONI 2001b.

The small structures in the courtyard and along the west wall of Sa Fogaia are thought to be late Punic in date[69].

Sa Gruxi

Lilliu identifies Sa Gruxi as the first of a group called Tres Nuraxis, which he claims are about 200 m from each other and were built to block the pass from Siddi to Gonnostramatza («a m. 200 circa di distanza reciproca, avvicinate con lo scopo di sbarrare la via da Siddi a Gonnostramatza»)[70]. While it is true that the distance between Sa Gruxi and Su Pardu, the second of the Tres Nuraxis group, is a little over 200 m, the distance from Su Pardu to Sa Mammonaia, the third structure in the group, is over 350 m. Lilliu provides few details of Sa Gruxi itself, describing it only as «una torre... con una celletta.... Gli si addossa, a sud, un cortile o contrafforte...»[71]. This brief description proved accurate, though Lilliu's drawing of Sa Gruxi (p 148 Fig 17) greatly exaggerates the circularity of its shape[72]. We were able to identify a main chamber, probably a pseudo-tholos based on its sub-round shape and the presence of large stones toward the top of the chamber where there is a visible opening, as well as a wall forming a courtyard that abuts the southwest face of the main structure (Fig 9). These structures indicate two separate building episodes.

Sa Mammonaia

Lilliu provides only a very short description of Sa Mammonaia, which he calls the simplest of the Tres Nuraxis monuments. He identifies few features of the structure, only that it preserves three rows of stones at its north end and a single course of stones incorporating the bedrock to the east that marks the rest of its outline («conserva ancora tre filari a nord…un filare nel resto del contorno incorporato, ad est, nello sbancamento roccioso delle lave»)[73].

We found Sa Mammonaia to fit Lilliu's description (Fig 10). The preservation of the site appears to be quite poor, similar to the limited preservation of Pranu Strintu. However, unlike at Pranu Strintu, Sa Mammonaia is not surrounded by a large amount of rubble, whether collapsed around the structure itself or organized near it in piles. There is a long, low wall about 50 m to the west of Sa Mammonaia, and it is possible that Sa Mammonaia was deconstructed to build this wall. An alternative possibility is that the nuraghe was begun but never finished. Usai discusses the occurrence of 'little nuraghi' in the Sinis, defined as single-tower nuraghi preserving only one to three rows of blocks but without obvious signs of deconstruction or collapse, as likely being related to failed attempts at expansion by Nuragic communities[74]; it is possible that Sa Mammonaia should be interpreted as such a failed expansion. Given the state of preservation of Sa Mammonaia, it is difficult to estimate the number of building episodes it represents. However, the current remains can be explained by a single episode.

Sa Domu 'e s'Orku

The giants' tomb Sa Domu 'e s'Orku is probably the best-known monument on the Siddi Plateau and is frequently visited by tourists. It is considered an excellent example of the coursed-stone type giants' tombs, which are more common in the southern part of Sardinia than the stele-style giants' tombs (Fig 11). Lilliu considers coursed-stone giants' tombs to be the first properly Nuragic giants' tombs («a struttura propriamente 'nuragica'»)[75], and other researchers have elaborated on this association[76].

69 SANTONI 2001a: 90–91.
70 LILLIU 1941: 146.
71 LILLIU1941: 147.
72 LILLIU 1941.
73 LILLIU 1941: 148.
74 USAI 2014: 38–39.
75 LILLIU 2002: 242.
76 BLAKE 1999; BLAKE 2001; DEPALMAS 2009: 139.

