Apulian prehistoric community connections: Preliminary results of GIS analysis and field activity

Apulian Prehistoric community connections: preliminary results of GIS analysis and field activity

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Summary

In a selected area in the region of Apulia, Italy, an ongoing project is currently dealing with the comprehension of how prehistoric communities moved in their territory and how they exploited the landscape during the Neolithic and the early Bronze Age. Apulia is especially interesting in early prehistory. It is characterized by fertile soils, a favourable climate and an abundance of valuable raw materials, especially high-quality flint, and obsidian sources off the coast. Thus, the density of settlements is very high through all of prehistory, and it is not surprising that the region played an important role as a bridge between the eastern Mediterranean Sea and the inner peninsular areas during pre- and protohistoric times. Ideas, artefacts and people travelled from east to west and from north to south.
The scope of the work presented here is based on a collection and re-evaluation of sites from the Neolithic to the Early Bronze Age in northern Apulia. We outline the results of first GIS analysis (visibility analysis and least-cost path analysis) which were conducted in order to understand the networks of ties and relationships between sites. Furthermore, we describe the results of surveys undertaken to verify the position of sites, their chronological setting and their placement in the landscape. The high percentage of finds, mostly pottery sherds and a modest quantity of flint, confirms the placement of settlements recorded during the 70 s and allows examine the relationship between the sites in depth in the course of time and how the communities related with their landscape.

Keywords

Apulian prehistory
Neolithic
Copper age
Visibility analysis
Least-cost path analysis
Mobility
Landscape archaeology
Survey

1. Introduction

The early prehistory of Italy is marked by a sometimes hard to grasp mesh of small-scale archaeological cultures. These were defined in the last century, mainly with the help of typologies of material remains from settlements such as pottery, flint or polished stone tools as well as specific settlement types. The recently acquired absolute dates, however, suggest that these cultural phenomena which were thought to succeed each other overlap in large parts, and what

makes it even more complicated is that their chronological development may also differ micro-regionally.
Rather than delving even deeper into pottery typology, a more promising way to approach prehistoric societies may be to focus on how they interacted with each other and the landscape during different time slices, especially in terms of mobility and communication. The method for this approach has to be landscape archaeology. With it, we can outline the layout of networks and the roles of players within them.
To organize this kind of research and to address these questions, the project "R.P.C.M. Apulia" (Reconstructing Prehistoric Communities' Mobility in Apulia) is currently underway in a cooperation of Münster University, Germany, Bologna University, Italy as well as the Soprintendenza Archeologia, Belle Arti e Paesaggio of the province of Barletta-Andria-Trani-Foggia, Italy. An area in northern Apulia has been selected for the research because the territory is rather diverse: it incorporates the regions between the Fortore River valley and the north of the Gargano promontory, including the Lesina and Varano lakes (Fig. 1). Favourable climate conditions, an abundance of natural resources such as high-quality flint and fertile soils, but also a high biodiversity due to the varying landscape can explain the important role of this region and an increasing human frequentation during pre- and protohistory (Fig. 2), with communities settling and changing the landscape according to their ideas and needs (Gravina, 1999, Boenzi et al., 2001). The project aims to outline the influence of human presence on the landscape and vice versa and to understand the dynamics of groups of people in the landscape. This does not only regard local communities but also people coming from other regions.

Fig. 1. Northern Apulia. In red the project area; in blue the Fortore River; green flags show the main modern cities (image developed by the authors).

