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Bronze Age settlement patterns in Dorgali municipality (Sardinia)

SUMMARY - BRONZE AGE SETTLEMENT PATTERNS IN DORGALI MUNICIPALITY (SARDINIA) - This paper discusses settlement patterns in Dorgali municipality during Bronze Age based upon three analyses using the positional values of domestic sites. Different settlement classifications have been obtained by Multivariate Statistical Analysis. Some of our initial hypotheses have been tested through an examination of the differences among the settlements. The sites are always situated in places where territorial control is possible. However, while the location of some settlements enables the territory as a whole to be controlled, other settlements only attempt to control the fertile land, pastures and ways. This hierarchical system with centre and peripheries is found from the Early Bronze Age, as shown by the differences among the *protonuraghi*.

Keywords: Sardinia, Bronze Age, nuragic culture, settlement pattern, multivariate statistical analysis, hierarchisation.

INTRODUCTION

Nuragic Sardinia belongs to the Bronze Age (1800-1000 BC) although chronological debates are frequent mainly because of the scarcity of absolute dates (Tykot 1994; Webster and Webster 1998; Tanda 2004; Spanedda 2007; Lai 2009). Although proposals about Nuragic tower origins vary, researchers tend to accept the oldest chronology of so-called *protonuraghi*, which show inner spaces restricted to corridors and not chambers with false vaults (Manca and Demurtas 1984; Moravetti 1992, 2006; Ugas 2006; Manca 2007; Depalmas 2009a; Santoni 2009), even with some problems in certain areas as Gallura (Antona 2005; Puggioni 2009). The end of Nuragic towers and Nuragic culture is now situated at the beginning of the Iron Age although most villages continued to be occupied up through Roman times (Melis P. 2003).

Another important aspect to be addressed is the growth sequence of the main Nuragic villages, especially those that include complex fortresses. Classic interpretation believed these fortresses to be a result of continuous growth between the Middle and the Late Bronze Age, around 1450 B.C. (Lilliu 1982), but in recent times other researchers have proposed an alternative explanation. According to them many Nuragic towers can be considered to have

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been complex ones having different wall lines with towers since their founding (Lo Schiavo and Sanges 1994; Ruiz-Gálvez *et alii* 2002). However, continuous additions are shown by the best known Nuragic fortress, Su Nuraxi (Barumini, Medio Campidano) (Lilliu and Zucca 1988, pp. 83-84), and complete changes can be seen in Nuraghe Nolza (Meana Sardo, Nuoro) (Cossu and Perra 1998, p. 97). Anyway a date of the end of the Middle Bronze Age, at least, can be kept in mind for these fortresses (Depalmas 2009b).

These issues have an effect on territorial studies (Llobera 2007) but we have chosen a synchronically-based analysis aimed at finding out how territory was controlled during the Final Bronze Age, when most of authors agree that the Nuragic world was at its peak.

Territorial archaeological research in Nuragic Sardinia (Melis P. 2004; Spanedda 2007; Cicilloni 2009) has been traditionally focused on studies about resources potential, sometimes by using Site Catchment Analysis which treats every settlement as an autonomous entity (Moravetti 1986, 2000; Depalmas 1990, 1995; Melis M.G. 1997, 2000a-b, 2003, 2007; Melis P. 1998, 1999-2000; Melis R.T. 1998; Alba 2000, 2005; Onesti 2002; Foddai 2003). Some studies have tried to approach site relations, especially through Thiessen Polygons Analysis (Depalmas 1990, 1998a; Alba 1998, 2000, 2003; Foddai 1998, 2003; Ugas 1998; Castia 2003a-b). However, this method has been used for the whole of sites without taking into account their differences in size and position. Even visibility studies have been affected by these problems (Ruiz-Gálvez *et alii* 2002; Basildo *et alii* 2005). Only in some studies (Depalmas 1990, 1998a; Moravetti 2000) a formal typology has been used as a useful criterion to separate sites according their possible function. A qualitative definition of emplacement (Depalmas 1990, 1998a; Tanda and Depalmas 1991; Marras 1998; Melis P. 1999-2000; Cicilloni 2007; Campus 2008; Cicilloni and Migaleddu 2008; Cossu and Perra 2008; Forci 2008; Leonelli 2008; Perra 2008) has also been an important help to discuss about political organisation.

Our approach will be slightly different and we will also proceed to study territory sizes and resource control after showing strategic control as defined by topographical position. So, formal types (complex and simple towers, classical Nuragic towers and *protonuraghi*) as well as site types (villages, isolated Nuragic towers and villages with Nuragic towers) will be only used to assist us in understanding our results based on topographical situation of every site.

In this sense, following a topographical method presented by F. Nocete (1989, 1994) and used in studies of Southern Iberian Peninsula Late Prehistory (Moreno *et alii* 1997; Cámara *et alii* 2004), over the last few years we have developed a new line of research (Spanedda 2002, 2007; Spanedda and Cámara 2009; Spanedda *et alii* 2004, 2007) which has been already applied to other Sardinian areas (Alba 2005, 2009; Puggioni 2009).

Here we will present a study in different phases as the only way to go from definition of strategic sites to assessment of political control.

HYPOTHESES

The main aim of this paper is to show the existence of a hierarchical and state organization during the Sardinian Bronze Age, using a settlement pattern analysis as the starting point. State here is defined according to classical historical materialism as control system aimed to reproduce social unequality (Engels 1884, p. 192). Social unequality and state are always united. Our intention is to test different hypotheses based on previous works made in different Sardinian areas (Navarra 1997; Melis M.G. 2000b; Cicilloni and Migaleddu 2009):

1. Differences among sites depend on the site's function in relation to natural condi-

tions (land and water) and means of production (agricultural and pastoral land, livestock) appropriation, labour force control and yields of certain raw materials (metallic minerals, building rocks, wood resources, etc.). Exhaustive territorial control is achieved.
2. A territorial system was at least begun in Early Bronze Age.
3. Easily defendable positions were preferred by the settlements even in plains areas although artificial defences were built.
4. Some important sites could be settled in plain areas and be protected by other sites.

GENERAL METHODOLOGY

A specific area of Sardinia has been chosen to test the combination of different settlement pattern analysis methods. The Dorgali municipality (fig. 1) is one of the better known areas in terms of its archaeological remains because several catalogues and surface surveys exist (Taramelli 1933; Manunza 1985, 1995; Spanedda 1994-95; Moravetti 1998) and also thanks to famous sites discovered many years ago, such as Tiscali (Pais 1911) and Serra Orrios (Lilliu 1947). Moreover, it is situated in an interesting area with considerable environmental contrasts among coasts, valleys and mountains. Our research was drawn to these characteristics and in other papers we have made different proposals on the visual control of the sea (Spanedda *et alii* 2007) and the importance of the ritual marking of space (Spanedda and Cámara 2003).

