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Landscape Archaeology in the Venetian Plain (Northern Italy)

Abstract: This study underlines the links between environmental sciences and social sciences and aims for a better understanding of the landscape dynamics in the Venetian plain. The geodynamic constraints resulting from natural forces and the historical land occupation patterns are approached jointly. The analysis of the agrarian morphology of the plain is integrated with the geomorphological data. The prevalence of the irrigation networks constructed in order to control the hydrous flows, by irrigation or draining is highlighted. This includes 1) centurial forms, understood as a remarkable tool for agrarian improvement, 2) patterns of land planning, dating from the 12th and 13th centuries AC, 3) modern networks accompanying the Venetian nobility's colonisation campaign of the plain. These agrarian dynamics allow us to pinpoint the complexity of the historical heritages, closely combined with the natural components, while restricted to the Venetian plain landscape.

Introduction

This study focuses on the history of agrarian landscapes in the central part of the Venetian plain. Firstly it discusses the environmental geodynamics and the human dynamics, aiming to locate the forms of land occupation over more than two millennia. The main thread of the argument will be based on the magnitude of the transformations which man has imposed on his natural environment from prehistoric to modern times.

The Venetian plain, situated between the lagoon and the foothills of the Dolomites, can be separated into two main parts: the high and the low plain which are characterized by the different granulometry of the deposits. The anthropic dynamics were systematically oriented toward the water organisation in a region where hydraulic conditions were critical: there was lack of water in the high plain and difficulties of drainage in the low plain. Throughout these areas are the Roman centuriations which represent the dominant structure of these territories since antiquity.

Our aim is to explore and define, on the one hand, the nature and the forms of control that man has exercised over the environment and on the other hand, the influence of water resources on the anthropic dynamics in this area. This approach addresses the correlation between the archaeological agrarian forms and the natural components of the Venetian plain. Therefore, be it a protohistoric settlement, antique land-planning, distribution of medieval foundations or the organisation of modern irrigation networks, these dynamics are directly linked to soil properties. In this study, we focus on the Brenta's high plain, a sector particularly well documented from the geomorphological, archaeological and historical points of view.

Tools and Methods

We utilised GIS in order to manage and analyse the large set of georeferenced data coming from environmental sciences (i.e. geology, hydrology, geomorphology) and human sciences (i.e. history, archaeology, geography). The understanding of the natural environment begins with the recognition of the main geomorphological units based on the planimetric documentation offered by the Environmental Protection Agency of Veneto (Arpav 2005). Of particular interest is the digital elevation model of the landscape specifically designed for geomorphological analysis. Built by the Department of Geography of the University of Padua – in collaboration with the ARPAV – it interpolates the elevation points of the *Carta Tecnica Regionale* (C.T.R.) on a 1 : 10,000 scale. The C.T.R., published in Italy some twenty years ago, possesses a higher number of points than the Italian army's (Istituto Geografico Militare) topographical maps on a 1 : 25,000 scale.

In the context of an analysis of natural landscape forms, only the representative points on the alluvial model were selected. The anthropic structures are separated. In addition to this topographic documentation, all available planimetric documentation was georeferenced, from IGM's topographical maps to historical maps consulted in the State Archives in

