

## Project Description

The 1<sup>st</sup> millennium BCE western Mediterranean is known for its high degree of connectivity: Phoenician traders from the Levantine coast sailed to North Africa and the southern coasts of Iberia, Greek settlers reached the shores of Italy and southern France, and the Romans—in their turn—conquered and colonized territory stretching to the Atlantic Ocean. Sardinia, the largest island in the western Mediterranean, sat at an important crossroads in this interconnected world. An indigenous culture—the Nuragic culture—developed across the island, and these local inhabitants interacted with foreign colonizers and traders, who came to exchange goods and to access Sardinia’s salt, marine resources, obsidian, metals, and rich agricultural lands, among other products. Both because of Sardinia’s diverse landscape and central position in ancient social and economic networks in the western Mediterranean, archaeology on the island is uniquely positioned to contribute to ongoing discussions about connectivity, human-environment interaction, and the impact of colonialism on both urban and rural landscapes in the ancient past.

To this end, the Sinis Archaeological Project (SAP) will use multi-scalar regional survey and UAV data collection to explore settlement patterns, landscape use, and colonial interactions in west-central Sardinia (see Figure 1), a particularly varied landscape from both environmental and cultural perspectives. The project will hold its inaugural season in June 2018, and continue each summer for five years. I serve as co-director of the project along with my colleagues Dr. Alexander Smith (The College at Brockport – State University of New York) and Dr. Linda R. Gosner (University of Michigan). Our primary research questions include: How were these diverse landscapes used over the course of the 1<sup>st</sup> millennium BCE and beyond? To what extent did Phoenician, Punic, and Roman colonial interaction impact each of these landscapes? Were there major differences between colonial interaction in urban and rural environments, or between landscapes with different resources (e.g., agricultural vs. mountainous)?

## Research Design and Methodology

The Sinis Archaeological Project is a large-scale, diachronic regional survey. Over the next five years, we will survey four selected zones within the Sinis Peninsula and the adjacent inland region (Figure 2). Each zone encompasses an important natural resource and/or key archaeological site: Zone 1 – Nuraghe S’Urachi and its surrounding agricultural fields, Zone 2 – the Roman site of Cornus and mountainous metal deposits, Zone 3 – salt-water lakes and dense indigenous settlements, Zone 4 – the hinterland of the Phoenician port city of Tharros. Our multi-scalar methodology will assess the landscape within these zones at three different scales: regional reconnaissance with UAV (unmanned aerial vehicle) imagery, systematic pedestrian fieldwalking at the intermediate scale, and intensive scatter-based collection at the smallest scale.

During the first field season in 2018, field work will focus on the two largest scales of investigation within Zone 1, pedestrian field walking and UAV survey. At the intermediate scale of analysis, we plan to conduct intensive fieldwalking (detailed in Cherry 1983). For this method, we will systematically walk the landscape with a team of 6-8 people, beginning at known archaeological sites (e.g., S’Urachi, Cornus, Tharros) and radiating outwards from these

central areas. We will walk in transects spaced with 10 meters between each fieldwalker, who will be responsible for collecting artifacts and noting features within a 1 meter radius. This will roughly correlate to 20% coverage of the survey areas walked. A team leader will use a handheld GPS to record the boundaries of the fields that are surveyed, the ground visibility and other conditions impacting work, and the quantities of artifacts (ceramics, stone, metal, glass, modern trash, etc.) discovered and collected by each fieldwalker. Non-diagnostic ceramics will be left in the field, while diagnostic ceramics and other significant artifacts will be collected for further laboratory analysis. By inputting all of this information into our project database, we will be able to add information about the distribution and chronologies of artifacts to our map using ArcGIS, allowing us to better understand the chronologies of settlement patterns and landscape use in each survey zone.

