ABSTRACTS

Lidar and Landscapes in the Archaeology of Greece: An International Workshop

15 March 2024 – Cotsen Hall, American School of Classical Studies

SESSION 1: LIDAR IN ARCHAEOLOGICAL SURVEYS (9:00–10:50 am)

Lidar-Based Research in the Phokian Kephissos Valley

Katja Sporn and Will M. Kennedy (Deutsches Archäologisches Institut Athen)

In 2018, the joint Greek-German Kephissos Valley Project (German Archaeological Institute at Athens and the Ephorate of Antiquities of Fthiotida and Evrytania) was launched with the aim to explore the regional settlement development (including associated sanctuaries, necropoleis and general urban infrastructure) in the Phokian Kephissos Valley. The approximately 145 km² large study area forms a representative "cross- section" through the valley, encompassing the dominant mountain ranges of the Kallidromo and the Parnassos, and includes major sites such as Tithorea or Elateia, the latter becoming the most important city of ancient Phokis next to Delphi. Opting at providing a better regional understanding of the natural and cultural landscape development of the Kephissos Valley, the project cooperated with Geosystems Hellas early on, who conducted a comprehensive airborne lidar scan of the entire study area – the first of this size in Greece. The data provided the project with high-resolution aerial photographs, georeferenced orthoimages and lidar scans, with which it was possible to map a large number of potential archaeological and environmental features (approx. 2700 anomalies). Recently, the study of multi-spectral satellite imagery revealed approx. 2500 additional anomalies. Lidar-based analyses and other remote-sensing methodologies have thus greatly contributed to regional settlement history research and gained significant insights at important sites within the Kephissos Valley, where the combination of intensive pedestrian surveys, building archaeological research and geophysical prospections have allowed to devise detailed site plans. This paper aims to reflect upon past experiences and future promises of lidar-based research within the Kephissos Valley Project, particularly in combination with other remote-sensing and field archaeological methodologies. It hopes to discuss common issues such as site classification and identification, the importance of interdisciplinary collaboration, issues of scale, as well as the potential for farther-reaching spatial analytical analyses.

Lidar-Based Remote Sensing and Ground Truthing in the Eretria-Amarynthos Survey Project

Sylvian Fachard and Chloé Chezeaux (Swiss School of Archaeology in Greece, University of Lausanne)

While planning the new Eretria-Amarynthos Survey Project (EASP), the Swiss School of Archaeology in Greece commissioned a Lidar survey of a vast area stretching from Lefkandi to

Mt Servouni. The data enabled the production of DTM, DSM, aerial photos, and a digital elevation model covering an area of about 200 square kilometers with a spatial resolution of 0.25 meters. At present, this is among the most expansive lidar coverage areas in a Greek archaeological project.

The acropolis of Eretria served as the perfect testing ground for evaluating the lidar data's accuracy, as it contained a wealth of previously identified and mapped architectural details. With this precise calibration, we were able to generate a comprehensive collection of DTM tiles covering the entire survey region. Using *QGIS* Relief visualization tool, we were able to generate Hillshades (HS), Slope gradients (SLOPE), Multi-Scale Relief Models (MSRM), and Sky-view factor images (SVF). Each tile was used for remote sensing and ground truthing using *ArcGIS Pro*. The previously recorded anomalies served as a guide for survey teams in the field. Thanks to this method, many notable archaeological discoveries were made, including terrace walls, roads, towers, ruined chapels, and even illicit excavations. The extensive survey teams were able to save a significant amount of time in challenging terrain due to the efficiency of the workflow and method. This paper will provide a brief overview of the EASP lidar data, including the protocol and methodology, workflow, and both its main advancements and limitations. Over the course of three seasons, the implementation of lidar-based remote sensing and ground truthing has become integral in the examination of archaeological landscapes, resulting in significant advances.