Sa Domu ‘e s’Orku is also one of the best-published monuments on the plateau, though the scholarly material on it is still limited. Lilliu mentions it in his later publications[77], though he mostly repeats his original description, and the excavations that took place there are briefly reported and referenced by a few publications[78]. Pottery dating to the Middle Bronze Age (16th century BCE) was found during the excavations, but no human remains and no later Nuragic material[79].
The description of Sa Domu ‘e s’Orku that Lilliu provides in his original 1941 article is one of the most detailed descriptions he gives of a monument on the Siddi Plateau, and it forms the basis for his later discussions of the structure. He focuses primarily on the measurements of the structure and the blocks that comprise it, noting the niche in the southwest wall (the left side as one enters). He also mentions a round, two-handled basin of porous black basalt found in the exedra near the door to the chamber, which he associates with ritual offerings[80]. We were unable to locate this basin, suggesting that it may have been moved during the course of the excavations and conservation work in the 1990s.
Though Lilliu could not have seen it, the clearance work and excavations of the 1990s revealed that Sa Domu ‘e s’Orku was built on «large basalt slabs placed to provide a level foundation» and that the chamber itself had a bed of carefully arranged basalt pebbles and marl[81]. This construction of the chamber floor is comparable to other excavated giants’ tombs in the area, particularly Tomb B at Sa Sedda ‘e sa Caudela in Collinas[82]. The preparation of a bed of basalt slabs, the construction of the tomb itself, and the finishing of a decorative floor brings the number of construction episodes at Sa Domu ‘e s’Orku to three, though they differ from the construction episodes at the nuraghi and should be interpreted with this in mind.

Discussion

Although our study of the monuments on the Siddi Plateau remains to be completed and we cannot yet provide detailed conclusions, the results of our 2019 field season provide additional insight into the individual sites as well as exploring a basis for new assessments of the relationships among them. To begin, recognizing the complexity of Sa Conca 'e sa Cresia and its inclusion of pseudo-tholos structures at a very early date requires us to reject the traditional developmental sequence of first corridor nuraghi, then early nuraghi with larger stone-roofed chambers, then tholos nuraghi. It appears that Nuragic architects knew how to construct embryonic tholos chambers from the beginning of their culture. This strongly suggests that the decision to build corridor nuraghi instead of pseudo-tholos nuraghi was a conscious choice between two potentially available options. Therefore, in approaching Nuragic landscapes, we have to seek reasons beyond chronology or increasing technical skill to explain the construction of corridor nuraghi without pseudo-tholos chambers. Whether this is explained by expedience, lack of access to builders with the correct knowledge, different uses or meanings of the structures, or some other rationale, simple chronology cannot be assumed to be a sufficient explanation.
Our results add to an ongoing discussion questioning the traditional conception of tholos nuraghi emerging from the experience gained by building corridor nuraghi[83]. Demonstrating that the architectural style and complexity of nuraghi are not straightforward indicators of chronological relationships encourages us to reconsider possible patterns of settlement development on the Siddi Plateau, creating a working hypothesis that can later be tested with excavation. For example, rather than assuming that simpler structures like Su Sensu and Pranu Strintu predated the more complex Sa Conca 'e sa Cresia, we

77 LILLIU 1975: 146; LILLIU 1988b: 335–337.
78 BALMUTH 1992; BADAS 2001.
79 BALMUTH 1992: 687.
80 LILLIU 1941: 149.
81 BALMUTH 1992: 687.
82 ATZENI *et alii* 2013: 31.
83 FOSCHI NIEDDU, PASCHINA 2003: 76–77; WEBSTER 2016: 51.

can view them as potentially built around the same time but serving different purposes. It seems plausible to consider all structures that include corridors and lack clear tholos chambers to be part of an initial building phase, whatever their level of complexity. Of the nuraghi surveyed in 2019, this would include Sa Conca 'e sa Cresia, Su Sensu, and Pranu Strintu in the north and Sa Fogaia in the south (Figure 12, left). It is important to keep in mind, however, that for complex structures such as Sa Conca 'e sa Cresia and Sa Fogaia, this initial establishment may have included only the first building episode: additional building episodes may have occurred later. A second phase of building on the plateau is suggested by structures that do not appear to include corridors and instead include only pseudo-tholos or tholos chambers. Of the surveyed nuraghi, this would add Molas and Sa Gruxi in the center of the plateau and Su Concali in the south (Fig 12, right).
The likelihood of multiple building phases on the plateau should not be taken to imply abandonment of the earlier structures: the earliest nuraghi on the plateau probably remained occupied - and were elaborated - throughout the two hypothesized building phases.