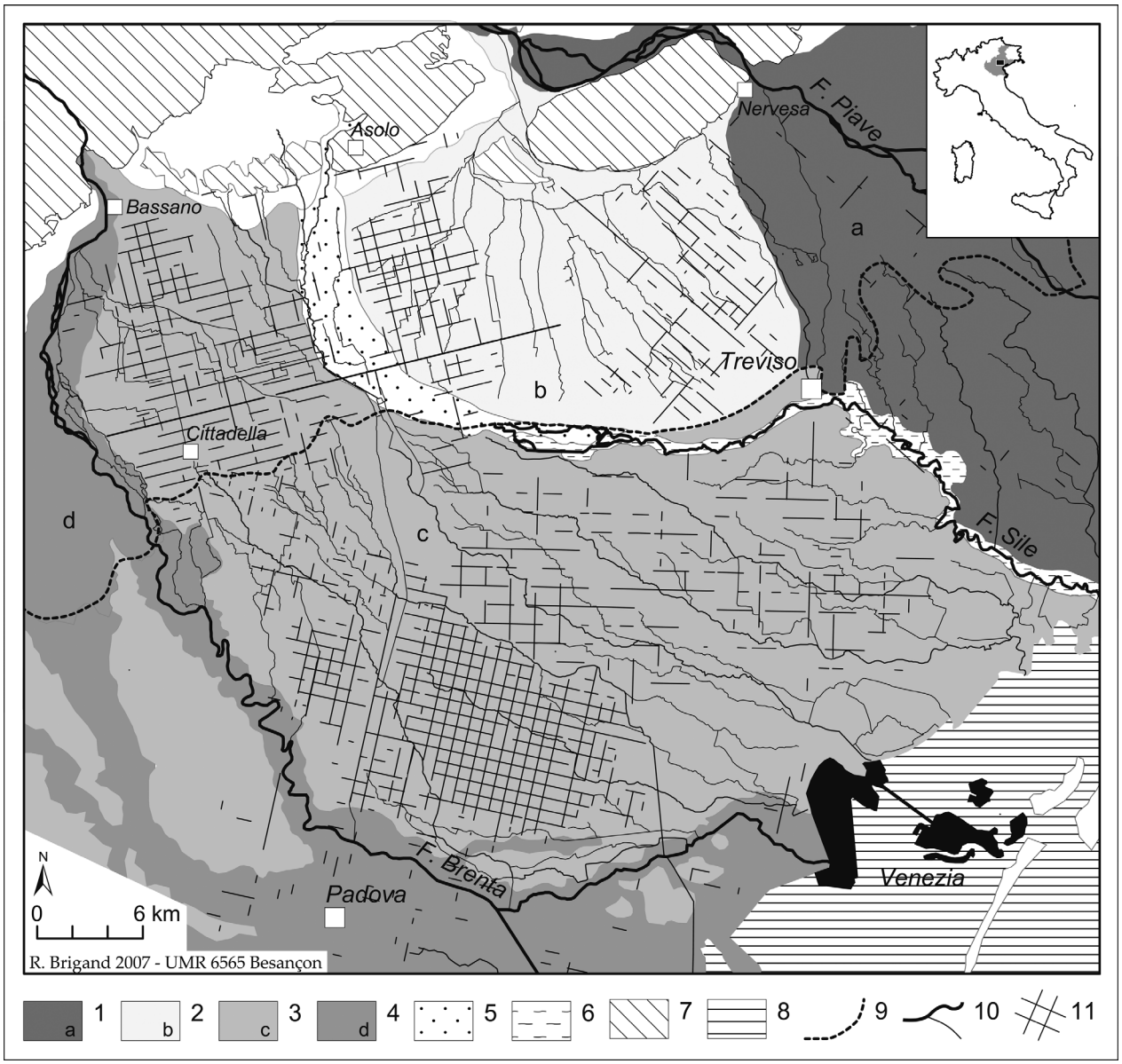

Fig. 1. Geomorphological units and centuriations in the Central Venetian plain (Arpav 2005; Mozzi 2005 modified). Legend: 1. Nervesa megafan, Piave River (Upper Pleistocene – Holocene). 2. Montebelluna megafan, Piave River (Upper Pleistocene). 3. Brenta megafan (Upper Pleistocene). 4. Brenta megafan (Holocene). 5. Musone River unit (Holocene). 6. Sile River unit (Holocene). 7. Mountain areas. 8. Adriatic Sea and Venetian lagoon. 9. Upper limit of the spring belt. 10. Natural and artificial hydrography. 11. Roman land-registers.

Padua, Treviso and Vicenza. Many multi-scale and multi-temporal remote sensing images (acquired by different satellite and aerial platforms from 1944 to 2003) were analysed to map the landforms on an area of about 450 km^2. Aiming to reconstruct the agrarian organisation before its destruction during the second part of the 20th century, we used the Austrian Land Register from the first half of the 19th century.

Analysis of satellite images acquired in 2002 (25/02/2002) by the ASTER platform showed interesting results. These results from the composition of SWIR (short wave infrared) bands, which are very effective for the visualisation of the different superficial deposits, and also the TIR (thermal infrared) bands that were useful for understanding the moisture contents of the soil *(Figs. 1, 2)*. These documents allowed us to capture the morphology of antique, medieval and modern agrarian structures linked with their natural environment. This approach is filtered by some theoretical knowledge and analytical practice.