The Samothrace Lidar Project

Dimitris Matsas (Ephor Emeritus, Hellenic Ministry of Culture), Michael Page (Emory University), Bonna D. Wescoat (American School of Classical Studies), Christopher Witmore (Texas Tech University), Thomas Garrison, and Brody W. Manquen (University of Texas at Austin)

The Samothrace lidar Project is part of the Samothrace Exploration Project, which, in conjunction with the American Excavations Samothrace, aims to shed light on occupation and land use on Samothrace from just before its earliest human inhabitation to the present. The lidar survey of the often rugged and wooded landscape encompassing the most important archaeological sites of this mountainous island forms the basis for an integrated diachronic investigation of settlement and transition across Samothrace. Among the basic aims of the project is to: 1) investigate the void of the Late Bronze Age, a period of complex and varied patterns of transformation and transition happening across the regions of the northern Aegean, eastern Balkan Peninsula, and northwestern Anatolia; 2) document the remains of the modern agricultural landscape, including the unique irrigation network which connected the major rivers and streams to the island field systems; 3) gain a better understanding of the landscape and possible anthropogenic features currently hidden among the wooded understories across the island.

We are in the initial stages of this project. During the summer of 2023 the Samothrace Exploration Project (SEP) commissioned AeroPhoto Co Ltd of Thessaloniki to undertake a lidar survey of three territorial zones of the island, which has generated a large amount of lidar data that will help us identify numerous surface features in the wooded understory. In this paper we present our aims for lidar research on Samothrace, while discussing the characteristics of the archaeological topography of the island, coverage and methodology, and expectations for analysis against the backdrop of select lidar imagery from the project.

Post-Fieldwork Lidar Applications in Archaeological Surveys: Feature Recognition and Quantification with the Small Cycladic Islands Project

Alex R. Knodell (Carleton College), Evan I. Levine (University of Copenhagen), Sam Wege (US Department of Agriculture–Forest Service), Michaela Fielder-Jellsey (Carleton College), and Demetrios Athanasoulis (Ephorate of Antiquities of the Cyclades)

In 2022 and 2023, the Small Cycladic Islands Project acquired lidar data over 97 currently uninhabited islands in the Cyclades. The goals of this work were several: (1) to supplement and expand our knowledge of areas already surveyed by SCIP (2019–2021), many of which are heavily obscured by vegetation cover; (2) as a precursor and guide to our own pedestrian survey work in 2022–2024, especially in large islands that cannot be surveyed at the same level of intensity as smaller ones; (3) to investigate islands that are well known and have been surveyed by other projects using other methods (Delos, Rheneia, and Despotiko); and (4) to cover areas where it is not possible for the project to carry out pedestrian survey work, due to issues of accessibility, size, or other constraints (Gyaros and Antimilos).

This paper focuses on the first goal, in order to provide a different, and, in some cases, more comprehensive view of archaeological landscapes that have already been subject to intensive pedestrian survey. We present the results of the post-fieldwork examination of aerially acquired lidar data over 39 islands surveyed during the first three field seasons of the project. In the first place, we compare patterns of feature recognition using pedestrian survey, on the one hand, and lidar analysis, on the other. We identify certain types of features that are more or less likely to be recognized by surveyors in either context. We also compare classification methods and quantify feature types and functions across the islands. We conclude that lidar provides significant "value-added" benefits to archaeological surveys, even after the fact, but that pedestrian survey remains essential for the identification and description of many types of features. At the same time, regional-scale lidar coverage allows us to carry out new types of quantitative and qualitative geospatial analyses, especially with respect to large-scale landscape modifications and inter-island comparison.

SESSION 2: REMOTE SENSING METHODOLOGIES

Terrestrial and Underwater Use of ALS/ALB in Mediterranean Landscapes: Archaeological Prospection for Roman Land Use on the Croatian Coast

Nives Doneus and Michael Doneus (University of Vienna)

Traditionally, the study of archaeology has revolved around artefacts and settlement remains in the landscape. For over a decade, this view has been challenged by the development and application of a wide range of non-invasive methods. In particular, the widespread use of large-scale archaeological prospection techniques has shifted the focus from interest in individual sites to a holistic view of cultural landscapes. In this context - and especially in the study of Mediterranean landscapes - airborne laser scanning has become one of the most important research methods.