Conclusions

While Lilliu's original study created an important first record of the settlement system of the Siddi Plateau, his classification system was not sufficiently detailed to allow for useful comparison, and subsequent brief mentions of the sites in articles and catalogs have not added enough information to make real comparison possible. Further, though they were proposed as a classificatory scheme, Lilliu's categories have been used to make assumptions about the development and chronology of the monuments that we have shown are untenable.
By reevaluating the monuments on the Siddi Plateau using a more detailed and flexible system of classification, the Pran'e Siddi Landscape Project is beginning to reinterpret the significance of the structures in terms of the architectural techniques used to build them, the labor invested in them, and the potential development of each site over time. Additionally, considering the relationships among the architectural techniques used to build the structures, it is possible to hypothesize a new set of chronological relationships among them. These chronological relationships differ from the pattern that is generally assumed or implied in the literature, i.e. that early corridor nuraghi were small and simple, and were followed chronologically by single tower tholos nuraghi, then complex tholos nuraghi. While only excavation can precisely identify the chronological relationships among the structures on the Siddi Plateau, our preliminary results are in line with other scholars who have questioned a direct evolutionary progression among Nuragic structures.

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Fig. 1 - SIDDI - Loc. Giara di Siddi. The location of the Siddi Plateau in south-central Sardinia (left), and the locations of the sixteen nuraghi and one giants' tomb on the Siddi Plateau (right). Sites described in detail in this article are indicated in red.

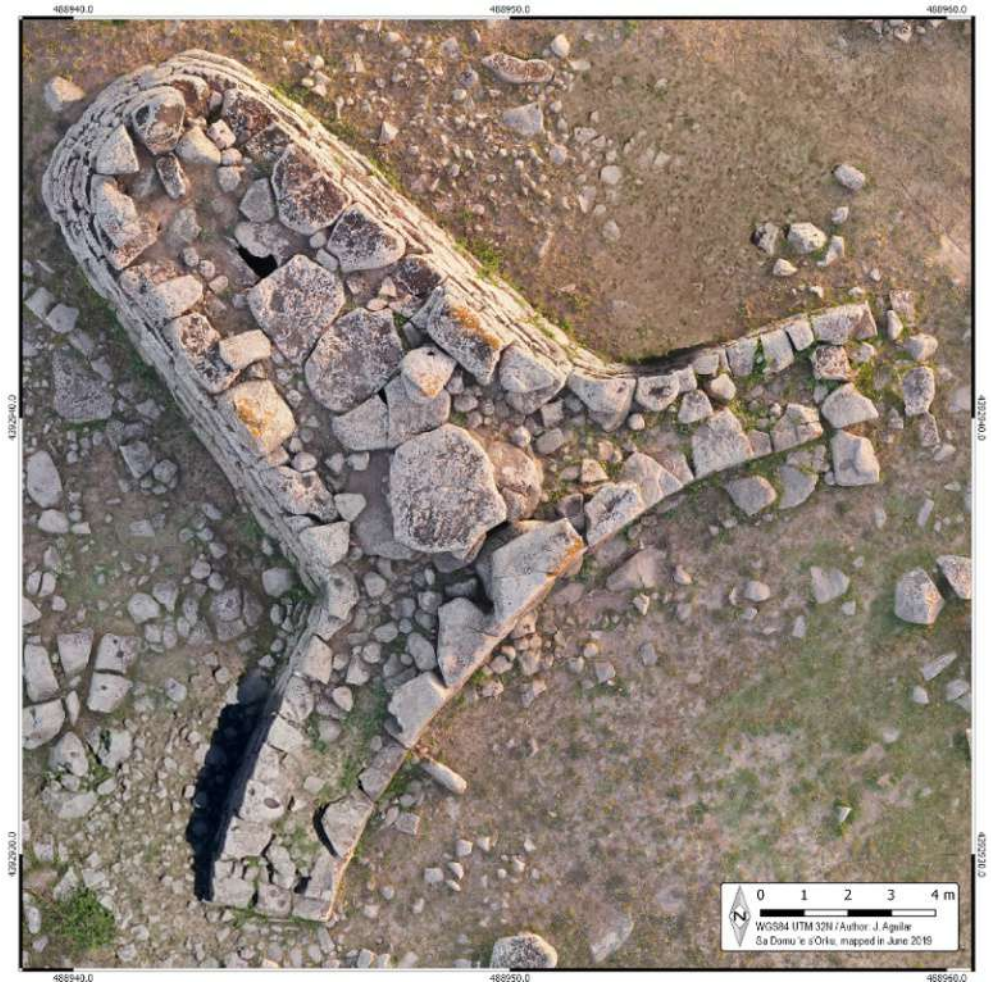

Fig. 2 - SIDDI - Loc. Giara di Siddi. UAV-based image of the giants' tomb Sa Domu 'e s'Orku (photo J. Aguilar).

