3.3 The prehistoric peopling process in the Holocene landscape of the Grosseto area: How to manage uncertainty and the quest for ancient shorelines

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ABSTRACT

In this paper, we intend to discuss the evolution of the Holocene prehistoric landscape in the Grosseto area (Southern Tuscany, Italy) and the interaction with the pre- and proto-historic peopling process. The study area consists of an alluvial plain pertaining to the Ombrone and Bruna rivers, demarcated by the Hills of Castiglione della Pescaia and Grosseto towards the north and east and by the Uccellina Mountains towards the South. The area was characterised by a marine and lagoon environment until 2800 BP. Then a progressive transformation led to the formation of the Prile Lake, which afterwards gave place to salt marshes. The present alluvial plain seems to be the result of several reclamation activities, which occurred during the last four centuries.

Our ongoing research is focused on the reconstruction of the Holocene prehistoric landscape, highlighting what we consider to be those features of the past that are still observable in the present, and most likely responsible for the formation of the present-day landscape. From an archaeological point of view, the evidence found in the area consists mainly of prehistoric funerary remains found in caves in the hills which surround the alluvial plain. The lack of information relating to settlement and production activities introduces some uncertainty. Which features of the landscape still preserve evidence from the Neolithic to the Bronze Age? How can we make use of the biased archaeological dataset?

To answer to these questions we have taken into consideration the relevant impact of sea level changes on the landscape as well as the land use. To the same end, we have devoted particular attention to identifying and defining the micro-topography of the Holocene prehistoric landscape. This research has been developed using GIS and drawing on a multi-scale dataset which includes archaeological excavation and survey data, historical cartography and aerial photographs.
KEYWORDS

prehistoric landscape, prehistoric settlement strategies, GIS analysis, BIAS factors

INTRODUCTION

This paper represents the initial step of our ongoing research into the interactive processes between people and landscape in the Holocene landscape of the Grosseto Area (Southern Tuscany, Italy).

The study area is an alluvial coastal plain that has been characterised by substantial changes during the last 20,000 years. From a Landscape Archaeology perspective, the understanding of these dynamic conditions is fundamental to the investigation of prehistoric settlement strategies as part of the general Man-Environment relationship. Moreover, analysis of the landscape evolution can contribute essential clues to understanding the settlement strategies that occurred from the Neolithic to the Bronze Age (6th-2nd millennium BC). Along with a description of this case study, we will present the methodological approach and the research strategies that we have developed within the Grosseto context, striving to elaborate upon our management of the uncertainties which characterise this archaeological data.

We have chosen, from the various meanings of uncertainty, the one that refers to doubts arising due to incomplete information (Foody & Atkinson 2002) and we have mapped out our variables of interest (e.g. prehistoric evidence of the Grosseto Plain) assessing these uncertainties in our maps.

GEOGRAPHIC CONTEXT

The study area consists of the alluvial plain of the Ombrone and Bruna rivers, an area demarcated by the Hills of Castiglione della Pescaia and Grosseto towards the north and east, and by the Uccellina Mountains towards the south (fig. 1). Several studies have been conducted by geologists in the Grosseto Plain (Innocenti & Pranzini 1993; Stea & Tenerini 1996; Bellotti et al. 1999; Bellotti et al. 2001; Bellotti et al. 2004; Lambeck et al. 2004). They were mainly interested in understanding the general dynamics of sea level and coastal changes on a large scale. Detailed information on soil characteristics, land unit interpretation (Arnoldus-Huyzendveld 2007) and palaeonvironmental reconstruction (Biserni & van Geel 2005; Arnoldus-Huyzendveld 2007) is also available on a more convenient scale for a landscape archaeology approach, and has been widely employed in our research. To summarise the landscape changes occurring in the plain, we should indicate that since the Wurm III (40,000-20,000 BP), when sea level was about 120 metres below the present-day level, a large area extending beyond the actual coastline was covered by fluvial and aeolian deposits, divided into two valleys by the main rivers, the Ombrone and the Bruna. Evidence of these eroded deposits is still visible in the outcropping of low terraces along the borders and in the central part of the plain. Subsequent to this occurrence, i.e. during the Versilian transgression (17,000-6,000 BP), an irregular rising of the sea level caused dramatic changes in the landscape, and as a consequence, the valleys, previously eroded by the above-mentioned rivers, became inlets. Quoting Bellotti (2004, 85), around 10,000 BP ‘the palaeogeographic setting of the area was characterised by a lagoon extending perpendicularly to the shoreline which was 2.5 km further inland than
today. The Ombrone river flowed into the lagoon, building up gravelly–sandy fingerprint deltaic bodies (fig. 2).