Principal Components and Cluster Analyses have been performed on data from Dorgali Nuragic settlements through topographical indexes. These indexes were developed by the Andalusian Late Prehistory Studies Group (GEPRAN, HUM274), as we have said, and eight of them were originally published by F. Nocete (1989, 1994) in a slightly different way (Spanedda 2002; Spanedda *et alii* 2004), accompanied by a ninth index referring to settlement gradient which is not used here. Six other indexes, developed by us, have been used in separate analyses (Spanedda 2007). As several researchers have indicated (Burillo and Picazo 2001), this method makes it possible to avoid problems derived from surface surveys, because the data of one site are not influenced by the data of other sites. In any case, the results allow us to compare all the known sites and to make inferences regarding their functional and hierarchical differences.

Particular information is provided by each index (formules are included) although they can be grouped into four categories:

1. Indexes that refer to the relation between the settlement and the surrounding area within a radius of 1 km, where the inhabitants carry out most of their productive activities. Among these, three indexes can be distinguished:
a) YCAIP or Index of Geomorphologic Area Gradient, which is obtained by dividing the difference between the highest (YCAHM) and lowest points (YCAHW) in the area by the distance between these two points (YCADH). It is important in order to separate sites that, located in high gradient areas, are aimed to territorial control and sites which search plain areas because of their farming potential.
YCAIP = (YCAHM-YCAHW)/YCADH
b) YCAI1 or Index of Relative Height 1, which is obtained by dividing the settlement height (YCYHM) by the highest point in the area (YCAHM). It let us to get an approach to visual control even if it is not evident.
YCAI1 = YCYHM/YCAHM
c) YCAI2 or Index of Relative Height 2, which is obtained by dividing the settlement height (YCYHM) by the lowest point in the area (YCAHW). Certain sites can exert an important control over lower areas and specific resources in spite of being located in lower emplacements.
YCAI2 = YCYHM/YCAHW

2. Indexes that refer to the restricted settlement situation, which F. Nocete (1989) called the Settlement Geomorphologic Unit. Problems in defining its limits have been indicated from critical positions which, however, have failed in their attempts to provide a simple and useful alternative (Esquivel *et alii* 1999). Given these difficulties, we have preferred to compare different approaches in every step or our analysis about Dorgali Nuragic sites. First we have used the same indexes as those presented by F. Nocete (1989), which depend on a qualitative definition of the Settlement Geomorphologic Unit

Fig. 1 - Dorgali municipality situation.

through the presence of relevant changes in topography (mainly little river courses). From this starting point different indexes are evaluated in relation to defensibility and suitability for settling.

a) YCUIC, or UGA Compactness Index, which is defined by dividing the area of the Unit (YCUAR) (a value that is multiplied by 4) by its length (YCULO) multiplied by itself and by Π (pi).

$YCUIC = (4 \times YCUAR)/(\pi \times YCULO^2)$

According to this formula, circular units will offer us values equal to one and can be defended easily.

b) YCUIS, or Section Compactness Index, which is defined in the same way but referring only to one part (section) of the Unit. Its area (YCUAS), multiplied by 4, is divided by its lenght (multiplied by itself and by Π).

$YCUIS = (4 \times YCUAS)/(\pi \times YCULS^2)$

This section is restricted to the Unit's highest part above the zone with the highest gradients and can be referred to sites with a more protected area or acropolis.

c) YCUIA, or Plateau Index, which according to F. Nocete (*Ibid.*) is defined by the Section length (YCULS) divided by the difference between the highest point and the lowest point in the zone with a greater gradient (YCUHM-YCUPM). We find it more useful in a modified version, in order to avoid very high values and to better define the defensibility which depends on the plateau height. So, we propose to divide the differences in height by the length (Spanedda 2002; Cámara *et alii* 2004).

YCUIA = (YCUHM-YCUPM)/YCULS

Sites with a high value cannot be considered very suitable to life and can be seen as strategic ones.

d) YCUIT, or Estimative Gradient Index, which divides the difference between the highest (YCUHM) and lowest (YCUHW) point at the Unit by the distance between them (YCUDH).

YCUIT = (YCUHM-YCUHW)/YCUDH

e) YCUIR, or Highest Gradient Index, which seeks the same result but in relation the highest gradient area. Difference between the highest (YCUPM) and the lowest point (YCUPM) in this area is divided by the distance between them (YCUDP).

YCUIR = (YCUPM-YCUPW)/YCUDP

3. As mentioned earlier we have also used other indexes in an alternative analysis (Spanedda 2007). They include an important change in the definition of the Unit. We propose the use of a new circle, with a 250 m radius, to obtain information and to avoid definition and localization problems. This is the approach which have been used by other Sardinian researchers (Puggioni 2009) even dividing the surrounding area in quadrants (Alba 2009) as we have previously made in a coastal analysis (Spanedda *et alii* 2007). These new indexes let us to know how certain sites are aimed to control the nearest surroundings and these data can be used to define not only main economic strategies but also sites which are more focused on controlling fertile lands ever using secondary sites. The indexes that can be used to know these tendencies are:

a) YCAUIP or Index of Geomorphologic Unit Gradient which is obtained by dividing the difference between the highest (YCAUHM) and lowest (YCAUHW) unit point by the distance between them (YCAUDH).

YCAUIP = (YCAUHM-YCAUHW)/YCAUDH

b) YCAUI1 or Index of Visual Domain 1, which is obtained by dividing the settlement height (YCYHM) by the highest point in the Unit (YCAUHM).

YCAUI1 = YCYHM/YCAUHM

c) YCAUI2 or Index of Visual Domain 2, which is obtained by dividing the settlement height (YCYHM) by the lowest point in the Unit (YCAUHW).

YCAUI2 = YCYHM/YCAUHW

4. Finally, indexes pertaining to areas with a 1 km and 250 m radius have been combined to form new secondary gradient and relative height indexes (YP, YV1 and YV2). Results drive to distinguish sites which are mainly aimed to the control of the nearest areas.

YP = YCAUIP/YCAIP
YV1 = YCAUI1/YCAI1
YV2 = YCAUI2/YCAI2

NURAGIC SETTLEMENT PATTERN ANALYSIS IN DORGALI USING FEATURES OF THE SETTLEMENT GEOMORPHOLOGIC UNIT

By combining indexes from the two first groups (gradient and relative height in the geomorphologic area and compactness and plateau in the qualitatively-defined geomorphologic unit) in different multivariate statistical analyses some interesting results in relation to territorial control have been obtained (Spanedda 2002, 2007). Principal Component Analysis results have shown an accumulated variance of 54.57% in the first two components and of 68.62 % in the first three. With regard to the importance of the different variables in each component we can say that the Settlement Geomorphologic Unit variables are significant in the first component, Gradient variables in the second component and Relative Height 1 variables in the third.

Based upon this distribution, groups, types and subtypes have been defined, by confirming the real values of each site. Situation in the first component (marked by YCUIT, YCUIR, and YCUIS and YCUIA values) has been taken into account to establish different groups (indicated in Roman numerals). Sites in which the UGA Section can be defined and an especial defended area (natural or built) can be suggested (group I) are located on the right-hand part of the graphics and sites with low YCUIT (group IV), supposed to be farming ones, are on the left (fig. 2).