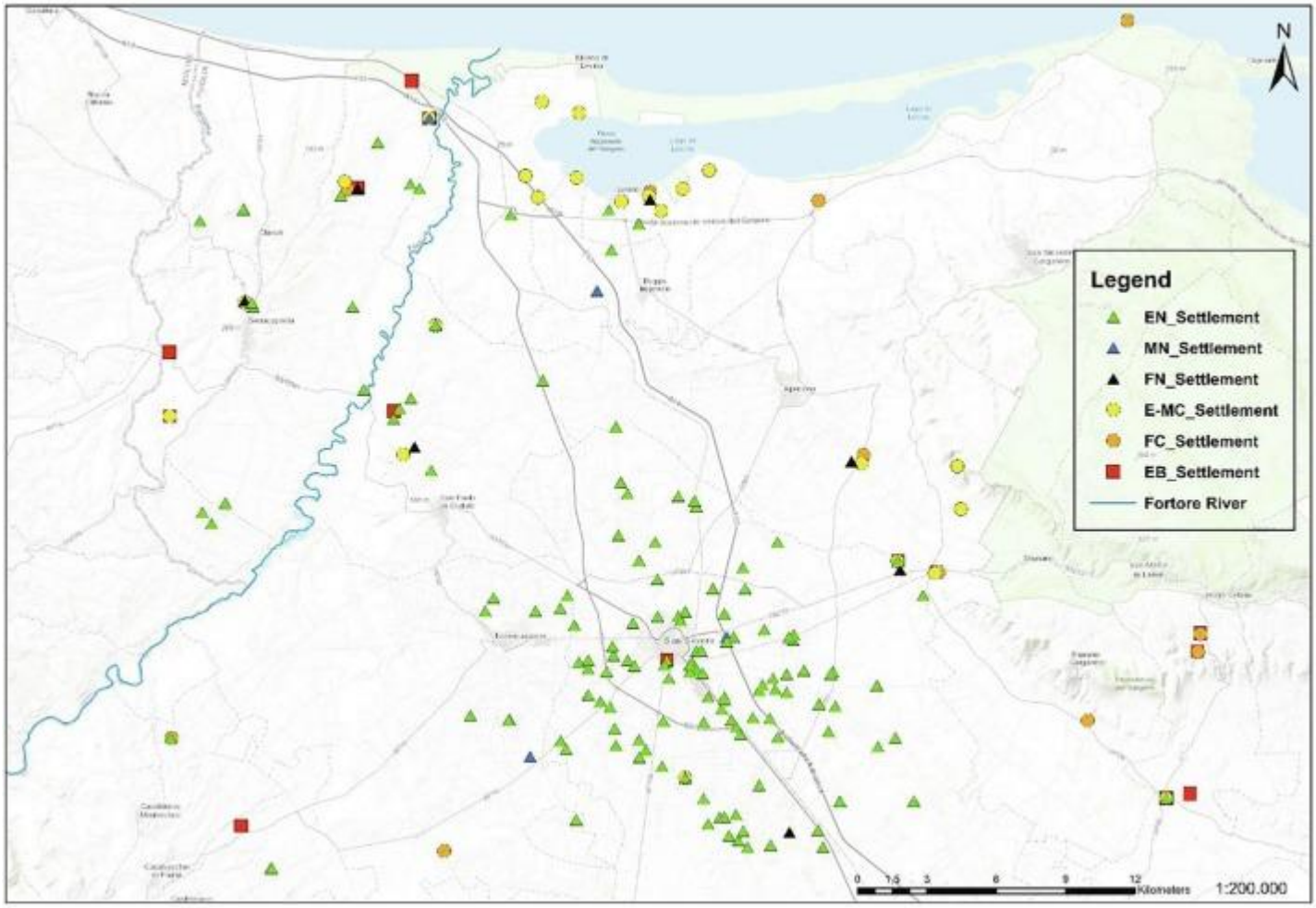

Fig. 2. Diachronic distribution chart of known sites. Triangles: ancient Neolithic (EN), middle Neolithic (MN), final Neolithic (FN); circles: early-medium Copper Age (E-MC), final Copper Age (FC); squares: early Bronze Age (EB) (image developed by the authors in ArcGIS).

In the following, we will present the first results of our work in northern Apulia. After some general remarks concerning the landscape and the archaeological background of the region, we will outline the methods we applied. These comprise GIS analysis, especially viewshed analysis and least-cost path analysis, and also surveys we conducted to enhance our database and verify our results. The combination of the methods yielded interesting results concerning the use of the landscape and the movement of prehistoric communities in the region which change in the course of time; they are presented in conclusion.

1.1. The environment

The region of Apulia chosen for the project was selected for a special reason: it is here that the earliest Neolithic traces can be found, and throughout prehistory, Apulia functions as an intersection between the inner regions of the Italian peninsula and other parts of the Mediterranean, especially during the Neolithic and the Copper Age, but also in younger periods. The reasons for this important role can be found in its natural environment: the Gargano peninsula as well as the Tavoliere plain and the *altopiano delle Murge*, a plateau in central Apulia, feature very fertile soils on a limestone substratum. Especially the red Mediterranean soils are of great importance, among them *terra rossa* which is highly suitable for agriculture. The red colour originates from iron enclosures or else from the accumulation of red mineral dust from the Sahara and Sahel regions (Muhs et al., 2010). Furthermore, clayey eutric cambisols can be found in the region which are

again well-suited for agriculture. Along with a mild climate, the stage is set for early Neolithic settlers from the late seventh/early sixth millennium cal. BC.
The limestone substratum is prone to karstification which explains why many parts of the region such as the *altopiano delle Murge*, the Gargano and the *alto* and *basso Salento*, feature caves (cf. the *Catasto nazionale delle Grotte d'Italia*, http://www.speleo.it/catastogrotte/mappa) which were in some cases in use in prehistoric times, some even since the Palaeolithic (e.g. Palma di Cesnola, 2005). Moreover, the limestone carries formations bearing high-quality flint on the Gargano peninsula which was exploited in underground mines since the early Neolithic (Galiberti, 2005).
Any research regarding the area has to take the changing coastline into account (Fig. 3). Sea-level changes can be traced back to climate changes (Lambeck et al., 2004) but also heavings and depressions of the country itself which can be ascribed to plate tectonics and the dislocation of rock in the subsoil.

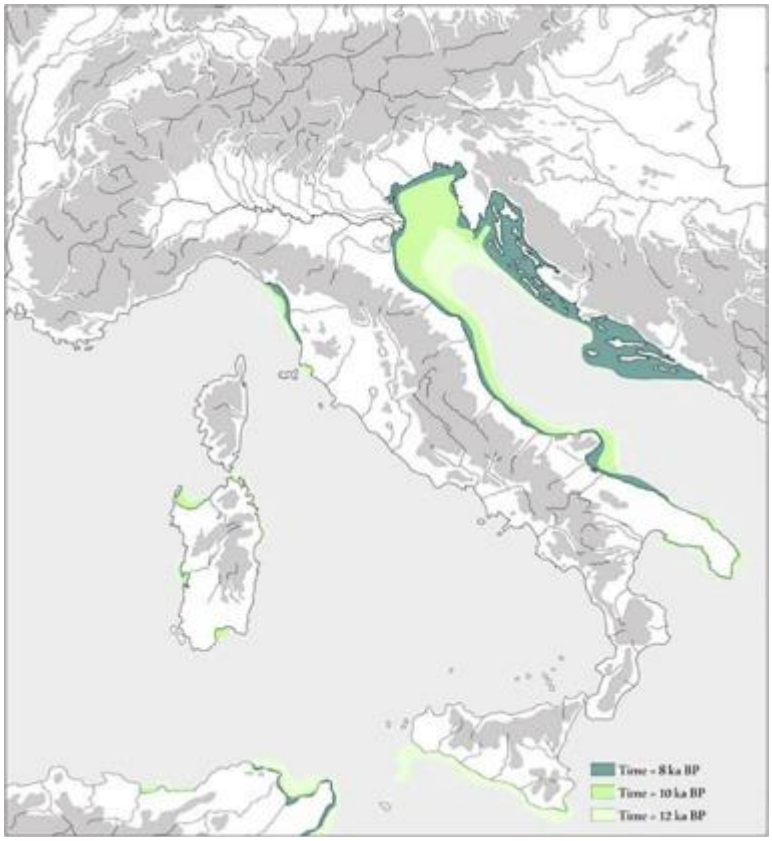

Fig. 3. Palaeographic reconstruction of sea-level changes between 12.000 and 8.000 BP with corresponding land loss (altered after Lambeck et al., 2004).

1.2. Archaeological and cultural background

With the onset of the Neolithic, human impact on the Apulian territory is distinctive. The early farming communities shaped and modelled the terrain, conducting agriculture, livestock breeding, hunting and fishing, activities which peaked in the Copper and the Bronze Ages. Their settlements are large villages surrounded by ditches, and it is on the Tavoliere plain with its fertile soils where they are especially numerous (cf. the excavations at Passo di Corvo: Tinè, 1983). The cultural phenomena associated with the early Neolithic are commonly described using pottery decoration and divided into three different phases (*ceramica impressa arcaica; ceramica impressa evoluta; ceramica dipinta/stile Lagnano da Piede/stile Passo di Corvo* and *Ceramica graffita*). Absolute dating, however, shows that this succession differs micro-regionally, and the stylistic phases overlap largely (Tiné, 2002, Fiorentino et al., 2013). In terms of absolute chronology, these phases can be set between 6000 and 5200 cal. BC. The middle Neolithic is characterised by of late painted pottery and pottery of the Serra d'Alto style and dates to the time around 5100–4500 cal.