It may be said that around 6,000 BP, when the sea level reached present-day heights, the role of the fluvial sediments was very determinant in shaping the landscape (fig. 3). The Ombrone River mouth prograded inside the lagoon, causing large accumulations, whilst the Bruna River, less rich in clastic sediment accumulations than the Ombrone, created a wider lagoon at the northern end of the Grosseto Plain. The Pleistocene deposits, accumulated in the central part of the plain, were still surrounded by water – as they had been since Etruscan times (8th-3rd century BC). It is after the 3rd-2nd century BC that the southern part of the plain was filled with Ombrone deposits, whilst the northern part was still a lagoon, which then converted to the lake Lacus Prilius (Curri 1978). Afterwards the coastal lake gave way to salt marshes, which underwent several reclamation efforts during the last four centuries for conversion into arable land. Medicean levees (17th century) and several channels regulated the flow of water into the plain, whilst the ‘colmata’ reclamation activities (18th-20th century) carried out sediment distribution in the area of the plain previously occupied by water.

When we take the above into consideration, it is clear that we are dealing with a context in which the incursion of environmental changes and human activity on Holocene pre- and protohistoric settings
is quite significant. The present-day surface in the Grosseto Plain has little resemblance to the Holocene prehistoric surface. In fact, some areas of the plain were submerged at that time by the inlet basins and gradually transformed into lagoons. In addition, the prehistoric shorelines may have been disturbed by erosion and accumulation processes related to sea level changes and palaeo-hydrographical activity. Furthermore, reclamation activities and continued agricultural exploitation may also produce bias factors which affect the analysis of archaeological data obtained by field survey activities.

**PREHISTORIC CONTEXT**

Southern Tuscany, and in particular the Grosseto district, is an area that has been part of the diffusion process of Holocene prehistoric cultures in Central Italy. Since the Neolithic period, this area may have played the role of ‘coastal bridge’ between the Tuscan archipelago islands, which lay in front of the Grosseto Plain, and the interior zones of Central Italy composed of Monte Amiata, the Siena district and the
Appennine area. In fact, during the first part of the Neolithic, the raw materials and many kinds of artefacts arriving from the Mediterranean Sea (e.g. obsidian from Lipari Island) and by north-western regions (green stone and incised ware) have been found in the Archipelago and along the coastal zone from Pisa to Grosseto (Tozzi & Weiss 2000). As concerned the Neolithic cultures, the Grosseto district is included in the zone of Mediterranean Neolithisation of ‘Cardiale-ware’ from the Tyrrhenian area and incised pottery from the Northern Italy.

Prehistoric evidence in the Grosseto district is very scarce, and very few obsidian blades dating to the Early Neolithic (middle of 6th millennium BC) have been found in the inland site of Manciano. Little evidence related to the generic Neolithic period has been discovered in the interior part of the district (Monte Amiata and Massa Marittima) and along the coastal area at Monte Argentario, Castiglion della Pescaia, Follonica, and in the urban centre of Grosseto and Roselle (Fugazzola Delpino et al. 2004; Grifoni Cremonesi 1970; Mazzolai 1960). Cardial pottery in caves has been found at Grotta dello Scoglietto (Cavanna 2007) and at Grotta del Fontino where two burials (dated 6420 ±40 BP) are associated with incised pottery of the facies Sarteano-Sasso (Vigliardi 2002). Ongoing rescue archaeology research reveals an Ancient Neolithic site located on the watershed hill on the north-eastern side of the Grosseto district (preliminary data, unpublished). Also, the findings of Cardial Ware in the site of Pienza – Siena district – (Calvi Rezia 1972, 1973; Calvi Rezia et al. 2000, Calvi Rezia et al. 2007), in the interior part of Tuscany, testify to exchanges between inland and coastal areas. The connection between the Siena and Grosseto districts – the interior and the coastal zone – is very important. We can assume that the communication system could have been developed through the hydrographic network formed by the Ombrone and Orcia Rivers.

Figure 4. The Copper Age sites in the Grosseto District.
In order to better understand the peopling dynamics during the Neolithic period (Volante 2007) in the Grosseto Plain, it is necessary to improve and augment our information on prehistoric evidence, which has up till now been very scarce in our study area. One of the challenges of our research is to identify, in the Landscape of today, the shorelines and landing places that could have been exploited and crossed during the Neolithic period in the framework of maritime – inland communication. As concerns the Copper Age (3rd millennium BC), we can observe other types of problems caused by the lack of prehistoric information. In fact, settlement areas and dwelling activities have not been uncovered or recorded. Instead, funerary complexes, as collective burials, have been discovered. These have been mainly found inside natural caves located on the calcareous hills which surround the alluvial plain (fig. 4).