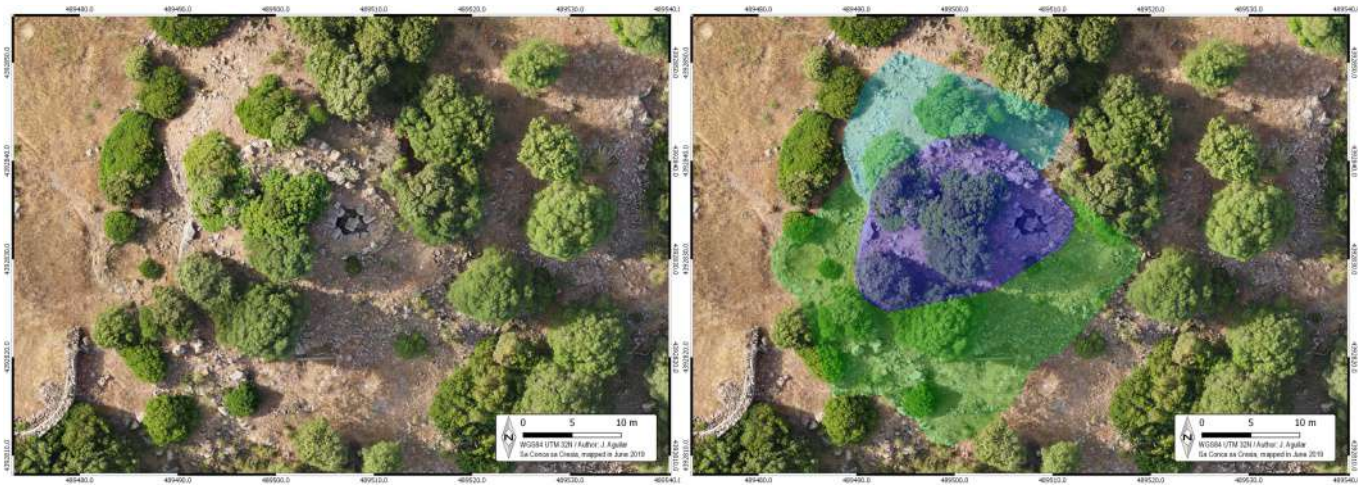

Fig. 3 - SIDDI - Loc. Giara di Siddi. UAV-based image of the nuraghe Sa Conca 'e sa Cresia (left, photo J. Aguilar), and Sa Conca 'e sa Cresia with the first (dark blue), second (light blue), and third (green) construction episodes indicated (right). Outlines of the construction episodes were approximated where the state of collapse made them impossible to trace with certainty.

Fig. 4 - SIDDI - Loc. Giara di Siddi. UAV-based image of the nuraghe Pranu Strintu (photo J. Aguilar).

Fig. 5 - SIDDI - Loc. Giara di Siddi. UAV-based image of the nuraghe Molas (left, photo J. Aguilar), and Molas with the first (dark blue) and second (light blue) construction episodes indicated (right). Outlines of the construction episodes were approximated where the state of collapse made them impossible to trace with certainty.