BC, whereas the late Neolithic is marked by the Diana culture (Bernabò Brea and Cavalier, 1960), widely spread in southern Italy and featuring pottery without any decoration (4400–4100 cal. BC). The final aspects of the Neolithic and the beginning of the Copper Age are marked by the emergence of a new cultural phenomenon called *facies* Macchia a Mare (ca. 4100–3700 cal. BC). Settlements now arise progressively in points of control of commercial and transhumance routes. The increase in contacts is also reflected in the material culture where influences from neighbouring regions start to appear (Palma di Cesnola, 1981, Gravina, 2009) and stretching even as far as Abruzzo (site of Paterno) and Southern Apulia (Zinzulusa cave; Gravina, 2009, Ingravallo, 1998). This should be an indication of an overall set of ideas distributed fairly widely.
The succeeding *facies* Piano Conte (3700–3300 cal. BC) is characterized by engraved pottery production which can be found in Apulia in the course of the Copper Age. Although up to now academics were prone to use the name Piano Conte in order to identify this *facies*, we would like to propose to use the term Engraved Pottery because it is really more than a *facies* spread in southern Italy; we could consider it as a cultural phenomenon with a common material production. Moreover, it seems to present evidence of the presence of a network linking the southern areas of the peninsula (Del Fattore et al., 2017).
The middle Eneolithic can be related to the Gaudo culture (3300–2900 cal. BC) but seems to be rarely represented in the research area. It is only in the final moments of the Copper Age, with the *facies* Laterza (2900–2350 cal. BC), that sites are again clearly visible in the archaeological record. Due to local peculiarities, it is extremely difficult to outline the distribution area of this culture on pottery alone (Tunzi Sisto and Monaco, 2010).
During the early Bronze Age, contacts with the eastern Mediterranean regions seem to grow more important. The possession and the control of land is emphasized strongly now. For this reason, sites were set up on the top of hills, close to inland watercourses, near the coast or at other places from where it was possible to dominate passages.
This short outline displays the important role Apulia played in early prehistoric times. It functioned as an intermediary between the eastern parts of the Mediterranean and the inner regions. Valuable raw materials such as the Gargano flint, which triggered increasingly dense economic relations with the areas mentioned above, contributed to this during the Neolithic. Early copper artefacts are, up to today, have not been found, but sites close to Apulia such as Santa Maria in Selva (Macerata, Marche), Fossacesia (Chieti, Abruzzo), Chieti (Abruzzo) and the Lipari Acropolis (Eolian Islands, Sicily) have yielded early copper.

2. Methodology

2.1. General considerations

Although Apulia is without a doubt a region of special importance, the exact time frame of its cultural phenomena and, moreover, their clear definition is still quite blurry and unclear. Part of the problem is the long-standing agricultural use of the land which goes on until today so that the land is greatly changed in comparison with prehistory.
In the past years, a database has been built to collect all information on archaeological sites in the region. Most data was collected from literature, but had to be re-evaluated and set in accordance with the formal database of the Superintendence at Foggia. In this process, attributions to chronological phases were re-assessed. This formed the basis for first GIS analysis.
Most of the sites in the region are known only from surface finds. In order to clarify the current situation of the sites and the potential presence of a new archaeological record, a survey was promoted in areas chosen based on the least-cost path and visibility analysis.
The investigation activity was carried out between the second half of April and first half of May 2019; this period was chosen due to funding for these months. Even though this displayed some problems because of seasonal cultivation (above all wheat) or spontaneous grass, a good number of

cadastral parcels was accessible. The archaeological information gained during the survey was added to the GIS database, thus permitting to evaluate it systematically and enhance the already acquired data.
It is necessary to point out that the survey activities played an important role because since the 1970s up to now the Tavoliere upper plain has not been subject to systematic field investigations. This produced a deadlock situation in the research process, leaving it anchored to old investigation and information.

2.2. Methods and course of action

2.2.1. GIS analysis

Before starting work in the field and the GIS analysis, it was necessary to collect all the information regarding the sites and the landscape. The data about terrain elevation, i.e. a Digital Terrain Model (hereafter DTM) (resolution of 8 m), was taken from the Apulian Region official website (http://www.sit.puglia.it/) and afterwards processed in ArcGIS in order to obtain a smoother surface. This step was necessary to reduce potential modern structural elements from the surface that could cause issues during the least-cost path and viewshed analysis estimations. Thus, the DTM has been proceeded with the focal statistics tool that estimates for each cell a statistical mean of the values within a specified neighbourhood around it (we set a rectangular moving window with a size of 3 × 3 cell units; cf. Esri's Focal Statistics).
On this base, we addressed visibility investigation by using fuzzy view analysis to obtain more detailed data on the observer dropping view. This method uses Ogburn's procedure (Ogburn, 2006) developed on the base of Fisher's theory (Fisher, 1992, Fisher, 1994) showing how an observer has a different visual perception degree of an object under various (or same) conditions (e.g. weather, distance, sight acuity related to age/physical state). This perception scale is solved by applying the fuzzy set theory: a viewshed is created that shows not the usual binary result (i. e. 1 = visible and 0 = not visible) but instead a scale of visibility degrees which are obtained by incorporating the value from the fuzzy membership to the common viewshed analysis. The result is a model with shaded zones representing the dropping-off in clarity from the observer to infinity (Ogburn, 2006). In order to develop this analysis we availed ourselves of Alberti's tool that permits estimation of the the fuzzy viewshed, in ArcGIS environment, according to the afore-said studies (Alberti, 2017). Furthermore, we introduced some parameters into our model: we set the value of 1 km as a range within which, from the observer's point, there is no drop in visibility (as suggested by Fisher and Ogburn). The height of the potential observer was set to 1.65 m, as was the height of a theoretical target (like, e. g., another human being) and a maximum radius of visibility of 15 km (i.e. ideal weather conditions as suggested by Wheatley and Gillings, 2002, 188; Fig. 4).

