

103. Detecting and interpreting fossorial marks in mountainous environment: From ground surveys to UAV prospections

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Since the very beginning of aerial archaeology, surface anomalies like soil, vegetation and shadow marks have always been the main elements for the identification of the buried archaeological record through remote sensing.

The increasing resolution of passive sensors and the introduction of active sensors (such as Lidar and SAR) have enabled a substantial step forward in the detection and interpretation of such anomalies. Furthermore, the advent of UAVs (Unmanned Aerial Vehicle) has given an outstanding contribution on the acquisition of remotely sensed data with ultra-high spatial resolution; this, in turn, resulted in an even more efficient identification of surface traces with archaeological significance. The technological contribution of these methodologies has triggered new challenges and new analytical and interpretative possibilities for the study of archaeological landscapes.

This paper aims to explore a peculiar type of surface anomalies which is usually associated by the archaeologists with post-depositional bioturbation processes: the molehills or, more generally, small piles of soil created by burrowing animals. It is indeed undeniable that the excavation of tunnels affects the buried archaeological record and compromises the stratigraphy causing a loss of information (Wilkinson, Richards, and Humphreys 2009). But despite disturbing the stratigraphy, these actions can also bring to the surface evidence of what is lying underneath the ground; for this reason, such traces – identified and recognized thanks to aerial and ground surveys

– can be used to identify and define the extension of archaeological sites and sometimes even those of specific structures. Anthropogenic layers are indeed the ideal ecosystem for the proliferation of micro-mammals, because of the lower compactness in the sediment and the greater supply of organic matter useful for their subsistence. Previous works have provided a very clear evidence of the usefulness of molehills and similar structures as a precious source of information during ground surveys (Sapir and Faust 2016; Trachet et al. 2017). However, in this presentation we want to focus on the potential of UAVs for investigating the surface patterns of these structures and their relevance in the archaeological interpretation of buried archaeological remains. Also, distinguishing the burrowing species involved case by case represents an exceptional source of information, as ethological studies can help in reconstructing the average dimension and penetration of the tunnelling, thus offering improved data regarding the maximum depth of the resulting material, both soil sediments and archaeological remains.

For this purpose, three case studies belonging to different chronological periods, but all located in mountainous areas, have been selected: the protohistoric site of Monte Corgnon in the municipality of Lusiana (Vicenza), a group of Great War trenches in the Laiten area – Asiago (Vicenza) and a series of charcoal pits distributed along the Prealps of Veneto. By analysing the results obtained in these sites, the presentation will illustrate the potential of UAV imaging for analysing the pattern of surface traces left by fossorial mammals, mostly moles and voles, but also including badgers, rabbits, and foxes.

From a methodological point of view, an approach combining qualitative analysis with quantitative data was adopted. The study involved a systematic application of field survey, UAV-derived imagery, historical aerial photographs (which proved particularly helpful as a validation strategy for the case study relating to the First World War), and distribution analysis. The process pipeline varied according to the case study, but included in all cases field observations, analysis of the exposed stratigraphic windows, and acquisitions with UAVs, and GPS.

Two different commercial UAVs of the DJI company, a Phantom 2 and a Mavic 2 pro, were used for drone acquisitions. The flight altitude was always quite low, between 5 and 10 m, to grant an adequate spatial resolution.

Historical aerial photographs were only employed for the validation process in the case study of the Laiten of Asiago. These are frames taken by the French Air Force between 16 March and 7 October 1918, during the last year of the First World War.

Only for the protohistoric settlement of Monte Corgnon, we collected and quantified the artefacts discovered on each of the molehills. This allowed us to produce distribution and density (both point and kernel) maps concerning the quantification of artefacts.

The use of multiple of methodological approaches is of course dependent from the research questions and the type of archaeological structure investigated.

Finally, it is important to underline that this reappropriation of anthropogenic layers and structures by the fossorial fauna fits very well in the framework of site formation processes caused by a continuous alternation of natural and anthropic interactions with the archaeological record. Yet their study – not only from a terrestrial, but also from an aerial perspective – can provide very important clues to interpret the extent and preservation rate of subsurface archaeological structures, offering a time and cost-efficient method to guide archaeological surveys.

References

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