Neolithic Settlements of the Tavoliere di Puglia (Foggia, southern Italy).
Topographic Analysis, Interpretation and Restitution of Archaeological Traces in Aerial Photographs

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Abstract

This paper is focused on investigating the prehistoric settlements of the Tavoliere di Puglia (Foggia, South Italy) through the analysis of archaeological traces in historical and recent aerial photographs, both vertical (IGM images taken in 1954 and in 1955, IRTA, AM and RAF photographs, colour orthophotos) and oblique. As is well known, the plain of the Tavoliere was densely inhabited during the Neolithic Age and analysis of aerial photographs showed noteworthy examples of archaeological evidence related to topographical organisation of villages, delimited by one or more ditches containing more or less dense series of compounds. Such complexes are located, in most cases, near waterways that have sometimes dried up, in the areas interfluvial or on plateaus and shallow edge of scarp; in the western sector of the territory not many prehistoric settlements appear in aerial photographs and they are mainly located at slight elevations, neighbouring modern farms. The georeferencing and graphic rendering of archaeological traces of the Neolithic settlement allowed the measurement of their extension. In some cases the analysis of archeological traces in aerial photographs have found a topographic continuity between Neolithic settlements and Medieval fortifications, in areas characterised by the presence of slight hills featuring geological outcrop (locally known as “crusta”); this data has been confirmed by field survey. The interpretation of the many visible traces, their geo-referencing and graphic rendering, combined with topographical survey make an important contribution to the reconstruction of settlement dynamics of the prehistoric period.

The integrated study of the historical and recent aerial photos was particularly functional when used to analyse archaeological contexts, no longer visible in recent aerial photos, and has facilitated a detailed analysis of the archaeological traces. The georeferenced data were, in part, controlled with field survey that has better defined the chronology of the archeological traces.

Keywords: Neolithic Settlements, Archaeological Traces, Geo-Referencing and Graphic Rendering, Historical Aerial Photographs, Recent Aerial Photographs

As is well known, the extended plain of the Tavoliere di Puglia (Foggia, southern Italy) was densely inhabited during the Neolithic Age. The geological and pedological characteristics of this area have made it an exemplary case for legibility of archaeological traces (related to ancient settlements and infrastructures) well rendered in historical aerial photographs that are sometimes better than recent ones for the analysis of situations today. Archaeological traces in recent aerial photographs are no clearer because they have been obliterated by the urban development or strongly compromised by agricultural processing (Fig. 1).

This paper analyses the population in the Neolithic Age of the plain of the Tavoliere – included in the F° IGM 164 – conducted primarily with an integral analysis of the vertical aerial cover made by IGM in the years 1954-1955 compared, where
possible, with photos taken by the RAF, some of which were published by Bradford, and aerial photos made by other bodies (IRTA1958, AM 1943, 1945 and 1964) in different years and at different scales, found at the historical archives of the Aeronautica Nazionale.

The study of historical images has also been integrated with the analysis of recent aerial photos (perspective images from the 1970s, large-scale strips SARA Nistri 1999, colour orthophoto of 2008 of BLOM CGR of Parma) and were found to be particularly functional to analyse archaeological contexts, allowing the creation of a homogeneous mosaic of archaeological evidence.

The work of photo-interpretation has been integrated with the systematic graphic rendering of archaeological traces by analytical photo restitution or georeferencing software of aerial photos on a map base in raster (igm maps 1:25000) or vector format (CTR 1:5000 of Apulia Region).

The archaeological traces have been put together graphically (with software CAD Microstation Bentley) as vector data and codified and calculated in a graphic data base. In some cases the graphic restitution of data was verified with topographical surveys that have defined with greater certainty the chronology of archaeological evidence, highlighting phases undocumented by the traces. The results of the topographical surveys and the analytical classification of data were included in an alphanumeric database linked to the graphic database by means of the Geographic Information System in use at the Laboratory of Ancient Topography and Aerophotogrammetry of the University of Salento. The result of this work was the production of cartography useful not only to historical analysis of the population of the Tavoliere but also for the purpose of land use planning and protection activities.

The work represented here is part of a long tradition of studies of aerial photography of the territory of the Tavoliere that, since the years after World War II and by J. Bradford, uses the aerial photography for archaeological research.

Fig. 1. Tavoliere di Puglia (FG, South Italy). Restitution of archaeological traces visible on historical and recent aerial photographs (vertical and oblique).
The aerotopographic studies of the Tavoliere were continued by the research of G. Alvisi (1970), GDB Jones (1987), G. Odetti (1975), D. Riley (1992) and G. Schmiedt (1970) to mention only the main authors and found, recently, in large part of the publication of the catalogue collections of the Aerofototeca Nazionale (Guaitoli, 2003).