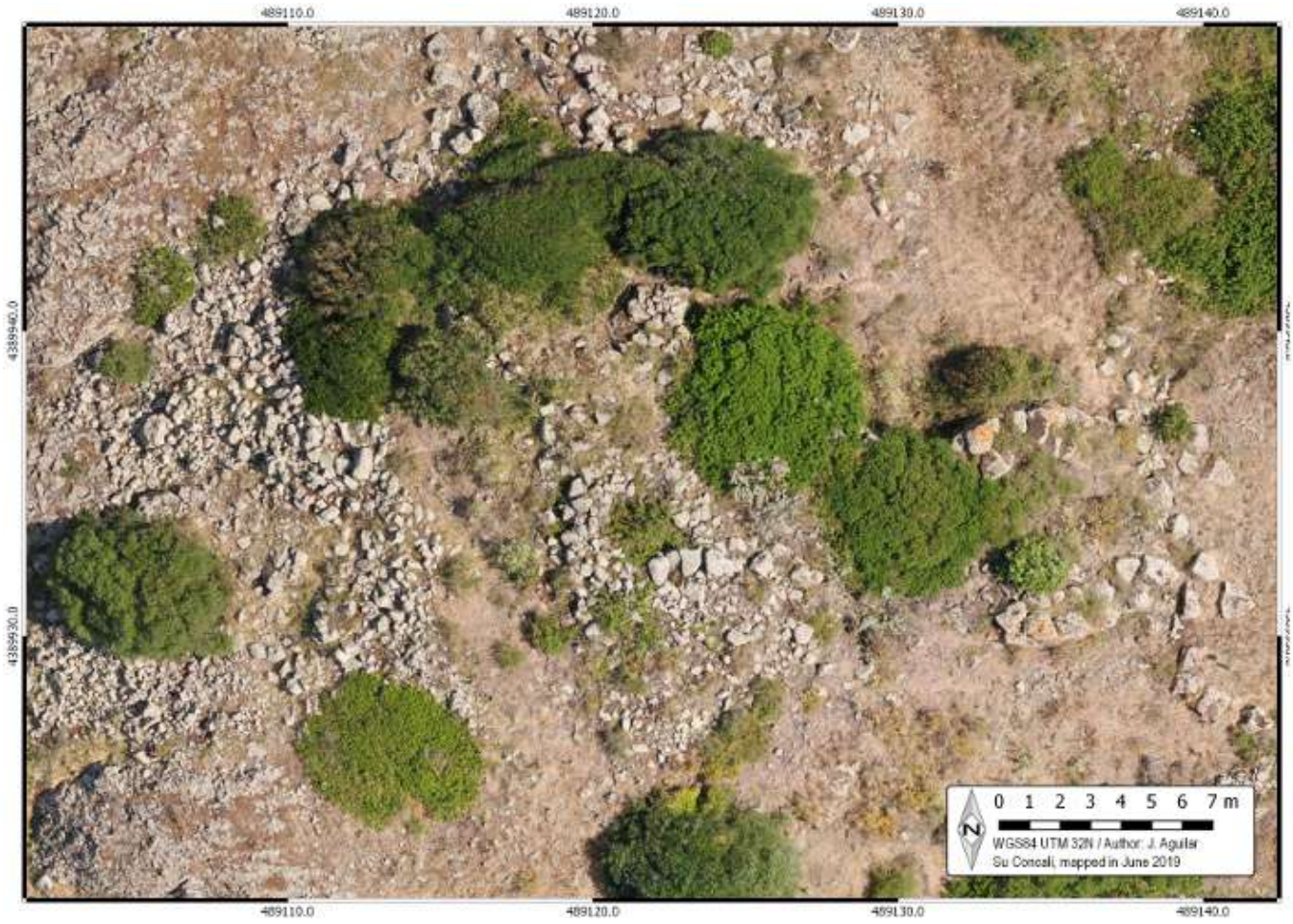

Fig. 6 - SIDDI - Loc. Giara di Siddi. UAV- based image of the nuraghe Su Concali (photo J. Aguilar).

Fig. 7 - SIDDI - Loc. Giara di Siddi. a) UAV-based image of the nuraghe Sa Fogaia (left, photo J. Aguilar), and Sa Fogaia with the first (dark blue), second (light blue), third (green), fourth (yellow), fifth (orange), and possible sixth (red) construction episodes indicated (right). Outlines of the construction episodes were approximated where the state of collapse made them impossible to trace with certainty.

Fig. 8 - SIDDI - Loc. Giara di Siddi. Stacked stone infilling of the northeast facing courtyard staircase at Sa Fogaia (photo D. Schirru).