Inside group I, type differences are based on all the indexes, but especially on Geomorphologic Area Gradient (YCAIP) and Relative Height 1 (YCAI1) and, to a lesser degree, on Relative Height 2 (YCAI2), with inner large plateaus even in emplacements where gradient are not high as we can see in type If (S. Diliga). If we consider group II, among these three indexes Gradient seems the most important but Geomorphologic Unit Section values (YCUIS and YCUIA) can also help in classification in a group where high YCAI2 values are very influenced by seaside situation in a lesser degree in types IIb and IIc. In group III subdivision is problematic and can be attributed to the Estimative Gradient in the Geomorphologic Unit (YCUIT), minimum in type IIIb, and to the plateau characteristics (YCUIA) of the places where some sites are located. Finally in relation to group IV, Geomorphologic Area Gradient (YCAIP) and YCAI1, higher in type IVa, are the basic indexes in order to subdivide the set of sites.

Final subdivisions (subtypes) have been made within some types, such as type IIIa where the inner differences are due to YCAI2 and the values of the Geomorphologic Unit. Subdivision in type IIIb is easily made because it encompasses all the indexes. Within type IIIc, differences can be established according to YCAI1 and Geomorphologic Unit indexes (YCUIC, YCUIT and YCUIR). Gradients and YCUIC are the indexes which mark the differences among subtypes in type IIId.

We must point out that differences within type IVa come from Geomorphologic Unit Compactness (YCUIC) and Highest Gradient (YCUIR), and can be also found in the Relative Height 1 index. Finally, divisions in type IVb can be appraised in almost the same indexes, although Geomorphologic Unit Estimative Gradient Index (YCUIT) is more important than Highest Gradient (YCUIR).

In addition to this schematic presentation of indexes values in every set (groups, types and subtypes), a summary of the topographical characteristics of each group is presented below in order to get a general frame to understand Bronze Age settlement pattern:

1. Villages located in craggy areas and Nuragic towers inside villages are included in group I. Examples of possible Iron Age villages of this group are Tiscali (Pais 1911;

Lo Schiavo 1978; Fadda 2000) and Tilimba, but for our analysis of territorial control it is more important to take into account the location of the Nuragic Bronze Age sites, especially Noriolo.

2. Southern coastal control sites such as Nuragheddu or Nuraghe Mannu (Fadda 1980, 1997, 1998; Lilliu 1984; Fadda and Prunetti 1997) are included in group II, but this group also includes Nuragic towers for purposes of boundary control, especially S. Elene, and Nuragic towers with villages which show important territorial control such as Biristeddi or Coazza.

3. Group III shows greater variability, and includes villages with or without towers and isolated Nuragic towers. However, tower sites are found only in certain subtypes and are linked to the limits of river basins.

4. River valley villages without towers and isolated towers located near villages represent almost the entirety of sites included in group IV.

A PRELIMINARY APPROACH TO TERRITORIAL ORGANIZATION IN DORGALI DURING THE BRONZE AGE

In order to test the aforementioned hypotheses we must point out that:

1. A) Cave sites, not included in this analysis, were situated along the deepest and narrowest river courses, in relation to livestock movements and can possibly be dated to late prehistoric times, like the few villages located in these areas and found in our group I. B) Villages looked for main valleys, with or without simple and complex Nuragic towers. C) Isolated simple Nuragic towers used for territorial control were located on summits, slopes or low hills over the river valleys.

2. *Protonuraghi* (Orrule and Su Barcu) presence and Early Bronze Age items in some sites, such as Serra Orrios (Fadda 1990, 1993, 1994; Campus and Leonelli 2000), can be used to prove the earlier date, around 1800 B.C., when territorial control was established (Spanedda 2002), especially because *protonuraghi* (ancient Nuragic towers with inner corridors instead of chambers) are found in strategic types. In any case, the system was actually improved through addition and it can be said that between 1300 and 1000 B.C. all the territory could be dominated from one or another site. Shortly thereafter Nuragic towers lost their importance and settlements became the only way to mark the territory linked to new ritual sites (sanctuaries) (Lilliu 1988; Melis P. 2003; Depalmas 2009c). Because of these changes and the problems associated with obtaining an accurate chronology for any known site, which are frequent in surface analysis (Badas 1992; Llobera 2007), our conclusions mostly refer to the final part of the second millennium B.C. as almost all the studied sites were being used at that time.

3. The defensive and control system, as a complete model, included: a) an external line of isolated simple Nuragic towers defining boundaries of exploitation territories, such as river basins (group III sites); b) one or several Nuragic towers linked to valley villages, in their centre as true fortresses (complex Nuragic towers) or in the periphery controlling the routes leading to fortified villages (group IV); c) some exceptionally important fortified sites with complex Nuragic towers which control wide areas (group II, although some values are influenced by sea proximity). This model can be seen in the central part of the Dorgali territory near Cedrino River and in the Dorgali Plateau in relation to the Biristeddi and Coazza cases.

Three different territorial blocks are suggested by the distribution of types in the maps. The first of them is located in the southern area, where settlement is not concentrated and there are no great differences in territorial control from Nuragic towers or villages, except the possibly later cases of Tiscali and Tilimba, with greatest control being exercised from Nuragic tower Mannu