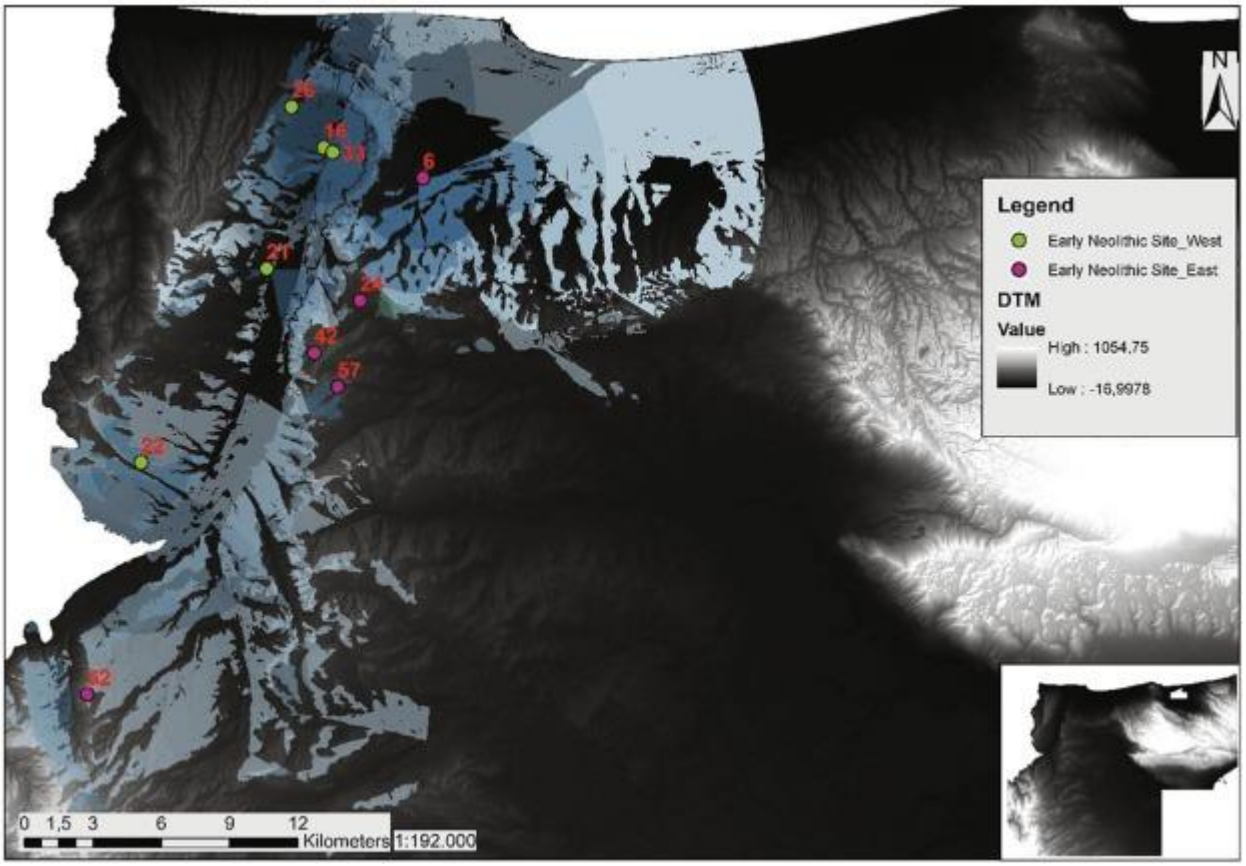

Fig. 4. Fuzzy viewshed analysis. The example displays the sites and the fuzzy viewshed. Overlap indicates the dropping view of the territory from the ancient Neolithic settlements placed within a maximum walking distance of 3 km from the Fortore River. The green points represent the sites on the western river shore whereas the purple points show the ones on the eastern side; background map: DTM overall (image by the authors).

Concerning the least-cost path analysis (LCPA), we used the smoothed DTM described above as a base to generate a raster based on the travel time cost. In order to do that, we applied the Path Distance ArcGIS tool using the slope generated from the smoothed DTM as cost raster; while the DTM itself served as a surface raster and input vertical raster. As far as vertical factor parameters are concerned, we used the Tobler's hiking function table developed by Tripcevich related to the movement from the source point to other points (Tripcevich, 2009). We applied Tobler's hiking function (Tobler, 1993) to the raster in order to obtain a friction surface to express the cost as time. In other words, the least-cost path describes the possibility to walk through the landscape from the start to the arrival point with the smallest amount of time possible (Fig. 5). Lastly, the estimation of the path was generated using the Cost Path tool.