The results of several Croatian case studies show that remote sensing methods have enormous potential for analyzing Roman land use at various levels. Airborne laser scanning and bathymetry offer possibilities that go well beyond mapping of archaeological remains. They allow analyses of landscapes, instead of sites, and can overcome the boundary between the land and the sea. Furthermore, the results show that a combination of ALS surveys with other prospection methods is always of benefit to archaeological research. By using a combination of methods, the details and context can be integrated into an interpretative, coherent model of a landscape that goes far beyond the analytical capabilities of any single method.

Issues of Representativeness in Lidar-based Landscape Archaeology in Mediterranean Contexts

Giacomo Fontana (University College London)

The Mediterranean region has a strong tradition of landscape archaeology, especially in countries like Italy and Greece. However, such research often focuses on coastal and plains areas, frequently overlooking other types of environments. lidar offers potential to reveal historically understudied landscapes, such as forested and mountainous areas. Nonetheless, the typical Mediterranean vegetation, like the maquis, poses significant challenges for lidar applications, challenges not encountered in other regions such as temperate Europe. The dense undergrowth often hinders lidar's ability to penetrate the vegetative canopy, leading to suboptimal representation of the underlying surface and raising concerns about the representativeness of the detected archaeological record, a topic still inadequately discussed.

This paper evaluates the challenges and possibilities of low-resolution but large-scale lidar in Mediterranean landscape archaeology, drawing on experiences from the Ancient Hillforts Survey in central-southern Italy. The project processed over 15,000 sq km of lidar data, detecting several hundred sites, of which 145 were ground-truthed. Insights from this project offer valuable considerations on the representativeness of the archaeological record as depicted through lidar in typical Mediterranean environments, such as mountainous and forested areas. It also suggests

approaches to address incomplete lidar-derived datasets for specific types of archaeological sites in geospatial analysis.

Using Lidar in Geomorphological Mapping: The Case of the Amarynthos River Valley (Euboea, Greece)

Tibor Talas (University of Lausanne)

In the context of the paleoenvironmental reconstruction of the Sarandopotamos catchment, the Swiss School of Archaeology in Greece commissioned a Lidar survey of the whole area. This survey allowed the production of a digital elevation model covering a surface of approximately 200 km2 with a spatial resolution of 0.25 m. During the process of creating a geomorphological map of the region, this DEM turned out to be an extremely precious source of information to complete the data provided by field observation. Because of the vast surface of the area of interest and the fact that some parts of the catchment are challenging to access, it was unrealistic to rely solely on observed data. Moreover, a lidar based DEM allows the observation of shapes and features that are hidden by the dense Mediterranean scrubland. The map was drawn with the use of the geomorphical features list developed by the University of Lausanne (C. Lambiel).

This procedure allowed the detailed observation of the river branches and talweg and thus the precise assessment of the zones of erosion and deposition. It also permitted to detect landslide deposits under the vegetation cover. The removal of buildings made possible to accurately characterise the size of the geomorphic formations on which cities were built. The high definition of the DEM also allowed to spot the localisation and shape of old channels, which was useful in order to understand the palaeohydrological regime and processes that led to the formation of a today inactive delta at the west of Amarynthos. In another geographical context this kind of method could also be used to observe some types of processes that result in small differences in altitude and are therefore difficult to observe with the naked eye. Lidar is thus a powerful tool and a real added value to comprehend the history of sediment mobilisation and deposition caused by a combination of multiple processes.