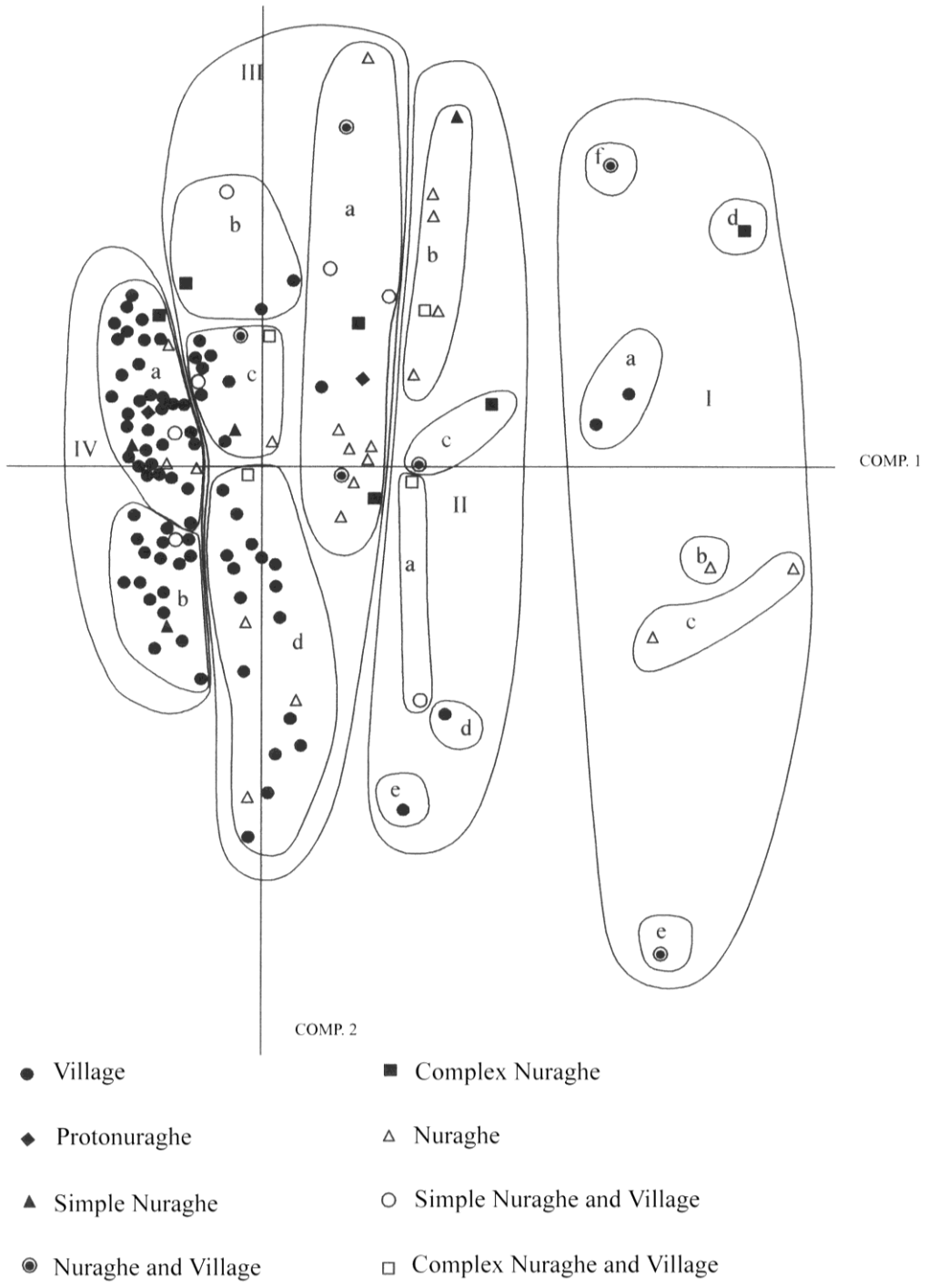

Fig. 2 - Principal Components Analysis using topographical indexes of Settlement Geomorphologic Unit qualitatively defined and of Settlement Geomorphologic Area. 1º and 2º Components Graphics.

de S. Anna and the coastal village Fruncunieddu. The second block is linked to Cedrino River and its secondary rivers. This block suggests a great demographic concentration and control from certain Nuragic towers, such as Noriolo or Sos Pruvereris, which might indicate a subdivision in relation to Osalla River. Also seen in the second block is centralization in relation to villages with complex Nuragic towers like Biristeddi and Coazza, perhaps each ruling over two different territories or making part

of a complex system as we will see, the existence of an external line of Nuragic towers as marked by S. Pantaleo, N. S. degli Angeli and Iscra Duacore group, and, finally, villages at the valley bottom. A third block can be defined in the north-western area, around Isalle River where the Cedrino model can be reproduced in relation to S. Diliga performing the same function as Noriolo. The coastal area can be considered on its own.

Thiessen polygons have been used to test these hypothetical areas, according to type I (fig. 3) and type II (fig. 4) sites, and taking into account the boundary lines defined by type III sites which are in relation to river valleys. The linking of these data has enabled us to create a map with hypothetical influence areas (fig. 5).

Eight areas have been defined. 1) Around Isalle River, domain is exerted by S. Diliga-Orrule, the last site being a *protonuraghe* which could suggest certain evolutionary changes. 2) The central area between Dorgali Plateau and Cedrino River, which has been the object of discussion in relation to Noriolo and Coazza-Biristeddi, although we must not forget that great central places can be situated in non-strategic positions, in search of the most fertile areas. As an example we can mention the concentration of ritual buildings (megaron type temples) at Serra Orrios from the Late or Middle Bronze Age (Fadda 1990, p. 151; 1993, p. 168; 1994, p. 87), although, as we will see, central places are located near farming areas but not on them. 3) Another area can be defined around Osalla River, with Sos Pruvereris-Concas de Janas as its axis. 4-6). Finally, three coastal entities can be referred, two central ones around Cala Gonone and Cala Fuili, where the village with Nuragic tower Codula Manna and the Nuragic tower Toddeitto act as central places, and a low demographic-density area in the south, around Tilimba and Fruncunieddu, possibly with evolutionary differences. 7-8). This hypothetical territorial system is completed by two more southern distributions, near the Dorgali territory boundaries, with low demographic density, around Tiscali and Nuragic tower Mannu de S. Anna. This model does not account for S. Elene, located between Cedrino basin and the Dorgali Plateau, which may be a linking point for these areas.

CONTROL OVER NEARBY EXPLOITATION AREAS IN DORGALI BRONZE AGE

A new approach has been taken in order to avoid location problems, to escape the criticism that has arisen in relation to the subjective definition of Settlement Geomorphologic Unit (Esquivel *et alii* 1999) and to discover which factors are emphasized in territorial and resource control. As we have said, new variables referring to a circle with a 250 m radius around the sites (YCAUIP, YCAUI1, and YCAUI2) have been added to the variables that refer to the area with a 1 km radius (YCAIP, YCAI1, and YCAI2). All of them relate to gradients and relative height and are explained above. The only potential problem of this approach is the duplication of indexes but values are basically different. Generic strategic factors can be hidden behind 1 km area values and agrarian resource control can be seen in the 250 m unit values.

Principal Components Analysis results show an explained variability of less than 71% in the first three components, but the first two include the greater weight of almost all the variables. Groups are basically separated by extreme values, with the maximum values being reached in gradient and immediate visual control in group III, and minimum values in immediate visual control and global gradient in group I, where, however, sites tend to look for the highest points within low and moderate gradient areas.

Due to group heterogeneity we must bear in mind type classification. In this sense, within group I (fig. 6), types are separated according to the gradient in the