As a compliment to the pedestrian survey, we plan to conduct an extensive UAV survey that will acquire high-resolution imagery and near-infrared data for each zone, beginning with Zone 1 in 2018. During each field season we estimate that we will be able to cover roughly 10 km<sup>2</sup> through intensive pedestrian survey, therefore the remaining area will be examined for archaeological sites and features through an examination of UAV-collected imagery. While the use of UAVs has grown rapidly in archaeological research in recent years, it has yet to be paired with an intensive pedestrian survey from the beginning as an essential methodological component of a large-scale, diachronic regional survey. Recent applications of UAVs have shown their great potential for site identification at the regional scale, particularly through the acquisition of imagery in the near-infrared spectrum. Buried architecture and archaeological features result in unhealthy vegetation growth in the soils immediately above them, making it possible to differentiate this poor vegetation from adjacent healthy vegetation in aerial imagery. While these crop marks can often be identified through true color aerial imagery, near-infrared data can be used to calculate NDVI (Normalized Difference Vegetation Index), a measure particularly useful for assessing crop health, and therefore identifying possible archaeological features in the landscape. The archaeological features within our survey area are ideally suited for this kind of analysis, since many of the Bronze Age nuraghi are composed of basalt and many of the colonial sites consist of linear features that stand out in the landscape.

The UAV survey will be conducted concurrently with the pedestrian survey, using 2-3 people: one flight operator and at least one spotter. Collecting data from large areas requires the use of a fixed-wing UAV rather than rotor UAVs which have been used more frequently in archaeological fieldwork. Fixed-wing UAVs allow for more efficient flights that cover larger distances, longer flight times, and greater stability during flight, which is essential for the western coast of Sardinia which often sustains harsh winds. The fixed-wing UAV will be equipped with two sensors to collect true color images and near infrared images concurrently. In addition, 15-20 ground control points will be placed per flight and mapped using DGPS. After the data is collected, it will be processed after the end of the field season, when we will be able to utilize the high performance of the supercomputer at the University of Texas at San Antonio. Photoscan software will be used to create a georeferenced orthorectified images and ENVI image analysis software will be used to calculate NDVI. Once processed these images will be systematically examined in conjunction with pedestrian survey results in order to determine optimal locations for future, more intensive, site-based investigations. These two methods employed in conjunction, pedestrian fieldwalking and UAV survey, will allow us to gain a more

comprehensive understanding of the archaeological landscape of each zone, which is critical for understanding settlement dynamics on a truly regional scale.

## Timeline

The project will take place from May 28-June 30, 2018. We plan to conduct four weeks of fieldwork followed by one week of laboratory work and materials analysis. The UAV survey will be conducted during all five weeks. The core team of eight-ten people, including the three principal investigators, will be present during the full season.

## Expected Outcomes

The data collected during the 2018 pedestrian and UAV survey will allow us to create a map that includes archaeological sites, features, and artifact distributions from Zone 1. Additionally, this initial season will provide an opportunity to refine and perfect our methodology for the three zones that will be surveyed in the future. The equipment purchased with the help of the Julie Herzig Desnick grant will be able to be used in each of these successive field seasons for further UAV data collection. Our overall survey region provides an opportunity to study the use UAVs and near-infrared imagery in a variety of landscapes, making it possible to assess the efficacy of such methods in a series of different environmental zones.

We hope that through this research, we will provide a clear picture of land use and settlement patterns in this region of west-central Sardinia. We plan to publish a preliminary report of our findings from the first year of survey in the *Fasti Online Documents and Research Survey Series*, which is an open-access and peer-reviewed journal. We will also submit abstracts to present our research at the Society for American Archaeology and the Archaeological Institute of America Annual Meetings. Our final publication plans include a co-authored monograph by our team members that presents our methodologies and materials from the entire diachronic regional survey. We will also write synthetic articles for the *Journal of Mediterranean Archeology* and the *Journal of Field Archaeology* focused on presenting our innovative survey methodology as well as interpreting our results.

The primary goal of the Sinis Archaeological Project will be to complete a large-scale survey of the region in west-central Sardinia encompassing the Sinis Peninsula and the land immediately inland. Given the fragmented state of knowledge of this landscape in antiquity and previous scholarly focus on major sites rather than whole landscapes, we believe it is necessary to produce an integrated view of the region as a whole. This will be of interest to archaeologists working in all periods on the island, as well as to others studying colonial encounters, human-environment interaction, and survey methodologies in the Mediterranean in general.