Airborne-Based Aerial Survey with State-of-the-Art Lidar and Photogrammetric Sensors within a Highly Complex and Feature Rich Mediterranean Environment: Facing Various Challenges from Flight Parameters to Feature Extraction

Themis Bournas, Christos Boutsoukis, and Nikos Dalampis (AeroPhoto Co Ltd)

Airborne lidar technology has revolutionized various fields, but key challenges such as Regulatory Compliance, Specialized Expertise, Data Accuracy, Resolution, Standardization, Processing Complexity, Ground Truth Validation, and Vegetation Interference still require technological advancements and collaboration among interdisciplinary teams. Various critical stages are involved in an airborne lidar survey for scientific research purposes and in particular for Archaeological interest. The initial phase of this presentation emphasizes on how critical is the proper flight planning parameter selection tailored to specific research questions, considering

factors such as local flight and weather conditions, aviation regulations, a/c performance specifications and accuracy requirements. A recently updated cost-effective SORA lidar system ensures sufficient point cloud density to support desired DSM/DTM/DFM resolution. Thorough strip adjustment of flight trajectory enhances the geospatial product quality by minimizing discrepancies in overlap areas, thus reducing the likelihood of possible generated artifacts complicating the already demanding archaeological feature identification. The subsequent stage focuses on point cloud manipulation techniques and geoinformation derivation, including semi-automatic ground classification in order to handle events of steep terrain gradients, dense canopy to name a few. Object type classification encompasses vegetation, buildings, and non-ground archaeological features, employing parameters such as z-height, intensity values etc. The methodology involves engineer-driven rule-based decisions, leveraging expertise in local geomorphology, vegetation and archaeological characteristics. Finally, software insights, encountered challenges and special deliverable requests are pinpointed.

Visualization, Vectorization, and Verification: Open-Source Lidar Methods for Archaeological Prospection and Accuracy Assessment in Mediterranean Shrublands

Brody W. Manquen, Thomas G. Garrison (University of Texas at Austin), Alex R. Knodell (Carleton College), and Demetrios Athanasoulis (Ephorate of Antiquities of the Cyclades)

Lidar remote sensing techniques are in their early stages of integration into Greek archaeological practice. Scholars primarily use lidar to create highly detailed topographical models of a target region that allow for the discovery of surface-level features or landscape modifications, even if under dense vegetation. Mediterranean maquis shrublands present unique challenges to lidar-based archaeology due to the low, dense vegetation limiting ground point density. Furthermore, archaeologists untrained in advanced GIS and remote sensing techniques may default to proprietary processing software, resulting in a “black box” of protocols that obscure methods. Furthermore, false confidence in highly ‘realistic’ models can produce complacency in investigating classification error, hindering comparability between studies. This presentation details methods and results from the 2023 Small Cycladic Islands Project (SCIP) field season which utilized lidar to analyze uninhabited Aegean islands for archaeological remains. This presentation will describe the open source lidar processing pipelines and the accuracy of classified results built from a robust field verification strategy. This research introduces transparent and accessible data processing methods to encourage reproducibility and transparency in lidar-based strategies in Greece. Finally, it begins to investigate the unique challenges to data quality and classification accuracy of lidar-based archaeology in Mediterranean maquis shrubland environments.

SESSION 3: DRONE AND AERIAL LIDAR

Drone and Airborne Lidar in Greece: A Mediterranean Perspective on Processing Techniques and Cultural Landscapes

Jesús García Sánchez (Instituto de Arqueología de Mérida), Thierry Lucas (Université de Picardie Jules Verne), Joao Fonte (University of Exeter), Lieve Donnellan (University of Melbourne), and Jitte Waagen (University of Amsterdam)

This paper will offer a reflection on how ancient cultural landscapes have been studied in recent times thanks to the popularization of lidar data. However, in some cases, national lidar coverage is not available, it is partial, or the quality of the data is not good enough to solve archaeological questions. Archaeological projects are acquiring data in alternative ways, using drone platforms or private companies using airborne platforms. These initiatives have resulted in complex datasets of exceptional quality, albeit with reduced spatial coverage. Archaeologists have to deal with processing and visualization routines to exploit these data from multiple perspectives, using similar software, algorithms, and perhaps similar research questions dealing with the long-term and dynamic Mediterranean landscapes.