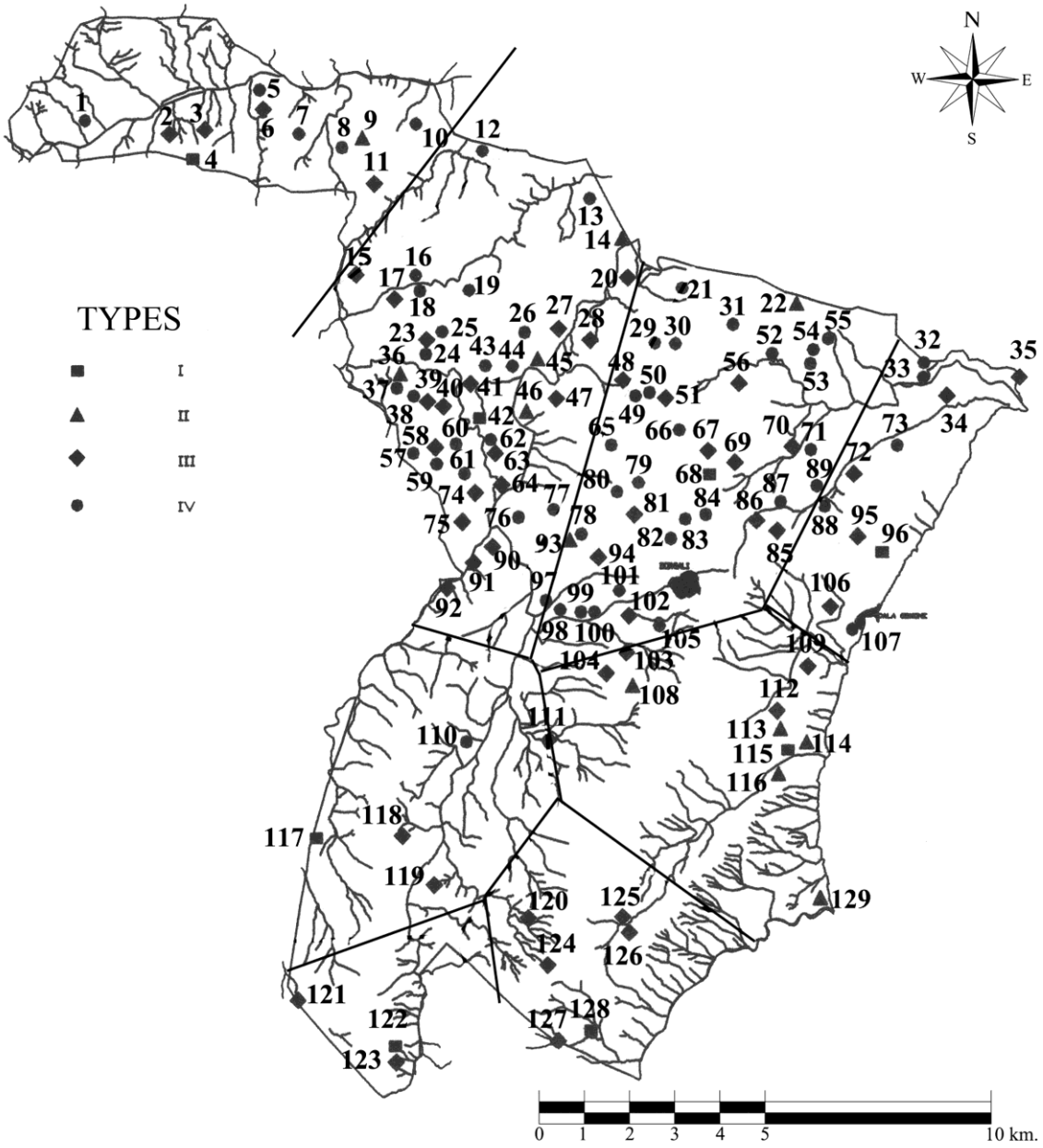

Fig. 3 - Thiessen polygons according to group I sites.

250 m area, the greatest gradient being found in type Ib where sites are located in the highest summits. This is clearly a strategic type because these sites are usually located in low gradient geomorphologic areas. If we compare new results with defensibility results from previous analyses we see that this type includes control settlements like Coazza, Biristeddi and Neulè in Cedrino River, S. Elene in Dorgali Plateau, and S. Diliga in Isalle River.

Inside group II, the distinction of type IIa is evident not only in visual control but also in the choice of a moderate gradient unit within a low gradient area, characteristics also found in type Ib mentioned above. The coastal site Golunie is the most well-known case. Differences between

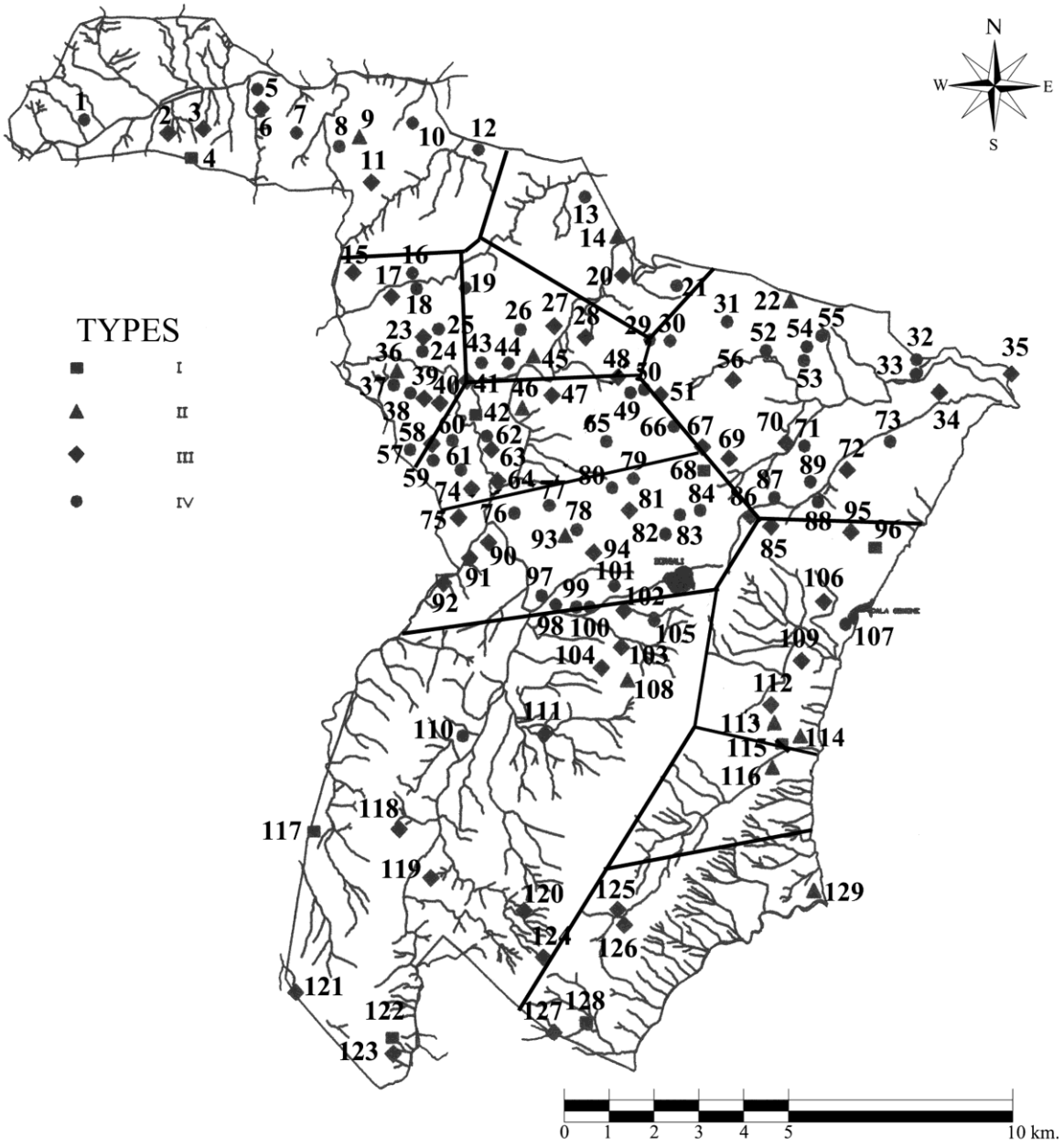

Fig. 4 - Thiessen polygons according to group II sites.

types IIb and IIc are not as clear although the first of them is situated in high gradient areas but little visual control is obtained, except over the nearby areas. Almost all the southern hilly area sites are included in this type.