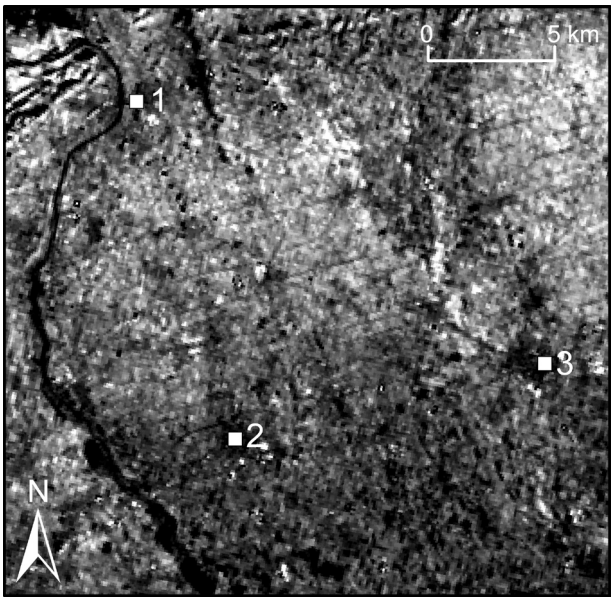

Fig. 2. Imagery acquired from *Thermal InfraRed* subsystem of ASTER (2002) for the upper part of Brenta's megafan, between Bassano (1), Cittadella (2) and Castelfranco (3). The gradual resurgence of water is distinguished by the soil moisture contrast and is visible, in the upper plain, the horizontal "constraint drainage" imposed by the Roman cadastre.

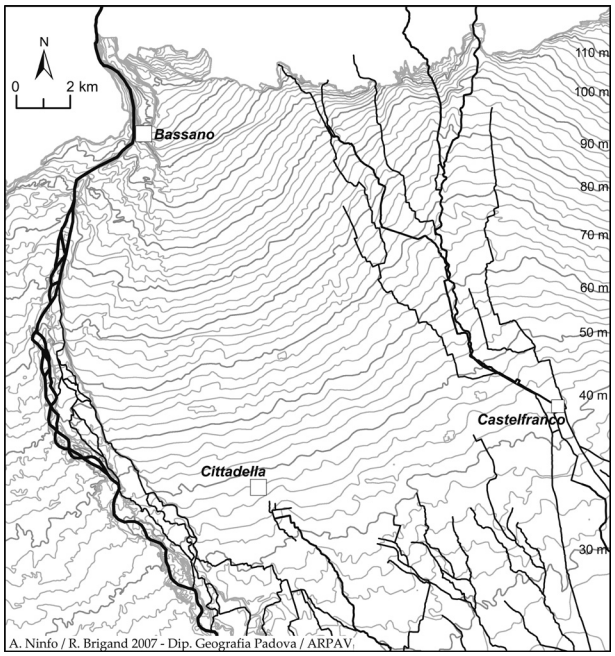

Fig. 3. Micro-relief map of the Brenta high plain and hydrography, with 2 m contour lines. The 1 : 10,000 scale map (*Carta Tecnica Regionale*, F° 104, 1992–1997) is used for contour interpolation. Cittadella, Castelfranco and Bassano are the 3 medieval towns (11th–13th AC) of this area.

Geomorphological Organisation

The central part of the Venetian Plain is formed by the alluvial systems of the two main alpine rivers that flow in this territory: Brenta and Piave (Comel 1955). These depositional systems have been recognized as being similar to the so-called "megafan" of the Indo-Gangetic Plain; so this terminology has been introduced in the geomorphological works in Northern Italy. Megafan is intended as a fan-shape deposit with an extension of 10^3–10^5 km^2 (Mozzi 2005). The Brenta fan is 2600 km^2 and Piave is 1050 km^2; between 21,000 and 8000 BP, these two systems covered the whole upper part of the Adriatic Sea.