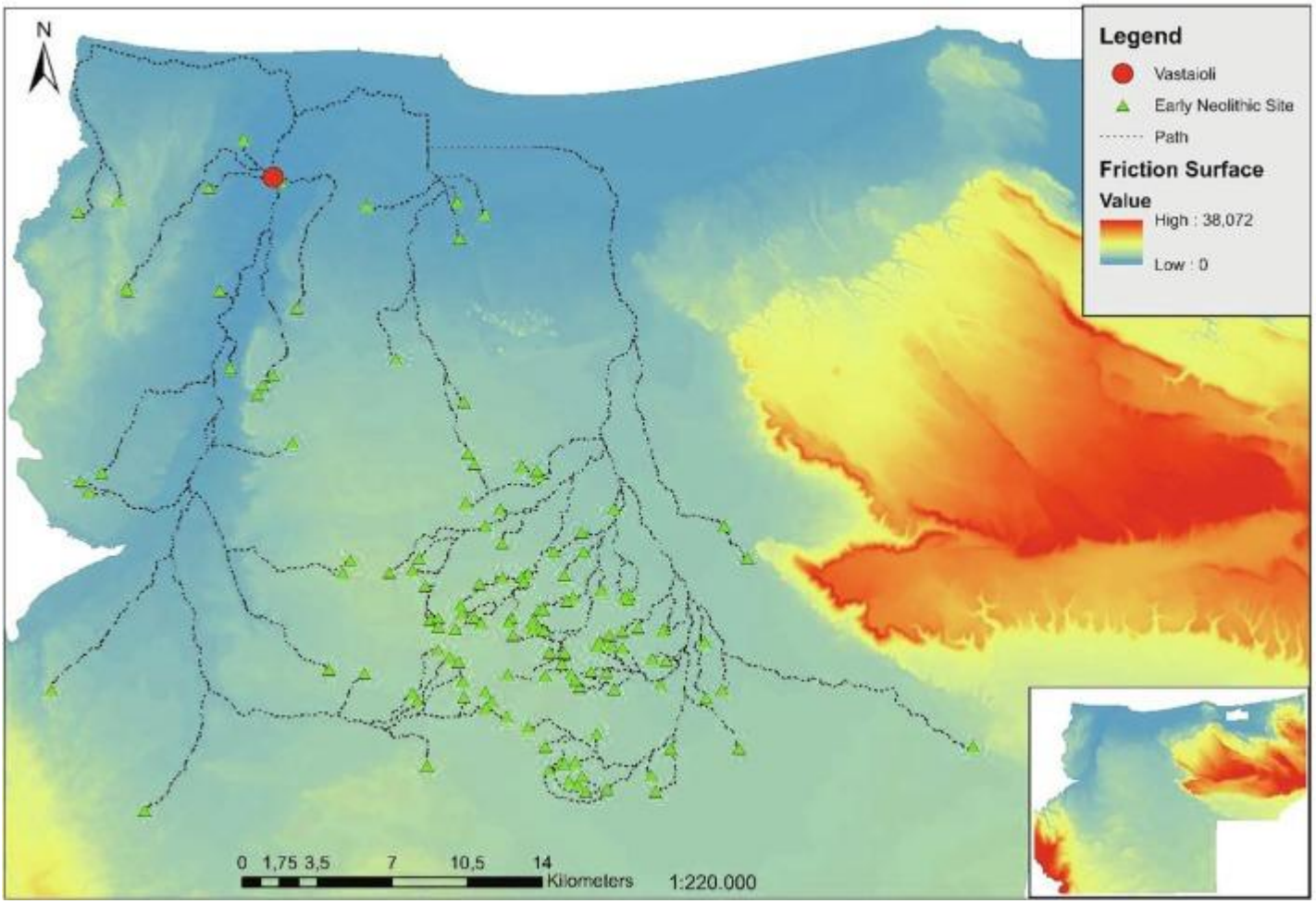

Fig. 5. Least-cost path analysis. The example displays the path network generated (in black) from the ancient Neolithic site of Vastaioli (in red) to all the other settlement of the area (in green). The surface shows the cost as time in hours. Background map: friction surface overall (image by the authors).

The scope was to comprehend how people could travel within a territory, how they could keep in touch with each other and how they could exploit the land with a minimum amount of time using, e.g. flat valleys or crossing watercourses. Although a lot of theoretical knowledge could be gained with these calculations, it needed to be verified in the field with specific surveys (cf. Filloramo et al., in press). The surveys have since been conducted and their preliminary results can be presented here, although an in-depth study of the finds is not yet completed and will be the scope of further research.

2.2.2. Surveys

The survey investigations were led in seven areas falling into the municipalities of Lesina, Serracapriola, San Paolo di Civitate, San Severo, Rignano Garganico and San Marco in Lamis (Fig. 1, Fig. 6). The municipalities are situated in the north of Apulia and were selected due to their importance with respect to the number of sites and their placement in the landscape. For this reason, we chose territories embracing different kinds of landscapes (i.e. river valleys, coastal proximity, hills or promontory tops and foothills) in order to comprehend the settlement choices of the prehistoric and protohistoric communities. The sites present a chronological arch comprising the Neolithic, the Copper Age and the Early Bronze Age, to yield a general frame of the community lifescape. As far as their categorization is concerned, most of the sites probably represent settlements, although most of them are only known from stray finds. Up to now, there is no evidence of deposits or cemeteries.