In a volume dedicated to the Neolithic period in the Tavoliere, Jones, using data collected from Bradford on aerial photos of the RAF and the photos taken personally along the route Lucera-Foggia-Manfredonia, identified 256 ditched settlements attributable to the Neolithic (Jones, 1987). The work of Jones, although based on a sampling of data, is a fundamental instrument for the study of Neolithic period of the Tavoliere. Rather problematic is the publication by Odetti (1975) that analysing the aerial documentation of Aerofototeca Nazionale – at scale 1: 33.000 – detects the presence of a thousand Neolithic villages in the plain of Tavoliere (exactly 1028). The data presented by Odetti however, is not supported by a distribution map of the settlements for easy location. In fact the sites identified are shown on a map to a very high scale – not specified – and therefore it is difficult to use for the precise identification of the sites.

The documentation of the populating of the Neolithic period is therefore entrusted for much of the analysis of data to information from the photographic documentation, lacking important information related to the articulation chronology of settlements. The evidence is not visible in the aerial photo, so a study to better understand the dynamics of the settlements of this period research of territorial distribution and systematic excavations needs to be conducted.

In the present study, based on the photographic documentation available, the results have been drawn on a cartographic base – an area of 2300 km² – with 60 Neolithic villages of which 31 are recognised and placed in the course of work (unpublished data) and 29 already known from literature and also visible in the aerial photo. The analysis of aerial photographs, both historical and recent, has thus offered remarkable cases for the readability of archaeological traces attributable to topographical organisation of the settlements, delimited by one or more ditches enclosing series of
compounds more or less dense and, in the case of larger settlements, large areas of land used, presumably, as pasture areas or for cultivation (Tinè, 1983). A parameter for the topographic distribution of settlements seems to have been the presence of a bank of calcareous concretion – locally called *crusta* – that underlies so much of the plain of the Tavoliere and that is found underground at varying depths and in the absence of which it may occur standing water on the surface that would have prevented any form of settlement and subsistence activities (Tinè, 1983).

For most of the data drawn it is well rendered the dislocation of the settlement in the area of waterways, sometimes dried up, in the interfluvial areas or on plateaus (as in the case of the vast plateau dell’Amendola) and shallow edge of scarp, in terraced surfaces and hardly ever in the valley floor (Delano Smith, 1975) except for the settlement of Motta della Regina.

Sometimes, the villages are located just behind the loops of the rivers that, in addition to water supply, ensured a natural defence. The coastline, which covers much of the area overlooking the ancient Holocene lagoon which extended from the area to south of Manfredonia to the wide mouth of the Ofanto, proved to be a place preferential for the settlements in this area. And the case, for example, of the villages that developed on the plateau of Amendola – near the mouth of Candelaro, close to the coastal lagoon connected to the sea – had to be in contact with the lagoon which guaranteed the irrigation of land and the food supply (Cassano et al, 1987). The settlements identified in the course of this work at the modern farms Candelaro, Monte Aquilone, Fontanarosia, Belvedere, Posta Alesi, Santa Tecchia, Stazione Amendola, Fonteviva and Posta d’Innanzi, together with the settlement of Coppa Nevigata, have the same type of coastal distribution as the settlements identified further south, near the damp area of Saline di Margherita di Savoia. More scarce numerically is the evidence visible in the western sector of the

Fig. 3. The whole complex of Motta della Regina in an oblique photo of May 2005 (photo: G. Ceraudo, LabTaf).
territory attested mainly on slight increases on soil “coppe” estimated around a few metres above sea level. These places have proved suitable for the allocation of villages and, not surprisingly, are often still used as farms today.

That the chosen places for human settlement are, over time, the same just because they exploit the most favourable conditions of the topography of the area is further reiterated by the topographic continuity between Neolithic settlements and medieval fortifications (as in the case of the evidence visible in the place names: Motta del Lupo, Motta della Regina, Casone-Torrione; Masseria Candelaro Petrullo, Vigna Barone) established in areas characterised by the presence of slight hills featured by geological outcrop (locally known as “crusta”) which guaranteed a natural defense area of the village. An exception is the Neolithic settlement located near the modern Masseria Fongo, SW of the Medieval settlement of S. Lorenzo in Carmignano: the village, which also occupies a considerable surface (about 20 acres), extends in an area characterised by a slight depression, likely wreck of an ancient marshland.

The restitution, integrated with georeferencing, of the traces attributable to settlements of this phase allowed the calculation of their extension: the villages that appear in aerial photos delimited by a single ditch, circular or ovoid, didn’t seem to affect extended surfaces (about 1 to 5 ha). Only in a few cases are the surfaces enclosed by a single ditch much broader (on average estimated about 15 ha); it is possible, in these cases, that there are villages with a system of more external ditches, concentric, the traces of which are not visible in the aerial photo.

Much larger are the settlements marked by a double system of ditches, concentric, roughly circular in shape or nearly oval (estimated at around 10-15 ha) although there are settlements with the extension of just over a hectare. In some cases the inhabited areas are defined by two ditches of different sizes of which the most extensive usually leans against the smaller without it stays entirely, highlighting, probably, an expansion of the village (Tinè, 1983) or a new phase of occupation, perhaps after it has been abandoned. This is characterised by the excavation of a new ditch, wider, which intercepts the first ditch which was abandoned and buried.

