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Reconstructing hidden landscapes. DC and EM prospections in the Terramara Santa Rosa (bronze age settlement - northern Italy)

M. Mele, M. Cremaschi, M. Giudici, A. Bassi, C. Pizzi, and A. Lozej
University of Milan, Earth Science Department, Italy (mauro.mele@unimi.it)

The Terramara Santa Rosa is an archaeological site, located in the Po alluvial plain (northern Italy), which has been explored since 1986. As as seen by aerial photograph, Santa Rosa site is constituted by two moated villages of the Middle and Late Bronze Ages (1600–1150 BC), delimited by earth rampart.

The smaller and older settlement (Villaggio Piccolo; VP), to the North, has a nearly circular shape and was founded during the Middle Bronze age, whereas the larger and younger one, delimited by a wide U-shaped rampart, is mostly dates to the Recent Bronze age. These settlements are surrounded by wide, asymmetrical moats, smooth and gradual on the exterior, steep and inaccessible on the village side, running parallel to the villages fences and being part of a complex hydraulic system; stratigraphic excavation involved the VP, at the transition between the VG and the hydraulic system, to the South.

As the Bronze landscape is today sealed by flood plain clays, up to 3-4 m thick, which hide the archeological features and constitutes the present-day topography, a large-scale geophysical survey was planned to integrate to map the buried structure of the settlements and surrounding areas and to yield useful information to plan future archeological excavations.

At this purpose, Direct Current Electrical Resistivity Imaging (ERI) and Electro-Magnetic Induction (EMI) geophysical prospections were applied to reveal the near-surface, lateral and vertical heterogeneities in order to improve the likelihood of locating the villages, the moats and other hidden targets in the surroundings.

70 ERI profiles, with Wenner and Wenner-Schlumberger array were collected with roll-along technique and electrode spacing ranging from 1 m to 3 m, for an exploration depth of 15 m below the ground surface and a total length greater than 9000 m. EMI survey was conducted over a 16 ha wide area in order to map shallow heterogeneities at the entire site scale. Data acquisition was conducted with a ground conductivity meter, simultaneously transmitting at 5 kHz and 15 kHz frequencies, and using a vertical magnetic dipole configuration with 1.2 m distance between the coils. Measures were acquired in continuous mode (data sampling 1 Hz) with a parallel profiles with 5 m separation.

ERI and EMI surveys revealed a number of apparent resistivity anomalies, supported by the results of the DC ERI data inversion. As the electromagnetic response of the site is strongly controlled by electrically conductive, loamy-clay sediments for which the presence of coarser textures (fine sand) increases the electrical resistivity, both geophysical survey highlights in a very neat and definite way i) the location of the villages, characterized by the highest electrical resistivity due to the increase of sandy textures that presumably build up the meandering point-bar complex where the villages were built on, ii) the moats that surround the settlements, which appear as a conductive structure and iii) several local anomalies in the surroundings, some of which can represent possible archaeological targets.