Our paper will examine the technicalities of specific Greek datasets obtained from the lidar flights over the Valley of the Muses and the city of Akraiphia (Boeotia), and their relationship to field-based projects, i.e. the Boeotia Survey Project. It will also discuss some preliminary results of drone lidar work done at the Classical site of Halos and the Iron Age necropolis Voulokaliva, Thessaly. Finally, we will reflect on the intersection of processing techniques and research questions in similar archaeological projects in the Mediterranean basin, ranging from southern Italy (Piano di Gioia Tauro/ Calabria-Mig Mag project), Spain, and Portugal (Odyssey project).

Lidar and Landscapes in Archaeology: The Case of Palaiokastro Pylos, Greece

Anastasios Kazolias, Vayia V Panagiotidis, and Nikolaos Zacharias (University of the Peloponnese)

Recent advances in archaeological survey techniques have provided unprecedented insight into challenging terrain. The use of aerial documentation has become a significant factor in the environmental and architectural study of archaeological spaces. Following recent and significant studies in Greece performed by the Laboratory of Archaeometry such as 3D documentation in Amphipolis in Macedonia and Amyklaion in the SE Peloponnese, research in documentation continued in the coastal area of Pylos in the SW Peloponnese. This paper presents a pioneering study using a Light Detection and Ranging (lidar) system mounted on an Unmanned Aerial Vehicle (UAV) to survey the densely vegetated archaeological landscape of Palaiokastro Pylos, Greece. Palaiokastro is a significant archaeological site, but its intricate details are covered by dense vegetation and cannot be documented. Traditional ground-based survey methods are hindered by the impenetrable canopy. A UAV equipped with lidar technology was used to capture high-resolution, three-dimensional data from above the canopy. The lidar-UAV synergy allows us to

penetrate dense vegetation and reveal hidden archaeological features, including structures, pathways and topographic variations.

The resulting dataset produces detailed digital elevation models, allowing us to document the ancient landscape with a level of accuracy not previously achieved. Findings reveal the spatial structure of the Castle complex, providing insights into its historical development and human-environment interactions. This study demonstrates the effectiveness of lidar in overcoming the challenges of dense vegetation at archaeological sites. The technology not only overcomes the limitations of traditional survey methods, but also increases the efficiency and accuracy of data collection. The use of lidar at Palaiokastro serves as a benchmark for similar archaeological sites, highlighting the potential for revealing hidden narratives beneath dense canopies. The study involves archaeological mapping through the incorporation of data-processed orthomosaics and digital terrain models. The combination of DTMs, visualizations and orthomosaics not only reveals the hidden history of Palaiokastro Pylos, but also provides a comprehensive toolkit for future archaeological investigations in similarly challenging environments. In conclusion, the research demonstrates the innovative impact of combining UAV and lidar technologies in archaeological exploration, particularly at sites with challenging environmental conditions.

UAV-Based Survey of Ancient White Marble Quarries on Mt. Pentelikon: Challenges and Successes of a Lidar and Photogrammetric Survey in a High Relief Environment

Scott Pike, Cassie Drazen, and Adelaide Kemp (Willamette University)

The locations of ancient Greek marble quarries are well known and multiple studies have been conducted that aim to geochemically and isotopically distinguish between the marbles of these various quarries. Despite the success of these provenance studies, the physical and geographical extent of many of the quarries has not been thoroughly investigated. In the summer of 2023, a National Science Foundation-International Research Experience for Students award funded five advanced undergraduate students from Willamette University to design and implement aerial surveys of ancient Greek marble quarries using UAV-based sensors. The aim of the project was to design a research methodology and carryout independent work to (1) detect the full extent of select marble quarry areas, (2) determine the volume of extracted material from quarry pits, and (3) identify roadways, tiling piles and other surface features associated with ancient quarrying activity. This paper will report on initial methodological challenges and successes as well as provide results of a drone-based photogrammetric and lidar survey at the ancient white marble quarries on the SW slope of Mt. Pentelikon, in Attica, Greece.

