Journal of Archaeological Science 40 (2013) 4648–4662

Contents lists available at SciVerse ScienceDirect

Journal of Archaeological Science

journal homepage: http://www.elsevier.com/locate/jas

The Terramare and the surrounding hydraulic structures: a geophysical survey of the Santa Rosa site at Poviglio (Bronze Age, northern Italy)

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ARTICLE INFO

Article history:
Received 17 May 2012
Received in revised form
23 May 2013
Accepted 28 June 2013

Keywords:
Archaeogeophysics
Bronze Age
Geoarchaeology
Irrigated agriculture
Landscape archaeology
Northern Italy
Terramara

ABSTRACT

The Terramara Santa Rosa is a Middle and Late Bronze Age archaeological site located in the Po alluvial plain, northern Italy. It is constituted of two moated villages delimited by earthen ramparts. The peripheral structures of the site are sealed by fine-textured flood plain deposits and they have not been fully explored through excavation due to their large extent. Because the shape of the villages and their relation to moats and the fluvial network are of paramount importance to understanding the landscape management and the use of water resources in the Terramare civilisation, a geophysical survey was planned to extend the results of the existing archaeological excavations to the site scale. A frequency-domain electro-magnetic sounding (FDEM) and electrical resistivity imaging (ERI) covered an area of approximately 26 ha; ERI was conducted for a total length >9000 m. Despite the predominance of electrically conductive fine-textured sediments, electrical resistivity anomalies were observed and they were attributed to subtle lithological differences in the sedimentary context of the alluvial plain. The geophysical interpretation, after the calibration with the excavation data, revealed the structures of the Terramara and of the surrounding hydraulic network, which are not visible at the surface due to flood plain deposits. The Santa Rosa site was founded in a favourable geomorphological position, on the top of a crevasse splay lobe of the adjoining Po palaeo-channel, rising above the surrounding alluvial plain. The Terramara and their surroundings were delineated through an artificial modification of this pre-existing crevasse splay lobe and a well-targeted urban design, with the objective of diverting water, most likely from a palaeo-channel of the Po River, through the digging of peripheral moats used to collect water around the site and to distribute it to the surrounding fields for irrigation. The water management documented by this study in the Terramara Santa Rosa can be considered as paradigmatic for the whole Terramare civilisation, which is therefore responsible of the introduction of the irrigated agriculture into western Europe for the first time.

1. Introduction

The Terramare are the archaeological remains of banked and moated villages of the Middle and Recent Bronze Ages (1600–1150 BC), located in the central alluvial plain of the Po River. They are evidence of a complex society, whose subsistence was based on intensive agriculture, pastoralism, and long-range trade (Mutti, 1993; Barfield, 1994; Bernabò Brea and Cardarelli, 1997; Cardarelli, 1988). It reached its apogee at the beginning of the Recent Bronze Age and, at the end of this period, it suffered a societal collapse that led to the abandonment of the villages in a few generations (Cardarelli, 2010).

The shape and the structure of the villages have been a main topic of the archaeological research focused on this civilisation, since the first seminal studies (Strobel and Pigorini, 1864; Chierici, 1881) and also in recent research projects (Bernabò Brea and

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0305-4403/$ – see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.jas.2013.06.033

Cardarelli, 1997; Pearce, 1998). The villages were supposed to have been built following sophisticated urban planning, as they are square in shape, with houses on posts that are distributed in regular rows, and enclosed inside earthen ramparts. They were supposed to be surrounded by a moat connected to an adjoining river through a canal network (Strobel and Pigorini, 1864; Chierici, 1881). This scheme is still under discussion (Pearce, 1998), but is supported by recent research on aerial photographs (Fig. 1) which show the existence of moats around most of the sites (e.g., Terramara Gaione – Mutti, 1993) and, in several cases, a direct connection with a neighbouring water course (e.g., Terramara La Falconara – Calzolari, 1997; Terramara Fabbrica dei Soci – Cremaschi, 1997; Terramara Castello del Tartaro – Balista and De Guio, 1997). At present, it is hypothesised that the moats were designed not only with a defensive goal, but also to collect water from the local fluvial network and distribute it to cultivated fields around the site (Balista, 1997, 2002; Cremaschi and Pizzi, 2007, 2011; Ferri, 1989, 1996), to sustain the irrigated agriculture on which the subsistence of the Terramare was based. The availability of water played a vital role for this culture, and it has been proposed that a dry climatic crisis is a possible cause of the disappearance of the Terramare (Cardarelli, 2010; Cremaschi, 2010; Cremaschi et al., 2006). Consequently, exploring the shapes of the villages and their relation to the moats and the fluvial network is of paramount importance to understanding the level of land exploitation performed by the Terramara culture on the surrounding landscape. Up to now, the knowledge about the shape of the sites and the presence of moats and ditches was manly based on aerial photographs, because subsurface surveys and archaeological digs extended at the site scale was lacking.