Group III is characterized by its sites' not looking for the highest points within the 1 km area, although top summits in the restricted area are occupied. Sites do not occupy top heights even when the gradient is high, such as in the case of types IIIc and IIId (Fruncunieddu and Gutturu 'e Jacas). This occurs frequently in order to be close to the important resources to be controlled, the sea and routes to inland areas (Spanedda and Cámara 2003), in an effort to obtain immediate unit control. Type IIIb is defined by the situation in hilly zones as shown by YCAI1 low values. Finally, the lowest

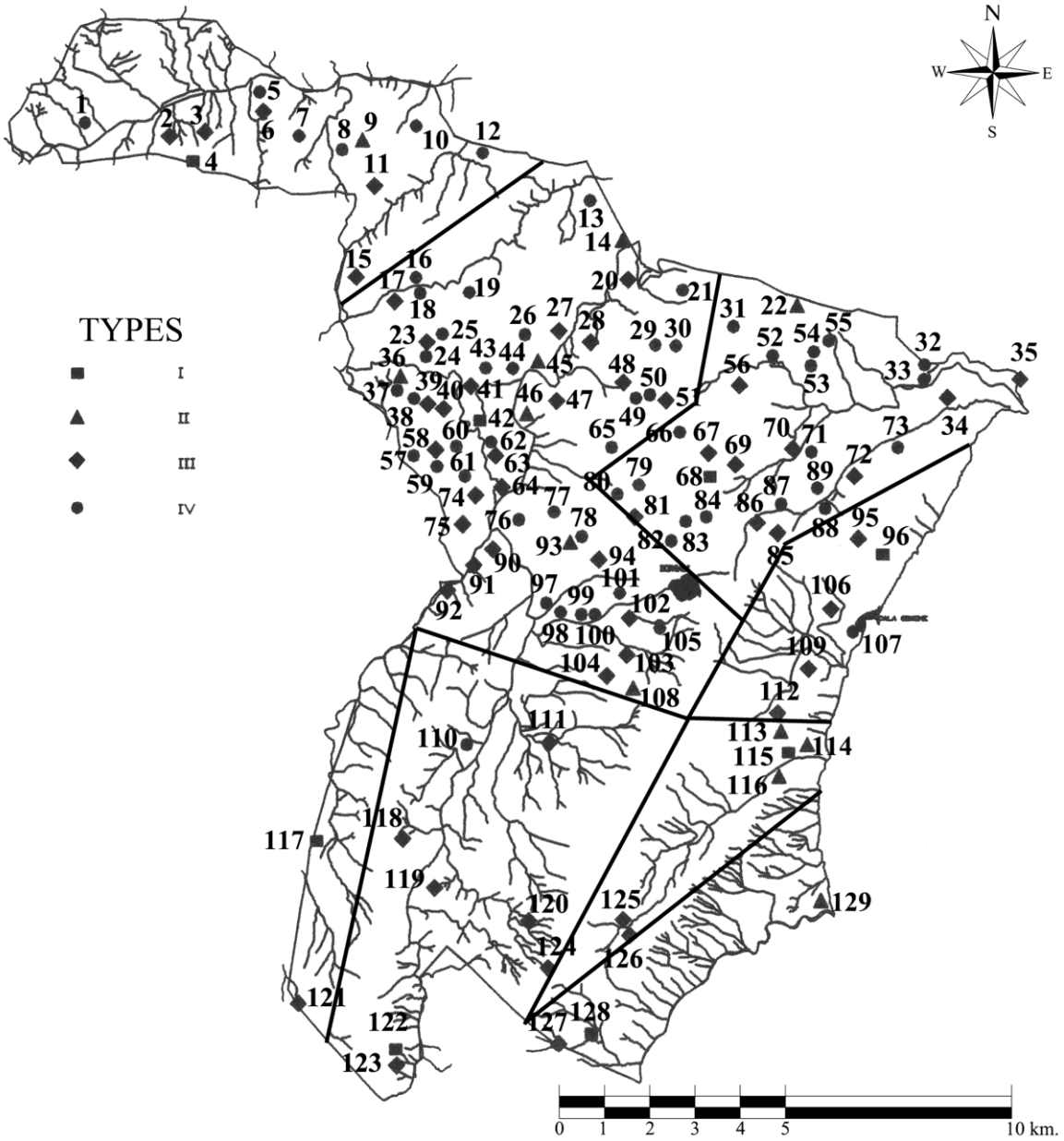

Fig. 5 - Hypothetical influence areas according results from the analysis made with gradient, control and defensibility data.

YCAUI1 values are found in type IIIa even with high YCAI2 values. These are coastal sites that emphasize routes inland and are slightly distanced from the shore.

If we pay special attention to type Ib and group II sites, we can see (fig. 7) the existence of lines of monuments not very separated from main river valleys, which are thus positioned in order to connect the valleys. In fact most of them were situated in groups I-III of the previous study, such as Biristeddi, Coazza and S. Elene. The scattered southern distribution is the result of control being less of a necessity, although control sites are located in points with greater visibility in order to exert domain over these hilly areas.

RESOURCE AND TERRITORIAL CONTROL: TWO DIFFERENT ASPECTS

Based upon the foregoing analysis we have discovered that certain sites, such as Biristeddi, even without emphasizing global territorial control, look for the highest situation in the restricted unit, although worse settlement conditions are present there. However, taking into account the problems arising in previous classifications, due to the excessive influence of YCAI2 and YCAUI2 (sea proximity), new secondary and testing variables have been defined. 250 m geomorphologic unit variables have been divided by 1 km geomorphologic area variables, thus obtaining three new indexes (YP, YV1 and YV2). High values (much greater than 1) are related to strategic settlements which look for control over the immediate farming zones and other sites, middle values (1.3 approx.) show little control emphasis, and values around 1 are due to sites that look for global and immediate control or sites that do not have any control. Finally, sites with low values (around 0) are related to global control and not to resource control (isolated towers).

It has been possible to use Cluster Analysis in the classification because of greater differences among sites, as is shown by the dendrogram division (fig. 8), which has been a guide in understanding the Principal Component Analysis results (fig. 9). Variable correlations are very low and explained variability in the first two components is less than 77%, although discussion is favoured by value concentration in the first component.

Low and moderate gradient sites are concentrated in Group I where 250 m geomorphologic unit control is emphasized without occupying the top summits in the 1 km geomorphologic area and few cases are found in which the highest positions are preferred inside a low topography. Unit control is even lower in type Ib, although relative height 2 indexes are greater than type Ia ones, within a low and moderate gradient context. Type Ib can be divided according to gradients, higher in subtype Ib2, and 250 m unit control, with lower values in subtype Ib3.