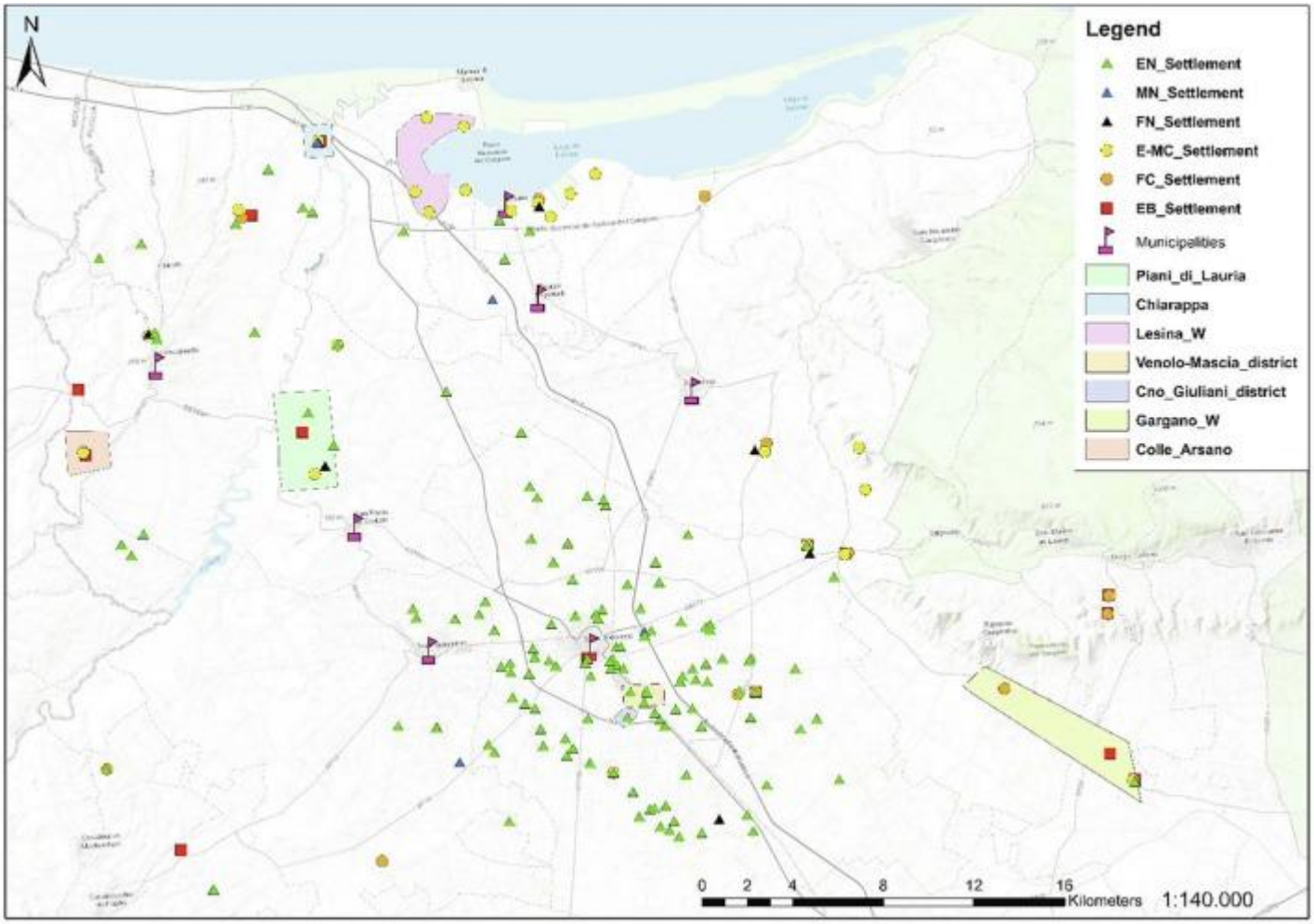

Fig. 6. Site distribution and survey areas (coloured rectangles); in purple, the Municipalities related to the surveyed areas (image by the authors).

Beside the above-mentioned aspects, we also took GIS analysis in consideration for selecting the survey areas. Specifically, the analysis yielded three promising micro-regions: the first placed on the left shore of the Fortore River, because it is open towards the inner areas of the Italian peninsula; the second on the right shore of the river which plays the role as an intermediate hub between the inner regions and the Alto Tavoliere Plain; and even though the river was probably not very sailable due to its size and flow rate, there were at least some crossing points. Eventually, the third micro-region, located on the Alto Tavoliere, represented the most populated area, especially during the ancient Neolithic, and connected the Basso and Alto Tavoliere.

Settlements in these micro-regions had a good overview of their surroundings, with sight contact to each other in good weather conditions. Moreover, they were placed in a walking distance of around 3 km from each other which indicates that, at a walking speed of 4 km/h (free of load), a person could reach the closest community in roughly one hour.

Since visibility is an important factor for site placement, we chose to survey those settlements with a potentially high visibility on the surrounding territory and easiest access.

For instance, the settlements of Piani di Lauria (San Paolo di Civitate), Colle Arsano (Serracapriola) and Chiarappa (Serracapriola) had to play an import role in the control and trade of the area because of their central position between the western side of the Fortore river valley (projected also towards the inner part of the Italian peninsula) and the eastern side connected to the rest of the region.

Similarly, the sites along the western coast of modern Lesina Lake (municipality of Lesina), where human impact is visible since the ancient Neolithic, likely exploited marine resources since the lake

only formed some millennia later during the Copper Age. It was indeed during that time that settlements began to arise all along the western lakeshore.
Concerning San Severo, we chose two sample areas where ancient Neolithic villages were set up that were surely connected to the Tavoliere upper plain village network. Likewise, the sites situated along the Gargano Promontory foothills, i.e. the final Copper Age settlement of Cicerale (municipality of Rignano Garganico) and the long-lasting site of Ciccalento (municipality of San Marco in Lamis), which was settled from the ancient Neolithic to the early Bronze Age) were selected (Fig. 6).
The survey data was acquired using a handheld Etrex20 Garmin GPS, with which points, tracks and area perimeters of the surveyed areas were recorded. In order to enhance the satellite signal accuracy, it was set to GPS and GLONASS systems. Regarding the maps, the Italian Territorial Map (scale 1:5000 and 1:25000) was used as basis, while as digital component we chose the Garmin TreckMap V5 Pro, which is one of the newly updated maps of Italy and also contains a DTM derived from the Italian territorial map. In order to have better data concerning the locations in term of cadastral parcels, we created specific maps extracted by the National Cadastre. In addition, the map work was complemented with satellite images and historical aerial photos allowing tracing of signs on the ground ascribable to the presence of settlements or structures (Fig. 7, Fig. 8). This permitted to select the areas to investigate.

Fig. 7. Satellite photo from 2013 showing traces of the ancient Neolithic C.no Giuliani village ditch (image extrapolated from Google Earth).

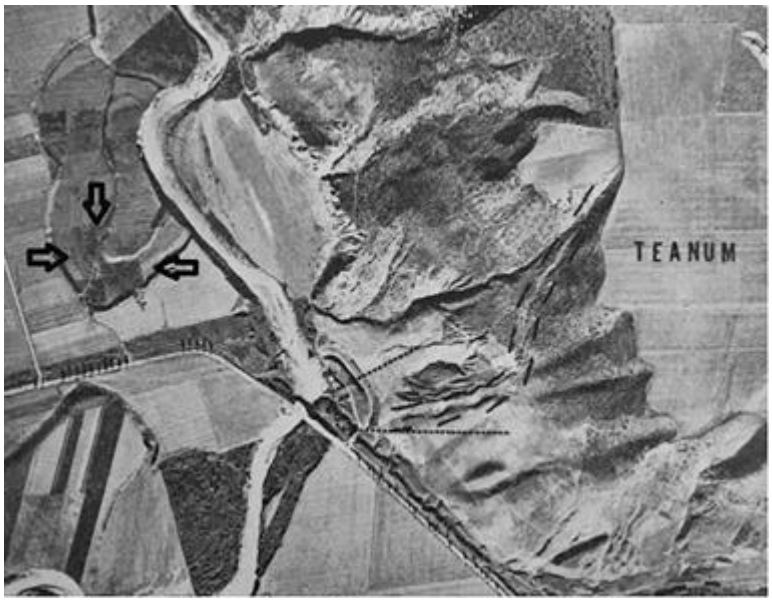

Fig. 8. Historical aerial photo showing traces of an ancient Neolithic village at Piani di Lauria (Alvisi, 1970, Fig. 25).

Moreover, in order to facilitate the evaluation of the visibility on the ground and the archaeological record, density scale values for all information were created. Therefore, the visibility was classified with a range from 0 (representing the impossibility to see the bare ground) to 5 (representing optimal visibility). As far as density on the ground was concerned, we set ranges relating the archaeological record and the square meters containing it. For instance, if within 5 m^2 the fragment density resulted equal to 0, the evaluation would be rated as "scarce", while beyond 15 m^2 and a fragment presence of more than 15 we considered the area as a zone of "high concentration".

