When university travel restrictions were lifted and international borders reopened in May, we traveled to Isola San Pantaleo, a small island in the Marsala Stagnone, a protected bay on the west coast of Sicily midway between the cities of Marsala and Trapani. The stagnone is flanked by low vineyard-covered hills on the Sicilian mainland, the source of the famous Marsala wine. Ancient salt pans line the stagnone’s shore, where windmills are still used to move seawater in and out of the evaporation basins.

Isola San Pantaleo (or in colloquial Italian, Mozia) is best known as the location of the ancient city of Motya, a Punic center with close ties to Carthage that met abrupt destruction in 397 BCE when it was sacked by Syracusan Greeks at the end of the Siege of Motya. Today, Mozia is an archaeological park where elements of the ancient city still stand tall after more than 2000 years, including monumental buildings, a ceremonial pool, and the remains of imposing fortifications that follow the islet’s coastline. Elsewhere, more humble remains such as potsherds and fragments of architecture peek out through flowering gardens and vineyards that produce award-winning Grillo wines.

The historic record of occupation on Mozia, and the period most relevant for our fieldwork, begins in the 8th century BCE when Phoenician merchants from modern-day Lebanon established an outpost on the island. These pioneers recognized the advantages that a small island in a protected lagoon provided for exchange with Indigenous Sicilians and Greek colonies, and as a waypoint for ships traveling between the eastern and western extremes of the Mediterranean Sea. Over the next few centuries, the settlement expanded from what
was likely an unfortified trading post to a city that covered the entire 45 hectares of the island in the 6th century BCE. At its height, Motya is thought to have been a dense concentration of workshops, sanctuaries, and public buildings surrounded by massive fortifications and connected to the mainland by a masonry causeway via the main gate at the north end of the island.

The ethnic and cultural diversity of Motya’s citizenry, and that of other Phoenician and Punic settlements in the central Mediterranean, has been a longstanding point of interest. Archaeologists are making inroads on this issue by using new scientific methods to reassess old results and to carry out fieldwork. For example, reanalysis of ceramic forms from Motya’s earliest remains demonstrates that the city was a multi-ethnic mix of people practicing Levantine Phoenician traditions with materials and forms indigenous to the central and eastern Mediterranean (Delgado and Ferrer 2006). Likewise, genetic material collected from burials at Mozia and from other Phoenicio-Punic sites in the central and western Mediterranean show that Indigenous populations mixed with Levantine peoples and potentially comprised a larger part of the population in these settlements (Matisoo-Smith et al. 2018).

Our project, “Space and Identity in Ancient Motya,” co-directed by Dr. Paola Sconzo (University of Tübingen) and conducted as part of the University of Palermo project at Mozia (under Professor Aurelio Burgio, University of Palermo), emphasizes geophysical survey combined with limited test excavations to map the layout of the city with minimal disturbance of the archaeological remains. Our goal is to connect urban planning concepts and architectural forms with known cultural traditions in the Mediterranean and Western Asia. In doing so, we hope to tease out the way the city developed over time and identify the ethnic orientations of Motya’s inhabitants by how they used space. This research builds on a prior geophysical survey at Mozia in which we used magnetic gradiometry to map a section of the city plan. Major support for that research and this iteration are provided by the Gerda Henkel Foundation.
GEOPHYSICAL SURVEY

Geophysical survey methods use digital sensors in the air or on the ground to measure physical properties of materials at or below the ground surface. The data collected by these instruments are used to create images that have the potential to reveal evidence of archaeological remains or changes in the landscape. Geophysical methods can be considered part of a broader suite or approaches termed remote sensing, which includes data from aerial and satellite sensors. Remote sensing approaches provide two primary advantages over traditional archaeological methods: the ability to detect physical changes over time or space that are invisible to the naked eye and the ability to investigate archaeological sites and landscapes non-invasively, that is, without destructive excavation.

Our work in the summer of 2021 relied heavily on the Center for the Analysis of Archaeological Materials’ (CAAM) capacity for digital recording in the field, including survey-grade GPS receivers and two geophysical instruments: a magnetic gradiometer and an electric resistance meter. In addition, a frequency-stepped multichannel ground-penetrating radar (GPR) array was used to survey open ground that was not under cultivation. With multi-channel GPR, a set of integrated antennas produces a near-3D image of buried materials and structures by measuring how radio waves reflect off buried materials. The combination of a wide swath covered by multiple antennas and GPS integration also provides the benefit of rapid survey coverage, enhancing overall efficiency of data collection.

The majority of our 2021 results come from our magnetic gradiometry survey, which records minute variations in the intensity of the Earth’s magnetic field. These variations are influenced by the distribution of iron-bearing materials in soils, affected by adding or removing magnetic soils or materials in construction, depositing iron-rich organic materials, or burning.

Using CAAM’s magnetic gradiometer, we were able to drastically expand upon the 2017 coverage to reveal almost all of the east half of the ancient city (Herrmann and Sconzo 2020). Our latest results found that a gridded plan oriented to the central axis road that we first mapped in 2017 does extend outside of the northeast quarter. However, we also found that the farther one gets from the central axis, the more likely structures are
Comparison of magnetic gradiometry and electrical resistance results over the same structure. A strong magnetic feature in the gradiometry data is seen in the resistance data as a circular installation, indicating that the magnetic feature is a built structure rather than a piece of magnetic rubbish at or near the surface. Figure by Jason Herrmann.

to be distributed according to the landscape rather than an orthogonal grid. We also were able to identify larger structures on the island's interior, many of which seem to be dotted with clusters of pyrotechnic installations that we interpret to be primarily kilns.

The idea that pyrotechnic installations are regularly distributed across the buildings at Motya has been suspected since the initial magnetic gradiometry survey, which recorded a number of highly magnetic circular features throughout (Herrmann and Sconzo 2020). The shape and intensity of these magnetic features, however, were strikingly different from the surrounding patterns, and the influence of modern activity, specifically the presence of metal rubbish, could not be ruled out as the source of these signals.

An electrical resistance survey carried out over one of the large buildings mapped with magnetic gradiometry in 2021 helped us to verify our interpretation of these features as pyrotechnic installations. Electrical resistance surveys record the ease at which an electric current passes through the soil near the surface. Differences in soil density, salt content, and moisture influence the ease by which a current is transmitted and reveal patterns in the way materials are arranged below ground. The resistance survey results confirmed the shape and location of the walls mapped with the magnetometry and showed that one strong magnetic anomaly is a buried archaeological feature, rather than a piece of strong magnetic detritus on the surface. This small area of resistance survey does much to advance our interpretation of the expansive magnetic gradiometry survey results and helps us to extend this interpretation to similar circular magnetic features at Motya.

FUTURE PROSPECTS

We hope to build upon the success of our work in the summers to come with an extensive surface collection that will match the extent of the geophysical surveys as well as with limited test excavations to verify key features visible in the geophysical prospection results. The research we have planned will be conducted jointly by the Penn Museum and the University of Palermo with the hope of providing students from both institutions with opportunities for training, experience, and intercultural exchange.

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CITED AND RELATED ARTICLES


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