The improbable lack of settlement and production activities occurring in the Grosseto Plain gives rise to several questions and forces us to deal with uncertainty. Such partial results can also be explained by archaeological preservation problems and by a general trend of the 20th-century archaeological research to investigate mainly cave contexts. Taking into account these biases, we must also investigate which features of the landscape may preserve the pre-protohistoric evidence.

PREHISTORIC LANDSCAPE: PROBLEMS OF UNCERTAINTY

The absence of prehistoric data recorded in the plain is probably caused by several factors. Some are surely related to the history of the researches, often performed in an unsystematic way and focusing exclusively on the caves. But the more effective ones are the dynamic changes of the geographical settings over the last 10,000 years ago.

Because of these factors, it is crucial to follow a landscape archaeology approach and try to reconstruct the prehistoric settings of the Landscape. From our perspective, it is very important to start with those specific features of the past, still observable in the present, that might have characterised the prehistoric scenarios during the Holocene Period. The palaeogeographic changes indicate that some part of the Pleistocene terraces were not underwater during the Holocene Period and are still visible today. The evidence of these deposits can be found in the outcroppings of low terraces along the borders and in the central part of the Grosseto Plain. The shift in sea level during the Neolithic and Copper Ages played a fundamental role in shaping the shorelines which have been delineated along the Pleistocene terraces. Their study has become one of the focuses of our research. To investigate these settings, we have constructed a GIS framework which includes a range of information on geological maps, topographical maps, historical cartography and colour orthophotos (2004).

Geological maps spanning a scale from 1:100,000 (Servizio Geologico d’Italia) to 1:10,000 (Carta Geologica Regionale – Regione Toscana) have been input into the system in order to acquire data on Pleistocene terraces and Holocene features which, together with recent alluvial deposits, characterise the plain area.

A detailed Digital Elevation Model (DEM) has been elaborated from the topographical maps available at a scale of 1:10,000 (Carta Tecnica Regionale – Regione Toscana) with the purpose of highlighting the surface and the edges related to the Pleistocene terraces. In order to best detect these edges, we have built up an ‘historical’ DEM, selecting only the contours and high points that are free from modern disturbances, i.e. that are not related to modern activities such as drainage channels, elevated infrastructures or channel banks, earthworks etc.
Nevertheless, we have to consider that within the last four centuries the area has been involved in several reclamation processes which, using artificial flooding, deposited a large quantity of sediment in the plain. The results of these activities may have hidden the edges of the terraces. Consequently, it is very important to map the areas that have undergone the reclamation process in order to better understand the sequence of alluvial sedimentation. However, it is worth remembering that our geological maps have not been very accurate in providing detailed information on the temporal sequence of the Holocene deposits. From this perspective the mapping of the reclamation initiatives has become an important goal. Several historical documents and maps have been used to define the reclamation areas (De Silva & Pizziolo 2004; De Silva 2006, 2007) in particular, the analysis of the 19th-century cadastral maps. An interesting comparison is then possible when we overlay this information on the artificial alluvial deposits over the colour orthophotographs. This comparison may detect crop-mark or damp-mark anomalies which confirm the presence of different types of soils. In the GIS environment we can perform spatial analyses between these various data within a multisource approach. In this composite framework, we try to focus on features of the landscape that may still retain the pre-protohistoric evidence, and to determine why some information has been invisible in the plain area. Our interpretation of the Prehistoric Landscape suggests that Pleistocene deposits, free from reclamation activities and with a very low slope gradient (according to our 'historical' DEM), can be defined as areas which could be ‘walkable’ surfaces during the Neolithic and Copper Age period. Moreover, these areas should not have been affected by massive depositional actions after the Holocene Prehistory. In other words, if we select areas that satisfy all our three criteria based on geological, historical and morphological variables we can identify portions of landscape that have a high archaeological potential, i.e. areas with a strong possibility for preserving prehistoric evidence or a ‘high potential for prehistoric preservation’. The selection of these variables has been performed through GIS tools, and the overlay of these areas highlights the portion of landscape where we can further focus our attention.

**PREHISTORIC EVIDENCE: PROBLEMS OF UNCERTAINTY**

We have already stressed that the prehistoric evidence in the Grosseto Plain has scarcely been assessed and very little data has been collected during previous research. However, the recent field activities carried out in a rescue archaeology framework, by the Department of Archaeology and History of Art of the University of Siena, suggested new interpretations of the peopling process of the area. According to the requests of the City Council, the archaeological surveys were carried out in the outskirts of Grosseto, in areas selected by the urban planning authorities and not according to our research priorities. Despite this procedure, the field survey, begun in October 2009, confirmed the presence of prehistoric people in the plain and, regardless of the sporadic nature of the archaeological evidence, it offered an encouraging perspective.