A New Tool for Landscape Survey: Using UAV Lidar to Reveal Quarried Landscapes on Naxos

Evan Levine (University of Copenhagen), Hallvard Indgjerd, Steinar Kristensen, and Magne Samdal (University of Oslo, Museum of Cultural History)

The ancient marble quarries of Naxos preserve complex landscapes of resource extraction, artistic creation, and labor exploitation in the Archaic Cyclades. However, their systematic study, mapping, and integration into broader discussions of island economies and political geographies has been limited by rugged topography and dense vegetation. This paper presents the collection and analysis of UAV lidar data for two ancient quarries on Naxos and the use of these data within a broader suite of interdisciplinary fieldwork that focuses on the landscape signatures and material culture associated with marble extraction. We begin by exploring the benefits and drawbacks of UAV lidar data collection for landscape study, with particular focus on its comparison to aerial lidar data and UAV photogrammetry. We then highlight the efficacy of UAV lidar data for the detection and classification of archaeological features, and the potential for these data to build accurate models of quarries, to identify traces of extraction, and to calculate volumes of extracted marble. We conclude by discussing how these methods and datasets have informed and guided other forms of fieldwork on Naxos, as part of a multiscalar and interdisciplinary fieldwork project. In so doing, we explore if and how UAV-based lidar platforms fit into the ever-expanding toolbox of Aegean survey archaeology.

SESSION 4: LIDAR ANALYSIS OF ARCHAEOLOGICAL SITES AND THEIR HINTERLANDS

Exploring the Rural Landscape of Attica Using Lidar and Other Forms of Remote Sensing: The Case Study of KASP at Ancient Aphidna

Anastasia Dakouri-Hild (University of Virginia), Stephen Davis (University College Dublin), Athos Agapiou (Cyprus University of Technology), and Eleni Andrikou (Ephorate of Antiquities of East Attica)

Lidar has been used in Greek archaeology in the last few years with increasing success. The paper presents the results of airborne lidar within the 2019-2021 footprint of the Kotroni Archaeological Survey Project (KASP), as part of its broader, multimodal survey methodology. Armed with ground-truthed knowledge about the Aphidnian landscape following the conclusion of the survey, we investigate the extended Aphidnian landscape using machine-learning techniques and combining lidar, high-resolution satellite imagery, and airborne ultra-high resolution photography as a tool for future investigation. In general terms, we discuss the benefits of advanced geospatial tools in the study of human landscapes at all stages of archaeological inquiry (prior, during and after ground truthing), the potential of combining satellite and aerial imagery with lidar in thickly vegetated Mediterranean landscapes, and the challenges and limitations in acquiring, processing and deploying lidar data in the field. We conclude that the combination of digital inquiry with standard field practices is a relatively cost-effective means by which to document landscape characteristics on a grander scale, guide field work, and support archaeological interpretation both in and outside the field.

The Lidar Survey at Akraiphia (Boeotia): Methodology and First Results

Thierry Lucas (Université de Picardie Jules Verne)

This paper focuses on the results of the lidar survey conducted at the site of the city of Akraiphia in 2021. It will first present the site, the methodology and the workflow used to treat the data and compute a DTM and the visualizations derived from it. Several methods have been used and combined in QGIS to have the best result. One important feature of this workflow is that it uses only free and open-source software (QGIS, RVT and the open core of Whitebox Tools). In the process, several ground classification algorithms have been tested. The Slope-based approach provided by Whitebox Tools (SBF) gave excellent results in that context compared to other algorithms. The DTM was also used to calculate the optimal mobilities on the site, to better identify the passages between the lower town and the acropolis; one road cut into the rock has been identified thanks to this method.

Despite the difficulties of the terrain (most of the acropolis is covered with thick shrubs with persistent leaves, the worst scenario for lidar acquisition), the survey yielded significant results: on the acropolis, most of the hilltop was divided into an orthogonal grid, of which almost nothing was visible on the ground. The northern slope of the hill was also entirely occupied by building several parallel terraces. At the bottom of the slope, one of these terraces, trapezoidal in shape, was

probably the place of the agora of the city: the survey allowed to identified the theater, as well as several anomalies that could be terraces or foundations for important buildings. The lidar survey also allowed to better understand the relation between the wall and the urban grid, and to identify the location of several towers.