3. Results

3.1. GIS analysis

The expected results, in accordance to the least-cost path and visibility analysis, established that a complex network between the communities had to exist (Fig. 5). During the Neolithic, we assume that the communities preferred to settle on open space in order to exploit fertile soils and paid attention to water sources in close vicinity. Thus, most villages were situated on the southern San Severo plain. Furthermore, they were also involved in a trade chain coming from other areas without the Italian peninsula, as some new studies are trying to demonstrate (Craig et al., 2014). This hypothesis stresses the influences found in some local pottery productions which seem to have links to southeastern Europe. In this way, trading was the means that permitted the diffusion of new production trends.

The following periods, i.e. the Copper and Bronze Ages, were characterized by a settlement placement aimed more at the control of the territory. In this sense villages were set on hilltops or in strategical places so that they could create a well-defined area controlled by several villages tied together in a closer network (Fig. 9, Fig. 10). This can be exemplified by the early Bronze Age villages of Chiarappa, Serracapriola and those in the Molise region (distributed near the Apulian border). Their aim was presumably control over the land and trading routes. The viewshed analysis conducted for the sites spread along the Fortore river valley confirmed this assumption, showing how those strategically set villages benefited from good visibility along the valley and, in some cases, towards the inner regional border (Fig. 4).

Fig. 9. Landscape view (NW) on the Fortore river valley from the site of Piani di Lauria. The river is marked by the tree line.

Fig. 10. Landscape view (N) from the site of Colle Arsano.

The least-cost path analysis displayed a possible movement frame in which distance was covered on land, avoiding the rivers as sailable routes and just crossing them at the most convenient points. By converting the accumulative surface from hours to minutes and laying out isochrones at a distance of 15 min we set up a model to create a visual idea about the path network and the time estimated to reach different areas. Taking two sample sites placed at the extremes of the study area, the result showed that from the settlement of Vastaioli (northern Fortore area) to the western Gargano foothills it would be possible to cover the distance in more or less five hours (Fig. 11a). Concerning the visibility analysis, it could be demonstrated that the settlements placed along both shores of the Fortore river at a maximum distance of 3 km from the watercourse had a medium to good visibility on both sides.

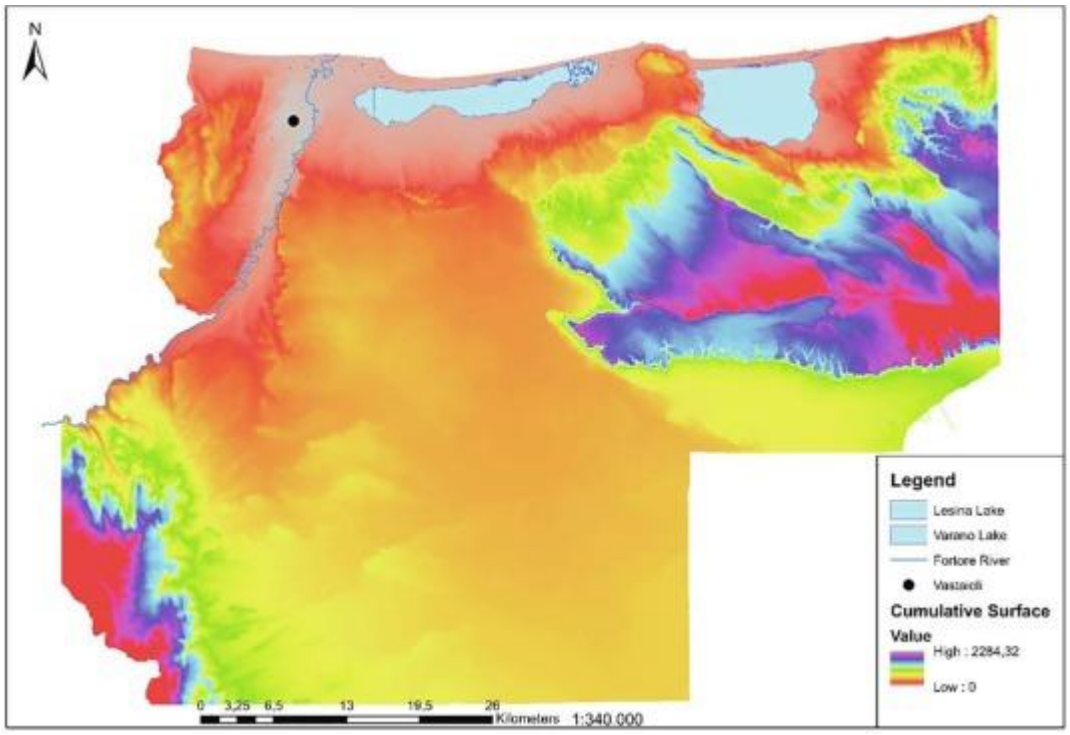

Fig. 11. Least-cost analysis. The example displays the cumulative surface in which the cost is estimated in time as minutes. The raster was generated taking the site of Vastaioli as starting point (black point).

3.2. Survey investigation

We decided to survey areas that had already yielded some archaeological material in order to confirm their presence, obtain exact coordinates and determine their state of preservation. Surveys in this region had last been conducted during the 1970/80s, and later only chance finds were made in some of the areas. The results of the surveys yielded new insights into chronology and the distribution of sites and enabled us to comprehend and enhance the chronological frame for the following field investigations.
The choice of the areas depended on the different types of landscapes and the differing chronological timespans of the settlements, so that the placement of sites could be correlated with spatial information. In addition to verify their archaeological presence in the field, it was possible to investigate the sites from a perspective of visibility in order to outline how significant the situation of a settlement was for the interplay between the site and its surroundings. For instance, the choice of hill tops for some sites underlines a privileged position to control the valley and therefore trade passing through.