Fig. 9 - SIDDI - Loc. Giara di Siddi. UAV-based image of Sa Gruxi (photo J. Aguilar).

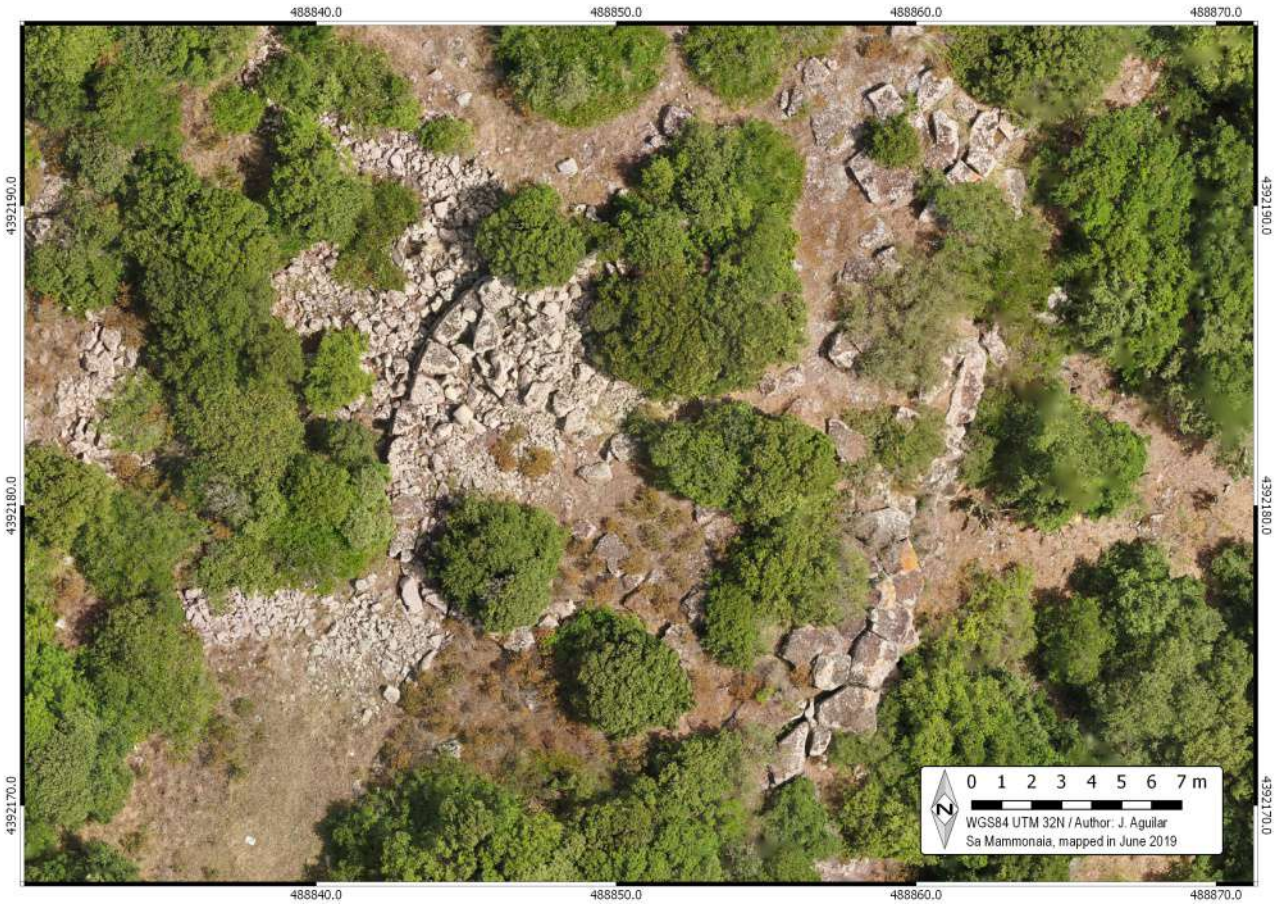

Fig. 10 - SIDDI - Loc. Giara di Siddi. UAV-based image of the nuraghe Sa Mammonaia (photo J. Aguilar).

Fig. 11 - SIDDI - Loc. Giara di Siddi. Front (left) and side (right) views of Sa Domu ‘e s’Orku (photos E. Holt).