In the first stage, we tested the reliability of data collected during the survey. We analysed the lithic artefacts, examining their characteristics, such as the presence of gloss and the state of the surface preservation of each item. These types of analyses helped us to assess that the majority of artefacts were found in a primary deposition. We also dedicated particular attention to the identification of raw materials that may substantiate connections with the archipelago (e.g. obsidian) or with the inland area.
In general terms, we can confirm the presence of prehistoric evidence in the Grosseto Plain. However, the typology and quantity of these artefacts still force us to deal with uncertainty. Indeed, the analysis of the findings indicates that often we are not dealing with diagnostic artefacts which could help us to figure out a well defined settlement pattern structured into functional areas or defined in clear chronological phases. In other words, this prehistoric evidence is not related to large sites but probably is the result of off-site activities.

The typological analysis allows us to subdivide these sites into simple chronological classes organised as follows: Holocene (often represented by Neolithic/Copper Age evidence), Holocene/Pleistocene (when we can identify both periods in the lithic assemblage), Pleistocene (only a few cases relate to Middle Palaeolithic), and generic ones (when no significant chronological attribution can be made). In order to exploit all the information gathered, we produced thematic maps (fig. 5), which show the reliability of data and their chronological assessment.

**DATA INTEGRATION: AN ANSWER TO UNCERTAINTY**

The observation of uncertain archaeological data in a GIS environment helps us to change our perspective. Off-site evidence, within acceptable parameters of accuracy and according to a landscape archaeology approach, may provide very valuable information (e.g. Bintliff et al. 2000) when trying to understand the use of territory. In our case study, the data collected during the field survey offers us the possibility of verifying whether or not our interpretation of palaeo-geographical settings is feasible (fig. 6). All prehistoric evidence has been discovered in areas with ‘high potential for prehistoric preservation’ (see section 4). Thus we shift to a more accurate scale to explore in detail the prehistoric settings, and specifically, landscape morphology. Today the field surface seems clearly uniform and very flat due to the modern use...
of powerful mechanical ploughing tools, so that ancient bumps and shallow areas have been levelled out. Thus in order to create the morphological context for these archaeological finds we need to reconstruct the terrain surface by referring to previous settings.

Precious information has been obtained from topographical maps published during the 1930s at a scale of 1:10,000, to ascertain the reclamation activities of the Grosseto plain (fig. 7). With the input of these historical maps into the GIS, we acquired contour lines and high points from which we were able

Figure 6. A 3D view of the Pleistocene terrace (grey line) overlayed to a DEM and to off-site Neolithic evidence in the Central part of Grosseto Plain (grey blocks). The image shows the edge location of the off-site in respect of the micro-morphologies and of the Pleistocene deposit.

Figure 7. An example of data integration: off-site distribution and Pleistocene deposits overlaid on the historical topographical maps (1930) which show a variety of morphologies. See also full colour section in this book.
to visualise the previous morphological settings. These appear to be much more complex compared with the present-day morphology. Actually, according to the 1930s maps, all the prehistoric finds related to Holocene periods are located on micro reliefs forming small/low hills (fig. 8). Moreover, it is worth highlighting that the sea level during the Neolithic period was supposedly 6 metres above the present-day level. In this respect, these little hillocks also show noteworthy inlets fronting onto the inferred Neolithic shorelines.

This morphological interpretation matches up with the results of the analysis of historical aerial photographs (1943, 1954) which show distinct damp-mark or soil-mark anomalies which we can assign to wetland or dryland features. Evidentially, in this case, the combination of historical sources provided excellent information, essential to the understanding of palaeo-geographical settings. Moreover the combination of these interpretations with prehistoric evidence provided new clues for our study.
CONCLUSION

This research, still in its initial stages, shows that, through the integration of data derived from field activities, archaeological analysis and GIS elaboration, it is possible to produce and sustain an effective cycle of understanding. This process implies a continuous shift in the data input from general to local scale and moreover a shift in data interpretation from local to general scale and vice versa. In our case study, for example, the off-site finds helped in the assessment of prehistoric occupation of the area, while the morphological analysis provides a possible insight into settlement strategies and location choices.

In conclusion, even though we are dealing with uncertainty, the landscape archaeology approach has ultimately eliminated many implausible interpretive strategies and helped define Neolithic shorelines while creating a context for off-site evidence. The correlation between the data furnished by historical sources (namely 1930s maps and historical aerial photographs) and the data furnished by archaeological means has been crucial to the research. In our endeavour to define the nature and shape of the ancient shorelines, the elaboration of these data allow us to imagine, despite the present-day flatness of the Grosseto Plain, a complex and indented coastline, which could have been an attractive feature during the peopling process of the area.

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