The north-eastern part of the upper Central Plain is the apex of the Brenta megafan *(Fig. 1)*. Here the fluvio-glacial deposits (sedimented mainly between 22,000 and 15,000 BP) are gravel and sands with a progressive decrease of the grain size along the slope. The transition between the high and the low plain, situated south of Cittadella, alternates between sandy-silt and clay levels. This transition from permeable to impermeable deposits causes the progressive resurgence of the underground water. Near Bassano the underground water table is about 75 m deep, while near Cittadella it is only 3–5 m deep. It outcrops near Fontaniva, the location of the spring belt (Arpav 2005). This water contributes to the alimentation of the dense hydrographic network of the low plain. The altitude of this zone ranges from 130 m a.s.l near the town of Bassano to 40 m near the spring belt. The mean slope goes from 0.6% to 0.2–0.3% south of Cittadella *(Fig. 3)*. At the end of the last glaciation, around 14,000 BP, the Brenta river formed a deep incision from the apex to the medium low plain. This head fan incision has drastically deactivated the sedimentation on the Pleistocene megafan (Bondesan / Calderoni / Mozzi 2002).

Archaeological and Historical Approach

The study of anthropic dynamics draws on punctual information provided by the localisation of archaeological sites on the one hand (Bosio et al. 1988), and conversely the historical agrarian forms inscribed in the land plots. We have insisted on taking a diachronic perspective of the dynamics of the Brenta's high plain between the end of the Bronze Age and

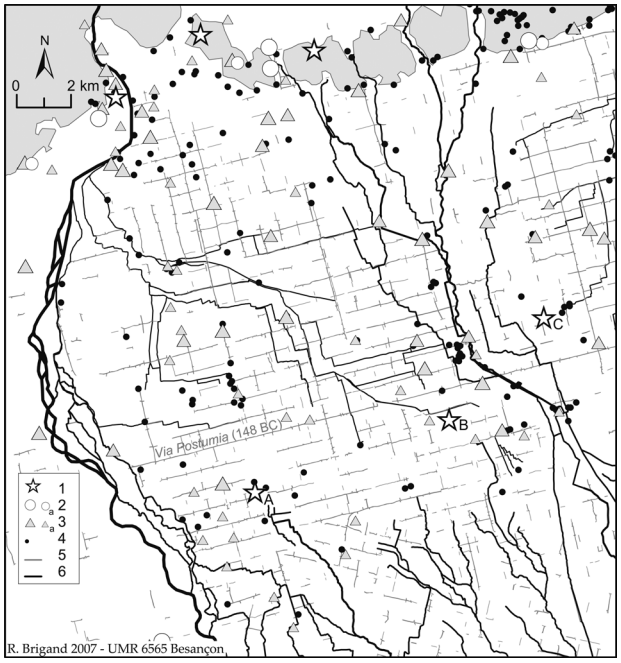

Fig. 4. Archaeological sites and archaeological evidences (Bosio et al. 1988, modified). Legend: 1. Bronze Age (2200–1000 BC) remains and protohistoric village with rampart from the end of the Bronze Age and the beginning of the late Iron Age: Cittadella (A), Le Motte (B), Castelliero (C). 2. Iron Age (1000–3rd century BC). 3. Roman Age (2nd century BC–5th AD). 4. Modern Venetian Villa (14th–19th century AD). 5. Agrarian structures from Roman land-registers. 6. Natural and artificial hydrography.

the Italian Renaissance. Also particular attention was paid to antique and medieval dynamics.

Bronze and Iron Age – During the Bronze Age and the Iron Age, the population remained modest and occupied the sectors where water was within easy reach: foothill sails the transition belt between the high and low plain, the Musone micro-valley between the Piave megafan and the Brenta megafan. Three important habitats dating from the end of the 13th century BC are picked out: Le Motte, Cittadella and Castellierro (Bianchin Citton 1997). These are relevant and indicative of the dynamics of settlements during this period. A map showing the connection between protohistoric villages with rampart and water resources illustrates a clear dependency (*Fig. 3*, on the right). More accurately, they two of them are located close to the upsurge of underground water. The micro-topographical map shows lightly depressed areas probably linked to old fluvial ridges *(Fig. 3)*. In contrast to Roman and modern times when hydraulic improvement is important, medieval and protohistoric dynamics are strictly localised close to water resource.