An archaeological project focused on these problems has been on-going since 1984 at the Santa Rosa site (Poviglio, Reggio Emilia, Italy; Fig. 2). At present, it is one of the largest archaeological excavations of European prehistory (Bernabò Brea and Cremaschi, 1996, 2004a, 2004b; Cremaschi, 2004, 2013). An area of nearly 1 ha has been unearthed from a larger 7 ha site, and a detailed geophysical survey was carried out over the site and in its closest

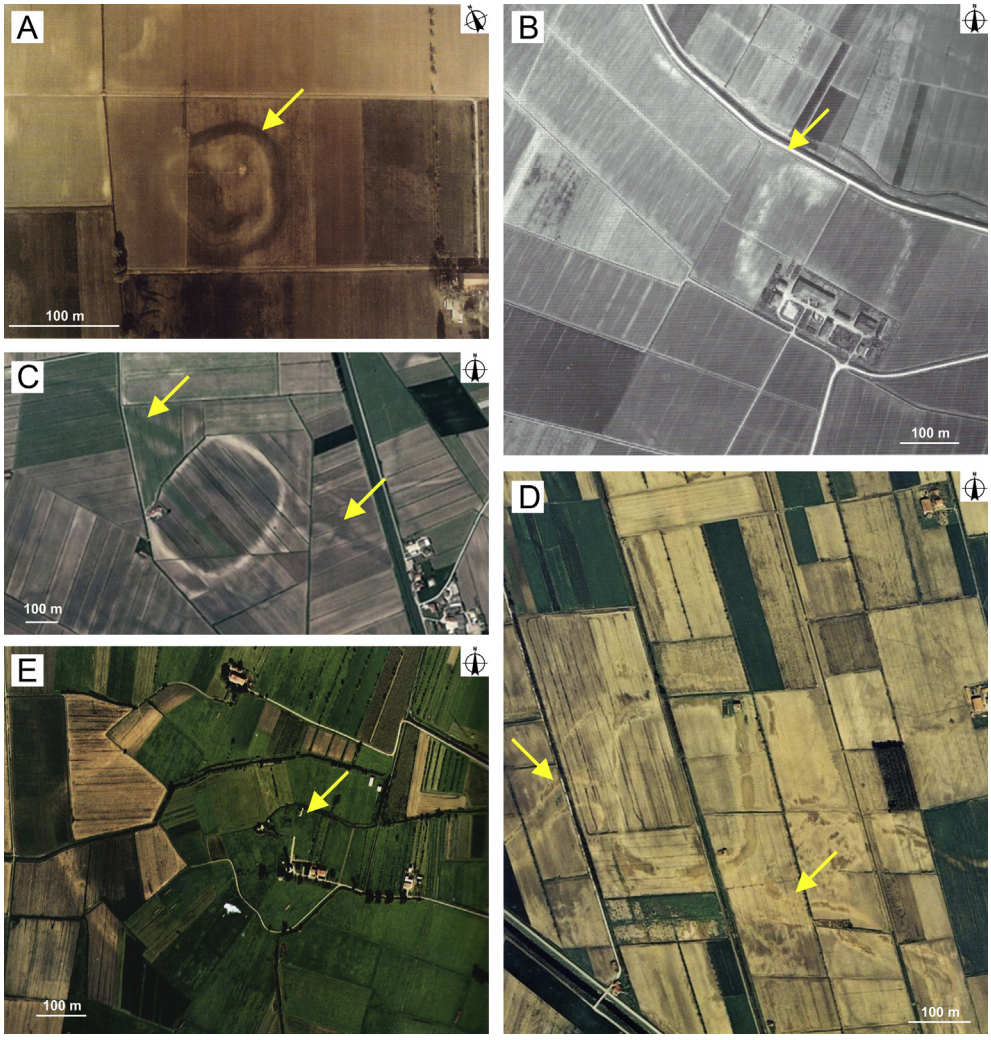

Fig. 1. Aerial images of Terramare quoted in the text and their relation with surrounding moats and fluvial network. A) Terramara Gaione (Parma; Mutti, 1993): the moat is the dark coloured strip (indicating organic rich deposits) around the earth rampart (in light colour). B) Terramara La Falconara (Modena, Calzolari, 1997): the contour of the Terramara is indicated by the earth rampart (in light colour). Arrow indicates the location of a paleochannel connected with the moat which existed around the site but poorly evident in the aerial photograph. C) Terramara Castello del Tartaro (Verona; Balista and De Guio, 1997): the earth rampart (in light colour) and the moat (dark sediments strip) are clearly visible. Arrows indicate the paleochannel in connection with the moat. D) Terramara Fabbrica dei Soci (Verona, Balista and De Guio, 1997; Cremaschi, 2009): the earth rampart and moat are clearly visible together with the connection to the paleochannel (indicated by arrows). E) Terramara Case del Lago (Reggio Emilia; Cremaschi, 2009): Terramara composed by two villages (the smaller village is indicated by the arrow). The earth rampart in surrounded by a moat indicated by dark coloured strip (indicating organic rich deposits). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)