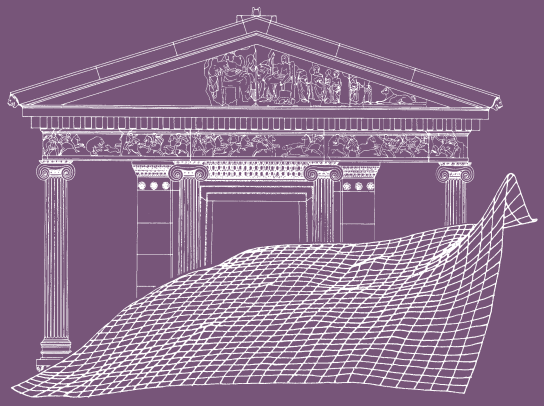

KNOWLEDGE, ANALYSIS AND INNOVATIVE METHODS FOR THE STUDY AND THE DISSEMINATION OF ANCIENT URBAN AREAS

KAINUA 2017

Proceedings of the KAINUA 2017 International Conference in Honour of Professor Giuseppe Sassatelli's 70th Birthday (Bologna, 18-21 April 2017)

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WHEN THERE WAS NO GIS SYSTEM: REDISCOVERING ARCHAEOLOGICAL RESEARCHES OF THE 19TH CENTURY THROUGH THE USE OF THE DRONE. THE CASE STUDY OF MOUNT SIRI (ANZI, BASILICATA)

1. Introduction

The use of drones and techniques of modern photogrammetry based on the Structure from Motion and Imaged-Based methodologies (Remondino, El-Hakim 2006; Caprioli, Scognamiglio 2009) allow the production of three-dimensional models related to partial areas or whole landscapes. By the 3D models, it is possible to extrapolate orthophotos, DEM (Digital Elevation Model), Google KMZ that can be added to GIS platforms for the analysis and the study of the investigated objects. Furthermore, 3D models produced in a very high resolution and precision way allow us to perform analysis on the microreliefs (Pecci 2016). In the field of archaeology, such techniques and methodologies have particular success, and they are established as a new tool of remote sensing (De Reu *et al.* 2013; Lasaponara *et al.* 2017).

In this contribution, the results of these applications will be shown in the archaeological investigation of the peak of Mount Siri, the acropolis of the ancient Anxia (Anzi, Basilicata). This is a very rich archeological area, in which several excavations, unfortunately known only through brief descriptions, were conducted since the 19th century.

2. Case study

The ancient centre, indicated in the *Tabula Peutingeriana* as *Anxia*, along the *via Herculia*, is located in correspondence of the modern village of Anzi (Potenza), on a rocky peak (Mount Siri, 1067 m) that dominates the surrounding territory. Due to its particular attitude as a natural fortress in the heart of the ancient Lucania, its privileged position with respect to the internal communication routes and its richness of natural resources, the site was always particularly suitable for human settlement.

Between the end of 18th and the first thirty years of 19th century, the researches in the territory of Anzi had a great success, but led to the systematic dispersion of countless archaeological findings (Donnici in press). Here, furthermore, new professionals were born: they were the "esperti scavatori" (expert archaeologists) and "rattoppatori de' cocci" (restorers of vessels) from Anzi, at that time known as the most renowned around the Kingdom of Naples (Donnici *et al.* in press).

As already mentioned, our case study concerns a small part of the territory of the modern Anzi: the peak of Mount Siri. In this area, crossed by Via Salita Rosario, we can now see the astronomical observatory, the Church of Santa Maria del Rosario and a tank of the local aqueduct. Moreover, until a few decades ago, the tower of a medieval fortress was still visible on the top. The slopes of the the peak are very steep (average slope about 45% on the southern part and 60% along the first hundred meters of the northern one).

The first reports of archaeological findings on the peak of Mount Siri are given by the Lucanian scholar Andrea Lombardi (Lombardi 1987, 75-74). He mentions the discovery, made before 1832, of more than a hundred ancient graves, «in the place called Coste di S. Maria, in the northern part of the village» (transl. from Italian). In the graves «some of the most valuable objects were found: Nolan and Sicilian figured vessels, some of them with Greek inscriptions; very good bronze objects, rare crystal vases and some golden or silver ornaments» (transl. from Italian).

About thirty years after Lombardi, G. D'Errico claims he could see on the Mount Siri the foundation of a castle, and the traces of an ancient road that, according to him, was a part of the *via Herculia* (D'Errico 1865, 76).

However, the news of excavations "a pozzetto", the so called "fogge", dates back to the beginning of 20th century, where ceramic fragments, amber objects and an iron spearhead were found (Di Cicco 1900, 36).

The last archeological findings in the area date back to the early 1980s, exactly close to the modern car parking in the northern part of the peak, where «a series of holes of a roundish shape in the ground» were discovered. Escaved in Middle Ages for landfill purposes, they contained a large number of archaeological materials that attests the human presence since the Iron Age (Bottini 1982, 48).

F.D.

3. Research method and results

The 3D model, realized with the drone and the Structure from Motion and Imaged-Based methodologies, was obtained processing 300 aerial images of the peak of the Mount Siri. Pictures were taken at zenith and at an angle in order to obtain a total coverage of the area. The drone we used is a DJI Phantom Vision 2+. The 3D model, elaborated with the Agisoft Photoscan software, results from a point cloud of 14,460,135 points, and a mesh of 32,988,767 faces; it was georeferenced on the basis of a previous topographical survey. From the 3D model it was possible to extrapolate the orthophoto (pixel size 0.0456361 m) and the DEM (pixel size 0.182544 m) to be analyzed in the GIS software (QGIS).