Roman Period – The Roman land-registers of the Venetian plain are highly visible on the ground, and constituted a radical transformation of the landscape. Specifically, the Roman division of the territory represents a methodical and geometrical reclamation of the soil in a place where hydraulic organisation is fundamental for enhancing the value of the ground. Principally since centuriation reconstitution modelling by P. Fraccaro (1940) and F. Castagnoli (1953) reconstitution methodology has hardly changed. In the pioneering work done by B. Marcolongo (Marcolongo / Mascellani 1992), the centuriation remains a purely historical document, only existing in terms of the chronology of romanisation and of the question of the political status of the *municipium* in question – *Tarvisium*, *Acelum*, *Patavium*, *Altinum*. Benefiting from the tools for modelling the antique land-registers, as proposed by G. Chouquer (1983) and F. Favory (1983), the objective here is to specify the impact of the Roman agrarian networks on soil quality, while also considering the context of the antique topography transformed by the dynamics of medieval and modern colonisation.

If the distribution of protohistoric settlements on the Venitian plain appears to be linked to a localised and specific exploitation of water resources *(Fig. 4)*, the antique agrarian structures represent the first continuing organisation within the territory of both the high and the low plains. In each of these cases, *decumani* and *kardines* – the main intermediate axes of the centuriation, are clearly linked to topographical constraints. Their essential function is that of soil irrigation or draining, in order to improve the land's agricultural value. The repartition of the archaeological sites dating from the 1st century BC to the 4th century AC clearly indicates that the organisation of the territories by the centuriation is the corollary of the agrarian colonisation.

Central Middle Ages – The second key phase of the construction of the Venetian landscape started in the 12th century. This period of economic and demographic growth provided the towns with human and financial resources, which in turn reinforced communal power on the land (Heers 1990; Balard / Ducellier 1998). If this "communal era" is a synonym for with economic, social and military growth, it is also marked by continuous clashes between communes wanting to establish their territorial limits and to control the key water resources. The territorial echo of this dynamic is the multipli-

Fig. 5. Morphology of agrarian structures close to the capillary upsurge of underground water between Cittadella and Le Motte (orthophotograph 2001). The black frame is an extract of the old cadastral map of Cittadella (1835). Legend: 1. Land-register of the Brenta low plain. 2. Land-register of the Brenta high plain. 3. Regular and geometric grid (20 × 20 *actus*, 708–710 m). 4. Medieval patterns of land planning. 5. Habitat and industry (in 1992–1997). 6. River bed and main canals.

cation of new towns, *bastides* and other new foundations in Europe and in Northern Italy (Fasoli 1942; Higounet 1970; Panero 1988; Ménant 1993). The Venitian area participated in this dynamic, and the new foundations systematically took on a double function: to give value to agriculture while delimiting and protecting the communal boundaries.

Modern times – The end of the medieval period and the beginning of the Italian Renaissance saw the advent of a true hydraulic revolution due to the urban authorities coping with the problem of supplying populated centres (Vergani 2001). This was the case in *Lombardia*, one of the provinces with the most flourishing agriculture in Europe, and particularly in Venice, where, with its desire for *Terraferma*, there were no doubts about the importance of hydraulic networks for irrigating the high plain and regulating the floods further down.

This dynamic is translated, in the modern charts, by the creation of a magistracy in charge of *adacquare li terreni*, into actions aiming at increasing the cultivated surface area and also protecting the lagoon and its surrounding areas with stagnant water. *In situ* on maps and plans, the organisation of land plots is shown to be directly adapted to the environment, the topography and to the quality of the soil, while often linked to a patrician villa. The location of the modern villa, at once a recreational place and a real agricultural *azienda* (Beltrami 1961), was directly influenced by the historical process of parcelling out the rural network.

Discussion

This discussion concerns the nature of the anthropical dynamics depending on a specific natural environment. These dynamics emphasize the importance of a morphological reading of agrarian landscapes. The spring belt, characterised by a better water supply, is an attractive factor for human communities and therefore we chose this frame for grasping the different forms of land occupation since the Protohistory, antiquity and Middle Ages. *Fig. 5* shows the main morphological features at the level of Cittadella, with those inherited by anthropogenic landscaping.

