

Roccia San Sebastiano cave. Signs for space analysis

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Roccia San Sebastiano is a tectonic-karstic cave located on the southern slopes of Mt. Massico (Mondragone-Caserta) in Campania, southern Italy. Systematic excavations have led to the exploration of an important Pleistocene deposit dated from the Middle to the Upper Palaeolithic. The archaeological sequence documents the transition between the last Neanderthals and the first *Homo sapiens* in Italy. The site's significance is enhanced by the presence of rock art, which includes signs traced on the cave's natural surfaces. These symbolic activities can be attributed to the Gravettian phase.

The cave is part of an intense settlement system during different phases of prehistory (Collina and Piperno, 2018, pp. 14-21; Aiello et al., 2018, pp. 70-85). Indeed, numerous localities of prehistoric interest have been identified in the Mondragone territory and plain during several reconnaissance campaigns. Among these, the most significant are those related to the early (Arivito) and later phases of the Upper Paleolithic (Incaldana - Roccia San Sebastiano), the Neo-Eneolithic (Arivito, Starza, Bagni Solfurei, San Pietro) and the Bronze Age (Bagni Solfurei, Sant'Eufemia).

The site represents the only stratigraphically investigated evidence of Paleolithic frequentation in the area between the northern coast of Campania and the southern coast of Latium. In particular, the Cave of Roccia San Sebastiano, due to the richness of its deposits, constitutes one of the most important testimonies of Gravettian frequentation in southern Italy. It represents a landmark for the study of the final phases of the Neanderthal settlement and the first arrival of *Homo sapiens* in southern Italy and, more generally, in the western Mediterranean. In particular, the most recent excavation campaigns have highlighted the Uluzzian levels, investigated the Mousterian levels from which a deciduous molar of a Neanderthal child came (currently being studied – Collina et al., 2020, pp. 11-24), and consolidated the study of symbolic activities in the cave.

An engraved stalagmite with discernible traces of red ochre, as well as sequences of marks on the vault form clearly intentional geometric patterns. The complex stratigraphic sequence, which attests to the different phases of site use and the articulated orographic context of Roccia, also due to the presence of a quarry that lapped the cavity, required a programme of 3D digitization of the site, which began in 2012.

The survey was developed from a preliminary outline of the planning and organization of activities with the objective of integrating the data produced into specific procedures, which were structured according to a rigorous and scalable methodology for the different areas of research. The intention was to integrate the data generated by the survey within a utilization dynamic that took into account the processes of updating and developing new technological systems for data production and management. Consequently, the digitization of the sites is developed over an extended period, defining an order of interventions on different scales. These include the territorial survey and the detailed survey of the archaeological layers and signs. This approach supports both the excavation activities, with an accurate documentation of the sites, and the subsequent phases of analysis and communication through specific multimedia products. Consequently, a coordinated utilization of technologies has been devised over time with the objective of generating data that can be integrated within a single digital representation system. This will enable each product of the survey to be related to the specific aims of the project.

A wide array of instrumentation has been used for this study, including: RIEGL LMS-Z 420i and VZ400 time-of-flight scanners, ScanProbe LT - Scansystems structured light scanners, Artec Eva structured light scanners, image-based systems, IDS's HI-MOD georadar and Dino-Lite microdigitalization systems. All the numerical models were processed and aligned in a single digital space, allowing for the verification of the stratigraphic heights and contexts of the cave's use, as well as the characterization of the anthropic signs within the space. Data analysis was conducted using visualization tools with the objective of defining possible geometric matrices, gestures and representation techniques. In order to enhance the interpolation of the signs on the complex cave surfaces, a data modeling methodology in space - SIM (Spatial Information Modeling), was developed through processes of segmentation of numerical models associated with different levels of data relationships (Repola, 2018, pp.781-788). The utilization of multiple instruments has enabled the generation of models at different resolutions, which has allowed the characterization of the study areas in relation to the specific peculiarities of the rock (natural surfaces, stalagmites, graffiti areas). This has resulted in the possibility of undertaking a multi-scalar analysis of the anthropic signs through visualization levels in the order of microns (for microphotogrammetric acquisitions) and centimetres (for laser scanner surveys).

Lastly, a 3D GIS platform integrating all the models, documentation and analysis of the site, data from the various context studies and finds has been implemented. This represents a more extensive research communication system incorporated in the new Mondragone Civic Museum.

References

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