Immediate unit control is strongly exerted by Group II sites, which look for strategic high gradient situations in low gradient areas. Many of the group II sites in our first analysis, such as Coazza and Biristeddi, are included in type IIa which can be defined by moderate gradient positions and domination of a wide territory, given the absence of visibility obstacles in 1 km geomorphologic area, although immediate control was emphasized. This 250 m unit control inside greater gradient areas is also preferred by type IIb. They are sites which are located on the boundaries of river valleys, so the same function given to our first analysis' group III centred in defensibility has also been attributed to these sites. If maximum control is exerted from the subtype IIb1 sites we must say that it is due to the fact that these sites are located in a hilly context as proven by YCUI2 values. Subtype IIb2 is characterized by the same features in relation to control but lower gradient units are chosen for settling. The foregoing suggests that settlements look for easily-worked agricultural lands.

Only one site is included in Group III, La Favorita, because of the contrast between the two relative height indexes, due to sea proximity, and also because of low gradients.

High values in relative height indexes are found in Group IV, whose sites are located inside low gradient areas where high gradient and strategic geomorphologic units are chosen for settling. Only subtype IVa2, Golunie, does not concern itself with general control of geomorphologic area because it has a sea special interest. All the other cases are visual connecting sites, especially in subtype IVa1 (Bia 'e S'Ebbas, Santu Nicola and Neulè).

We find again the same settlements in strategic groups. These sites were used to control wide territorial portions (*nuraghi*

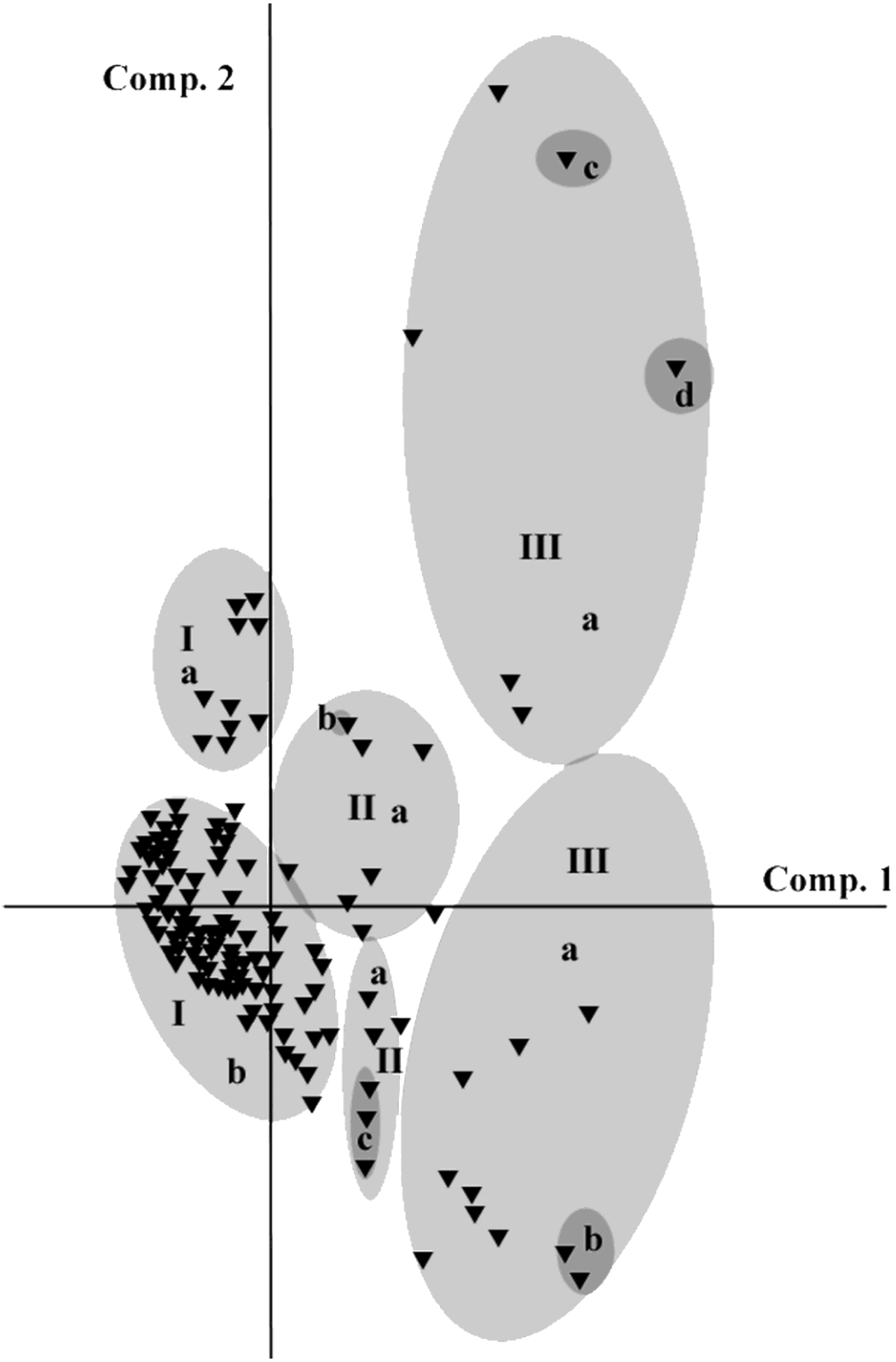

Fig. 6 - Principal Components Analysis from gradient and relative height indexes. 1º and 2º Components Graphics.