Seeing the Trees through the Forest: Lidar Analysis and the Identification of Ancient Sites in the Busy Built Environment of Southeastern Rheneia

Zozi Papadopoulou (Ephorate of Antiquities of the Cyclades), Vangelis Samaras (University of Athens), Pavlos Fylaktos (Ephorate of Antiquities of the Cyclades) Alex R. Knodell (Carleton College)

This paper examines lidar data from the southeastern part of Rheneia, located in the center of the Cycladic Archipelago of the southern Aegean, next to the much-visited islands of Delos and Mykonos. Rheneia has been the subject of an ongoing archaeological survey by the Ephorate of Antiquities of the Cyclades since 2019. The lidar data shows an exceptionally dense built environment, with over 200 km of terraces, field walls, and other constructions covering its relatively small area of c. 14 sq km. As such, differentiating between forms of land uses—some of which are mentioned in the inscriptions of Delos—is a challenge, especially when viewed in a diachronic perspective.

Here we compare the results of lidar analysis with what we know from surface survey and other forms of remote sensing (chiefly drone-based aerial photography) in the southeastern part of Rheneia. We focus on three particular areas in order to distinguish ancient constructions and patterns of land use in a landscape that has been modified in various ways from antiquity to the present. In the first place, we examine the boundary zones of the ancient cemetery of the Delians and their relation with neighboring activities/interventions. Second, we look at two sites next to the Marmarokopio hill. One is a small building near what may have been one of the access points of the island; the other is a small ancient farmstead. In each case we highlight the strengths and weaknesses of different remote sensing methods for identifying and characterizing sites and features. We conclude with some general thoughts about next steps and the implications of our results for larger-scale analysis on the island of Rheneia.

Lidar Analysis and Phasing at Multiperiod Sites in Cycladic Landscapes: Examples from the Islets of Amorgos

Rosie Campbell (University of Cambridge), Demetrios Athanasoulis (Ephorate of Antiquities of the Cyclades), and Alex R. Knodell (Carleton College)

While lidar has revolutionized the exploration of densely vegetated regions, its use in arid and rocky environments, such as the Cycladic islands, presents a unique set of challenges and opportunities to analyze ancient built environments. This paper explores site-level applications for lidar technology in the archaeological study of abandoned islands within the Cyclades, surveyed in 2023 as part of the Small Cycladic Islands Project (SCIP).

We focus on two comparative case studies on the islands of Kato Antikeri and Ano Antikeri, and two sites on Anydros. We use lidar imagery alongside other forms of remote sensing and pedestrian survey to analyze multiperiod sites featuring (mostly) drystone architecture. The objective is threefold: (1) to construct a general stratigraphic sequence of the built environment; (2) to detect possible "signatures" of walling from different periods; and (3) to better understand how site reuse and continued occupation across periods affects the preservation of architecture. We examine lidar data and aerial imagery alongside ceramic and other finds from the survey in order to examine whether phasing and chronological information can also be inferred from particular remote sensing signatures.

Lidar Applications in the Australian Paliochora Kythera Archaeological Survey: Workflows, Paradigms, and Limitations

Konstantinos Trimmis (King's College London)

In the context of the Australian Paliochora Kythera Archaeological Survey (APKAS) and the excavations in Kataphygadi cave, also in Kythera, airborne and mobile device- based lidar have been applied in conjunction with Structure for Motion (SfM) photogrammetry for the recording of archaeological features, buildings, prospection in areas with dense tree canopy coverage, and for surveying caves and rock shelters with evidence of human use. This paper aims to present the outputs of all lidar applications in both projects, to evaluate usability, and to showcase the projects' workflows. Lidar is evaluated against SfM photogrammetry applications that have been the backbone recording methodology for the same elements of the two projects until the 2022 season. The recording opportunities that lidar offers for surveying and recording archaeology underground are presented, alongside the projects' workflows. The paper concludes with the limitations of lidar in the Kytherian contexts and suggests future improvements in the workflows.