Fig. 1 – 3D Model and DEM of the peak of Mount Siri.

Starting from the analysis of the microrelief (Fig. 1), we can clearly see a straight mark in the north-eastern part of the peak, perhaps due to the presence of an ancient road, now disappeared. If this hypothesis is correct, the road was very large (about 14 m) and directly connected with the modern one which runs below (strada Campo Sportivo San Donato). We are probably in front of the access road to the medieval fortress, almost certainly the road identified

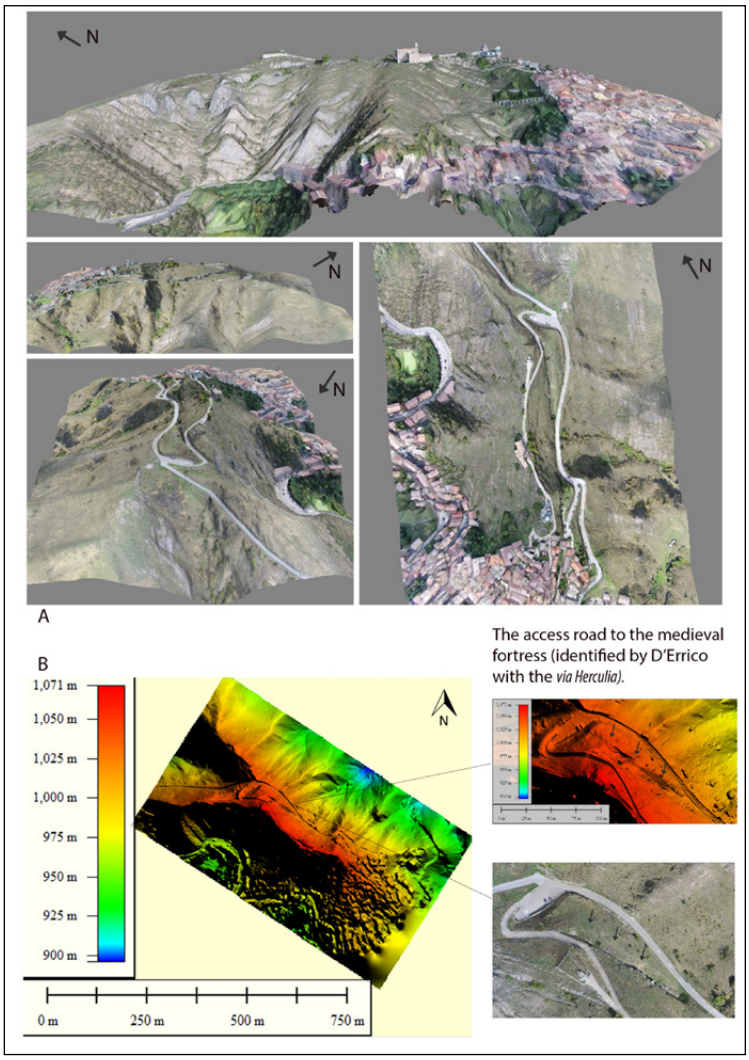

Fig. 2 – Orthophoto of the peak of Mount Siri.

by D'Errico as the *via Herculia*. In the orthophoto (Fig. 2), furthermore, we can see with a certain safety the holes identified by P. Bottini in the northern part of the modern car parking.

Relying on these types of crop marks, it is easy to identify other similar discoveries, perhaps the "fogge" found at the beginning of the 20th century by the archaeologist V. Di Cicco.

Other crop marks can be seen in the orthophoto, in a special way along the northern slopes of peak of Santa Maria (precisely in NE direction), namely the findspot where the graves were found in the early decades of 19th century.

4. Conclusions

News technologies of remote sensing on Unmanned Aerial Vehicle (UAV) platform allow us a qualitative and quantitative increase of the archaeological data. In some contexts, like that one discussed in this paper, they seem to be the only instruments capable of making more information, also in absence of an archaeological excavation. In our case study, they have enabled us to geolocalize, with good certainty, the archaeological discoveries that occurred in the past centuries, being able to fix them in the space with a high degree of accuracy.

A.P.

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ABSTRACT

Modern archaeologists often find it difficult to identify the exact position on the field (and on the maps) of the finds brought to light during archaeological excavations, particularly those conducted before the second half of the 20th century. In these cases, in fact, they are obliged to record data and information on their GIS as being unable to locate the correct place, or even the area, of those ancient archaeological investigations. This inability to be precise creates several problems from a topographical point of view and negatively influences the archaeological reconstruction of specific territories or sites. Therefore, how is it possible to correctly locate and, as a result, mark on the map what was discovered or excavated in the recent past? One possible solution is the 3D reconstruction of a modern landscape through the use of the UAV technology and some derived applications, such as digital techniques based on Structure from Motion and Imaged-Based methodologies. The 3D model can be analyzed using the GIS system, and through the analysis of the micro-relief and aerial photos it is possible to use an important tool to locate past archaeological investigations. In this paper, we present the case study of Mount Siri (Anzi, Basilicata), the location of several important archaeological discoveries which were made during the 19th century.

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