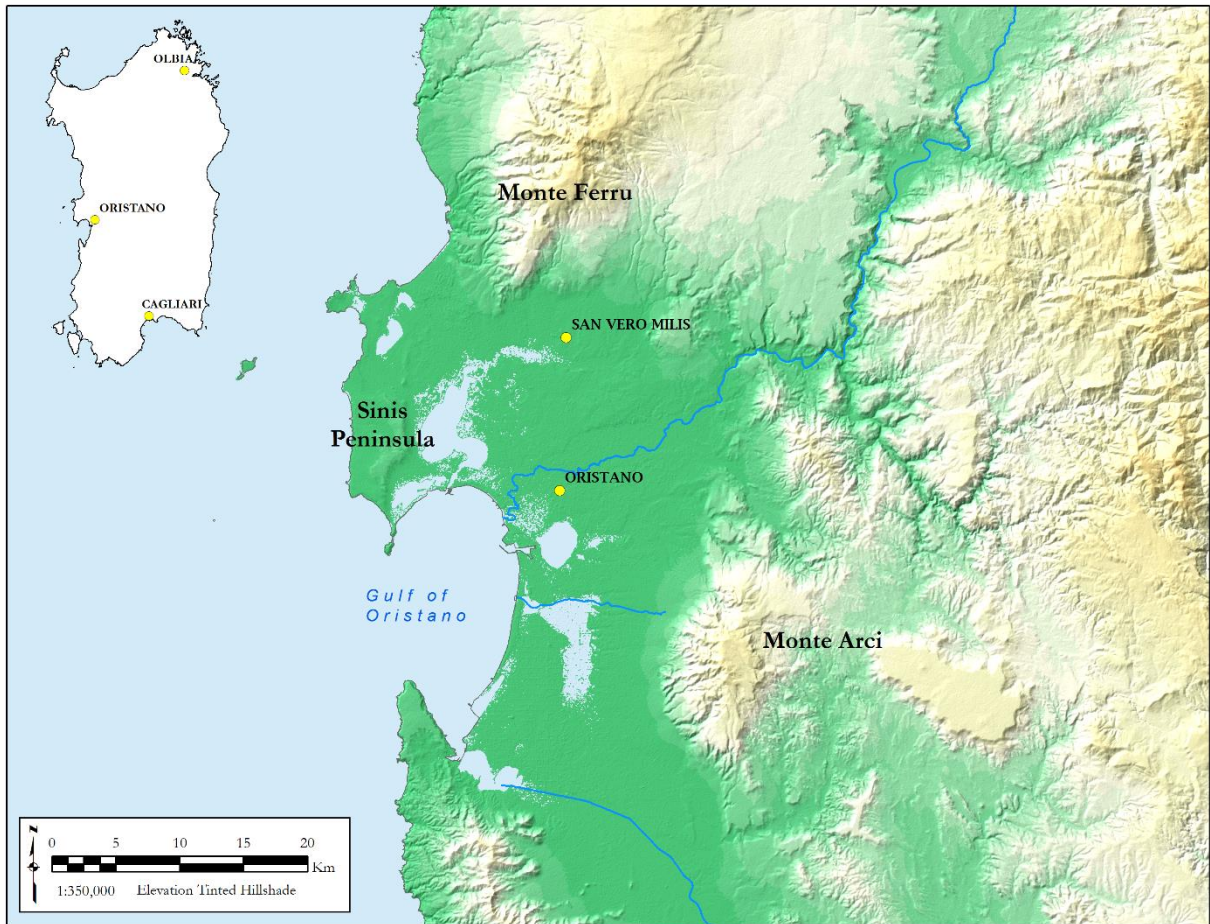


Figure 1. Map of Sardinia showing the general survey region.



Figure 2. Close-up map of our four survey zones outlined in distinct colors, key sites marked in black, and the ancient road network delineated in red.