3.2.1. Neolithic

The areas fall into the districts of Lesina, San Severo, San Paolo di Civitate, Serracapriola and San Marco in Lamis where previous studies indicated the presence of settlements or, at least, valid data regarding the presence of prehistoric activity. Chronologically the sites belong to the ancient Neolithic, except Chiarappa that showed traces from the middle Neolithic; only Ciccalento presented a complete sequence of all Neolithic periods (ancient/middle/final).
Unfortunately, some sample zones were not possible to survey because of wheat cultivation (such as Ciccalento) or other anthropogenic action. In particular, archaeological remains in the Fischino district (Lesina) were almost completely destroyed because the sandy soil was used as a main

component of buildings during the 1970s; the dugout zones were afterwards filled with new soil. This constituted a problem for research since the zone did not display any archaeological presence. Apart from the destroyed areas, however, the majority of the finds related to the Neolithic are flint cores or parts of flint artifacts (e. g. blades or arrow heads) found in moderate quantity at the site Chiancata-Conelle and Cannelle (Lesina Lake district) and Venolo, San Severo district (Fig. 12a, Fig. 12b, Fig. 12c). Even if we suppose that the cores and the blade fragments are related to the first aspects of the Neolithic, the arrow head may hypothetically also be dated to the final Neolithic. If this was true, it would open new speculations about the presence of final Neolithic communities in the Venolo area. This hypothesis should be verified with further research.

Fig. 12a. Flint core samples from the district of Chiancata-Conelle (Lesina).

Fig. 12b. Arrowhead from the district of Venolo (San Severo).

Fig. 12c. Flint sample from the district of Venolo (San Severo).

In the same districts, also pottery samples were found that can be dated to the Neolithic, although only very roughly. The period is testified by a small pottery wall fragment made from coarse or medium-coarse clay (from the district of Chiancata-Conelle) and an achromic *figulina* pottery sample from Piani di Lauria, San Paolo di Civitate (Fig. 13a, Fig. 13b). Very interesting in this context is the presence of two pieces of hut plaster found in Casino Giuliani, San Severo district (Fig. 14). With these, the old finds that recorded the existence of a village can be verified; additionally, we could locate a ditch that can be observed in parts on the satellite images (Fig. 8).

Fig. 13a. Ancient Neolithic pottery samples from the district of Chiancata-Conelle (Lesina).

Fig. 13b. *Figulina* pottery sample from the site of Piani di Lauria (San Paolo di Civitate).


Fig. 14. Hut plaster sample from the site of C.no Giuliani (San Severo).

3.2.2. Copper Age

The Copper Age is represented in the settlements of Piani di Lauria, Chiarappa, Colle Arsano, Fischino, Cannelle al Muro, Pontone, Palude San Lorenzo (all districts belonging to Lesina), Cicerale and Ciccalento. Unfortunately, due to the season of early spring, a number of parcels was already covered by wheat cultivation or spontaneous grass (this was the case at Cicerale, Cannelle al Muro, Palude San Lorenzo, and Pontone). Chronologically, the sites belong to the early or middle Copper Age, except Cicerale (only final Copper Age).
The highest concentration of finds was encountered at Piani di Lauria. The detected pottery fragments displayed polished surfaces and a medium coarse clay (Fig. 15).


Fig. 15. Eneolithic and historic pottery samples from the site of Piani di Lauria (San Paolo di Civitate).
Concerning the flint, the finds consisted of a core, a tranchet from Cicerale and a small blade fragment from Chiarappa. In accordance to the pottery found at Cicerale, the core and the tranchet could be ascribed to the final Copper Age. The blade fragment can hardly be dated more exactly since the site of Chiarappa was settled since the Neolithic (Fig. 16). Settlement activity at Cicerale was further secured through the find of a fragment of hut plaster (Fig. 17).

Fig. 16. Flint blade fragment from the site of Chiarappa (Serracapriola).

Fig. 17. Hut plaster sample from the site of Cicerale (Rignano Garganico).

3.2.3. Early Bronze Age

The settlements of Piani di Lauria, Colle Arsano, Chiarappa and Ciccalento showed traces of settling during the early Bronze Age. Because of their remarkable position, i.e. situated on hill tops and at valley entrances and therefore able to control the surroundings, they had to play an important role in the community networks established between the inner western and eastern peninsular areas. The majority of the finds, i.e. pottery fragments, came from Piani di Lauria, while at Chiarappa just one small pottery fragment could be detected. However, small and medium size vessel walls, rare diagnostic sherds like rims or bottoms, composed a huge concentration observed in Piani di Lauria. The pottery, at a first glance, displayed a medium and coarse clay with carbonate or quartz temper. The shapes can probably be reconstructed as open vessels, such as jars or bowls as well as transport vases, at least according to the thickness of the walls (Fig. 18).

Fig. 18. Early Bronze Age pottery samples from the site of Piani di Lauria (San Paolo di Civitate).
Unfortunately, Colle Arsano did not yield any finds because of the wheat cultivation, but along the hill side nearby the presence of a quite wide layer was observed. It consisted of small and medium stones packed together by a sandy soil completely different from the surrounding earth (Fig. 19). Maybe it can be interpreted as a containment structure, likely related to the village set on the hill top with a continuous life from the Copper Age to the Middle Bronze Age. In any case, further in-depth analysis should be conducted here.

Fig. 19. Stone layer from the site of Colle Arsano (Serracapriola).

4. Conclusion

The analysis of the landscape in combination with the evaluation of finds and features can offer new insights into the life of prehistoric communities and the changes they underwent in the course of early prehistory. Places of good visibility, possibilities of connection and communication such as valleys, ridges and rivers display the relations between natural and cultural resources. The results are still preliminary but already we can establish different strategies concerning settling in the course of time: from the first settlers with their wide, ditched villages on the plains of the Tavoliere to a growing wish to gain control over a territory and its routes and watercourses, going along with the placement of settlements in spots of ever-increasing visibility, close to paths connecting them to other regions of Apulia and the rest of the Italian peninsula. The analysis of connections through pottery, with the emergence of evidence for Early Copper Age engraved pottery, highlights links to the southernmost parts of Italy. Northern Apulia thus functions as a bridge between the inner regions of the Italian peninsula and the eastern Mediterranean. Further analysis will aim to indentify

the differences between the lakeside settlements of Lake Lesina, the farmsteads located on the fertile soils of the northern Tavoliere south of the city of San Severo, and the smaller, less densely spaced places of occupation along the outskirts of the Gargano which may be connected to pastoralism and thus display short-term use only. To define their role and placement in an ever-changing network of key players and less significant sites, of places of control vs. settlements excluded from exchange and access to resources, will be the scope of work in the near future.

5. Auhtor statement

The data and the results involved in the research are the outcome of the intensive analysis. The data used as base for the main analysis have been taken from the Regione Apulia web site or archives and are public domain.

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