The two protohistoric settlements, Cittadella and Le Motte, are fortified villages with ramparts dating from the end of the Bronze Age and the beginning of the Iron Age. Le Motte's surrounding wall is distinct from geometric field structures of the centuriation. The protohistoric rampart of Cittadella, is situated directly under the medieval wall (Bianchin Citton 1997). This explains the approximately circular form of the wall and its displacement in relation to the urban plot, linked to the new town from the 13th century AC. These settlements are positioned in direct proximity to the two underground streams draining the infiltrated water to the northern limit of the spring belt.

The land-register on the upper part of the Brenta megafan appears as a good example of good adjustment to the megafan's topography. This is why the *pertica* – the land divided by the centurial forms – is oriented in a way to warrant the optimal circulation of the water. The orientation of the *kardines* – the north-south axes – and the *decumani* – the east-west axes – are established by calculating the angles of a theoretical grid of 20 × 20 *actus* (708 m). The pertica is structured around the Consular Road, the *Via Postumia*, dating 148 BC, used as *decumanus maximus*, and the actual National Road number 47, which links up with Cittadella at Bassano del Grappa (Ramilli 1997). This road is used, for an important length, as *kardo maximus.* The grid metrology (20 *actus*) of these large centuriations, conceived for big assignments, and the historic context of the Roman colonisation, are probably dated from the 1st century BC.

The centuriation expanding on the high plain of Brenta is imbricated, in a particular way, with the one on the lower plain stretching towards the north-east of Padua until Cittadella, known on IGM's topographical maps as *graticolato romano*. This land register is also interesting for the morphology. The internal structures of the intermediate forms of the centuriation are clearly distinct depending on their location either at the proximal part of the megafan, or at the resurgence area. In the first area, the agrarian forms are more pooled or clustered. They do not seem to be integrated within an agrarian structure modelled on the Roman *actus*. In the area towards the south, where the depth of the aquifer diminishes and where the less marked topography regularly drain the water towards the Musone valley, the morphology of plots clearly appears to be well-kept and is organised according to the *decumani* and the *limites intercisivi.*

Two gaps in the continuity of the antique orientation must be mentioned. The first gap corresponds to two agrarian frameworks planned to the north-east and to the south-east of Cittadella; while the second gap is to the west of the protohistoric habitat of Le Motte. These two planned agrarian forms, the origin of which we will discuss, are directly located on the uphill slope of the Vandura and the Tergola resurgences and appear to follow an underground water-drainage channel all the way to the level of the resurgence (Civita / De Maio 2002).

Recent modelling of patterns of land planning in medieval times (Lavigne 2002) has shown the importance of agrarian planning within the context of landscaping new foundations. While the processes of colonisation and the foundation of new towns are generally well documented by texts, the clues concerning agrarian landscaping are rare and very often difficult to interpret. Henceforth, in the Italian case it is necessary to refer to some well known examples, the new town of de Massa Lombarda in *Emilia-Romagna* (Chouquer 1985), Villafranca di Verona or the improvement of the Zevio marshland to the south-east of Verone (Castagnetti 1974; Lavigne 2005). We have chosen the relevant Cittadella case. It relates to the foundation of the Padua commune in 1220, which sought to establish itself in face of Treviso's territorial pretensions, translated by the foundation of Castelfranco in 1195.

This massive colonisation was intended to control a key sector of the hydrographical networks, and also to improve the value of a peripheral part of the Roman land-register. More accurately, an area where centurial forms did not respond to the particularities imposed by the topography. Thus, the two planned frameworks, the modules oscillating around 130 m and the global surface planning of 300 ha, are disposed in accordance with the Tergola resurgence. It is particularly evident in the

meridional framework, which drains the resurgence in this slightly depressed sector. The field investigations show the importance of the ditches, certainly of medieval origin, intended to drain the water resurgence. The dating of land planning close to Le Motte is difficult, due to its disconnection from well-known historical contexts. Nevertheless, this agrarian structure could be linked to the medieval village of *Villafranca* documented on historical maps (18th century AD).

These few examples underline the importance of a geoarchaeological approach when observing the nature of human dynamics in face of natural environmental constraints. This stage is fundamental in the sense that the antique land structuration, constructed by ditches and channels, constantly organised the hydrogical flows and gave orientation to subsequent dynamics. Therefore, whether medieval or modern, linked to irrigation or drainage, they are directly inscribed in the antique planning. The Roman agrarian structure – both its distinct materialisation and its complete destruction – is explained by the natural and socio-economic parameters in these landscapes.

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