Finally, settlements were drawn with a more detailed plan that also occupy large surfaces of about 50 ha, as the villages of Schifata and Pal- mori, Posta d’Innanzi, Scaramella S. Vito, and up to 180 ha of the village of Passo di Corvo. Usually these settlements are delimited by three or more concentric ditches; in some cases there is the presence of a dual system of two circular ditches, concentric, located at a certain distance between them (it is possible that the two outer ditches defined the area of the settlement, also used for agricultural purposes or for cattle ranching, while the two ditches innermost could define the area more properly housing or the original nucleus of the village, later expanded, Tine, 1983). Sometimes the outer ditch, even included the entire area of the settlement, does not encompass it completely as in the case of the settlements of Passo di Corvo and Posta d’Innanzi.

In the scientific literature the debate still remains ongoing about the real function of the external ditches (defensive, reclamation and soil drainage for agricultural and construction; reservoirs for water supply, livestock fence or separation of livestock from cultivated fields) that marked the area of the villages requiring a large workforce digging (a summary of the different interpretative hypotheses with references to earlier literature in Cassano & Manfredini, 2004). It was also suggested the theory, more difficult to document, that the ditches also functioned as a system of territorial demarcation (Cassano & Manfredini, 1990; Cazzella & Moscoloni, 1992). The external ditches were up to 5 m wide and just as deep, cut in the crusta over a distance of hundreds of metres (Tinè, 1983). For the function of the compounds inside the villages the best hypothesis would seem that drainage of the area was around the hut (Tinè, 1983). The examination of aerial photographs shows a very low rate of compounds in the smaller and presumably older villages until that rate reaches and exceeds a hundred within wider and newer villages.
Fig. 4. Top left: Neolithic settlement in the area of Monte Aquilone (near Masseria Candelaro) in a photogram of IGM 1954. The settlement is enclosed by triple ditches and is bisected by the Foggia-Manfredonia road; the traces of the ditches are more evident on the northern side of the road; top right: The Neolithic settlement in a colour orthophoto of 2008; Centre: The Neolithic settlement in an oblique photo of 2003 (photo: G. Ceraudo, LabTaf); bottom: graphic scheme.
Regarding the internal organisation of the villages it has been proposed that small sites can be regarded as simple farms (homesteads) dating mostly to the Ancient Neolithic (Bradford, 1957; Jones 1987; Tinè 1983) and occupied by individual family groups, rather than of real villages. This interpretation seems supported by the absence of traces of compounds within the ditched areas; however, in the absence of systematic excavations, that allow to analyse the real nature of these villages, even the smaller settlements should be considered only a less extended version of the larger settlements. Also, this category of settlements has been hypothesised (Bradford, 1957) by their seasonal nature with respect to a stability of employment supported for larger settlements; this theory does not seem supported, however, by the data material as the ceramic finds attest to contemporary employment and duration of the phases of life for both types of settlement (Tinè, 1983). Instead the villages that in aerial photos present more complex planimetry (with external ditches that surround many compounds) could be considered villages with a more recent history (Cassano & Manfredini, 2004). Thus, it would seem possible to assert that over time, a greater planimetric complexity has developed in the internal articulation of the villages, from villages consisting of one or two ditches to sites increasingly complex up to the articulation of the villages type Passo di Corvo (Brown, 1991a).

Surface surveys conducted on the plateau of Amendola (Cassano & Manfredini, 1983) with a depth of excavation of the village identified at Masseria Candelaro (Cassano & Manfredini, 2004) showed that the distribution of the villages in the territory would seem oriented towards a functional choice to optimal exploitation of land with a dislocation of topographic villages preferably near waterways and on high ground at regular distances (two km) between them (Cassano & Manfredini, 1983). The surveys also seem to highlight that the oldest inhabited are surrounded almost always by one (or more rarely two) ditches, enclosing an area not more than hectare and, for this topology of sites, aerial photography would seem not show traces of interior compounds.

The plain of Tavoliere can therefore be seen as being occupied in a widespread manner by numerous settlements developed in a period covering more than two millennia (sixth - fourth millennium BC) and mainly during the earliest phases of the Neolithic period. For some of them, a continuity of
life is attested from the Middle and Late Neolithic
while, only in some cases, their foundation is ex
novo in the Middle Neolithic (as in the case of the
large towns of Passo di Corvo and Posta d’Innanzi)
and more recent. Moreover, given the research, it
is remarkable the amount of evidence generally
classifiable in the Neolithic period and for which, in
the absence of data from territorial surveys and/or
stratigraphic excavations, cannot provide additional
chronological indications. For many villages located
in the vast area of the plateau of Amendola, already
active in the Early Neolithic, we have assumed an
increase in the area inhabited during the Middle
Neolithic (Cassano & Manfredini, 2004). Also on
the Middle Neolithic was dated system of large and
flourishing villages (Brown, 1991b; Whitehouse,
1994) which often involve re-use and/or extensions
of older structures (Cassano & Manfredini, 2004).
Around the middle of the sixth millennium Neolithic
settlements begin to dwindle, if not disappear alto-
gether; the motivation for this has been attributed
to the progressive changes in climate and microcli-
mate of considerable scope (Delano Smith, 1978).

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