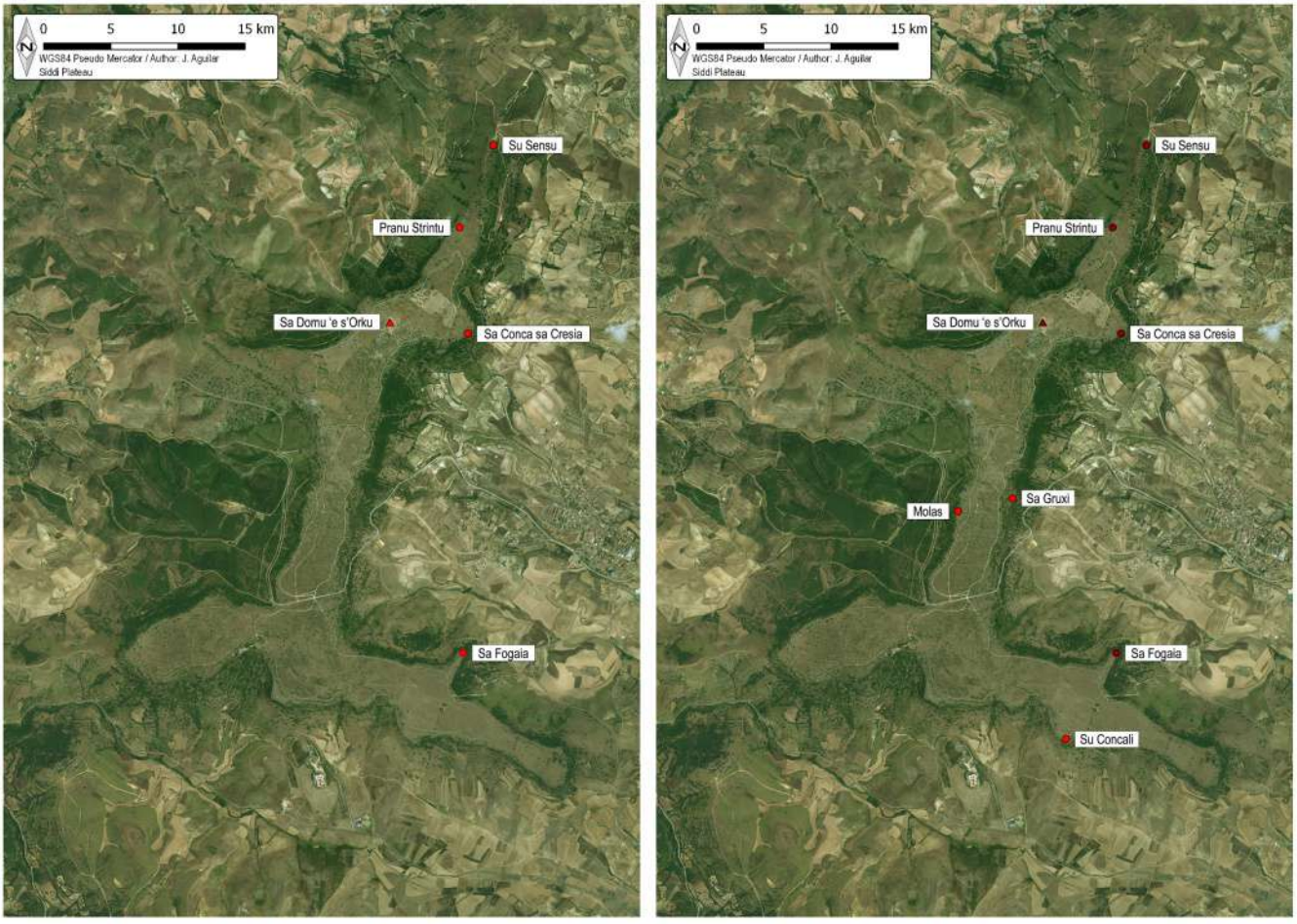

Fig. 12 - SIDDI - Loc. Giara di Siddi. Structures established by the hypothesized first building phase on the Siddi Plateau (left), and structures added during the hypothesized second building phase (right).