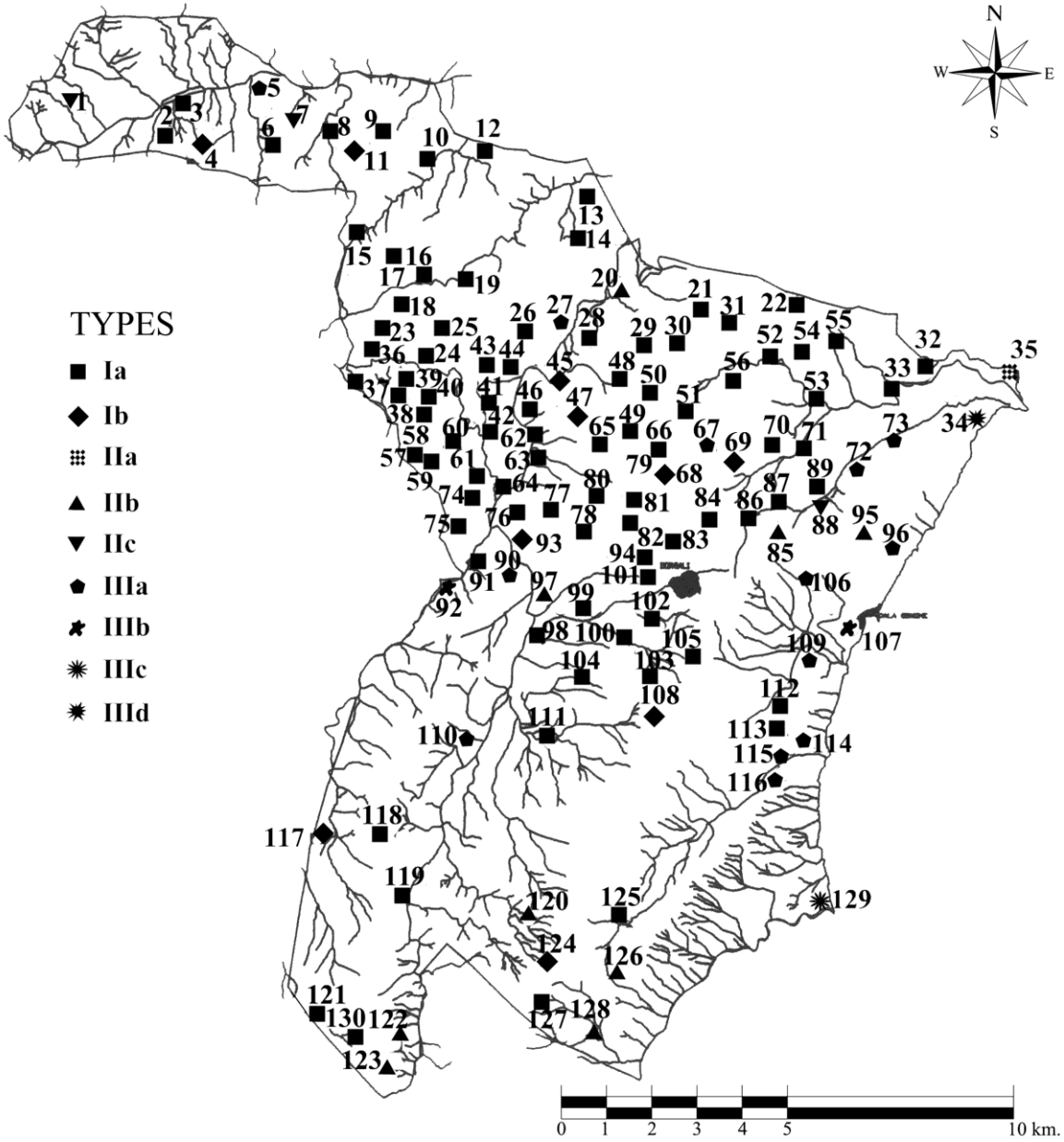

Fig. 7 - Dorgali territory distribution of site groups according to Gradient Relative Height.

included in our group II, especially type IIa, and group IV) while most settlements were located near rivers although some of them do not lose external control as is suggested by our type IIb. It is very interesting to note that *protonuraghe* Su Barcu is situated in our type IIa in order to control north-western Dorgali area, which is easily reached by sea.

Thiessen Polygons can be used to try to explain territorial organization based on type IIa (fig. 10) and the system of enclosing river valleys based on type IIb. Recurrent areas and respective centres are shown by these results: 1) Middle Cedrino River with Ruju-Biristeddi as centres and a defensive system formed by Abba Noa-Su Casteddu-Lottoniddu; 2) Dorgali Plateau with Coazza-Corallinu; 3) North-eastern area or Osalla River with Su Barcu-Casteddu

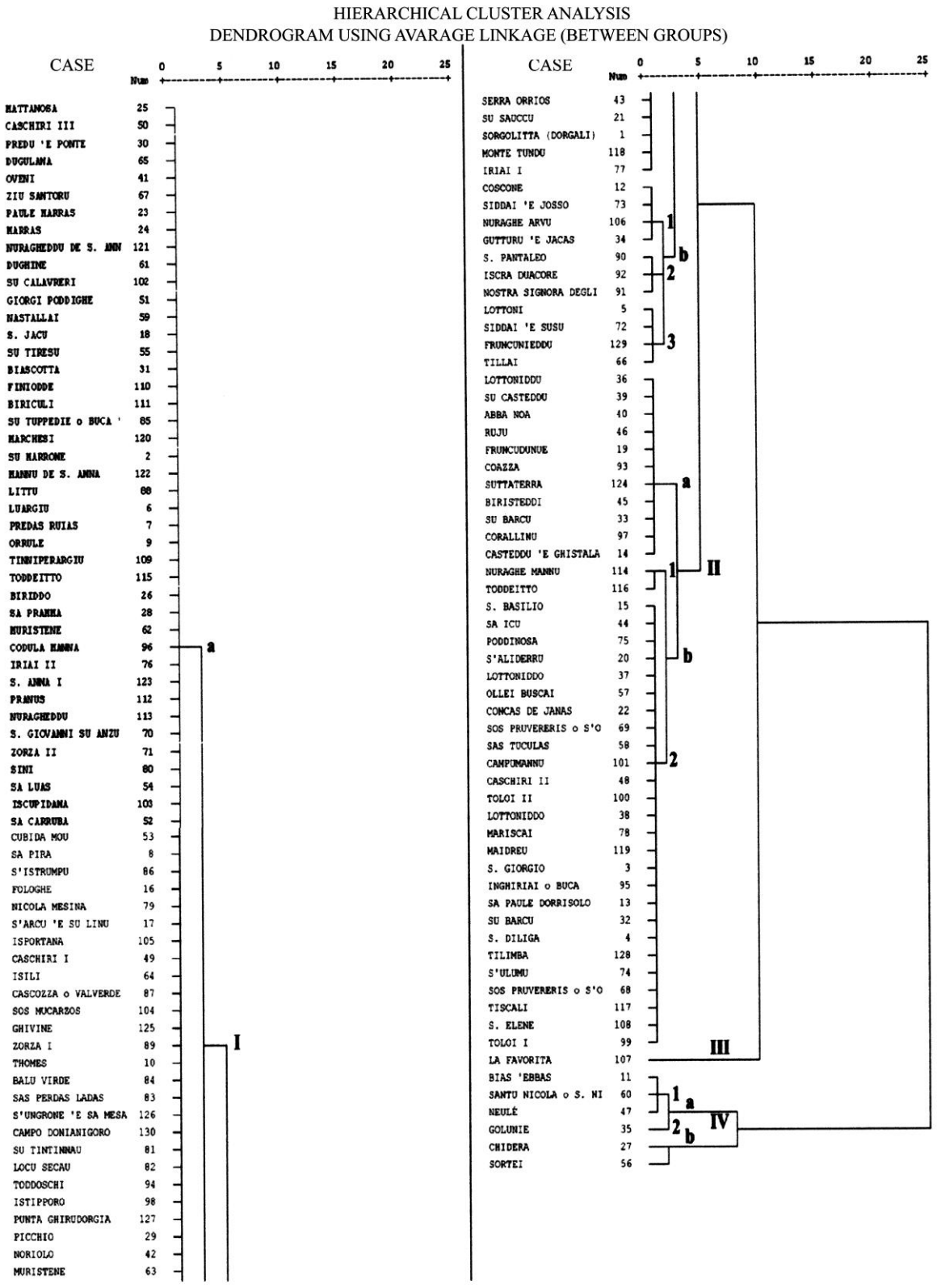

Fig. 8 - Cluster Analysis Dendrogram, using relation among 250 m and 1 km geomorphologic area Gradient and Relative Height Indexes.

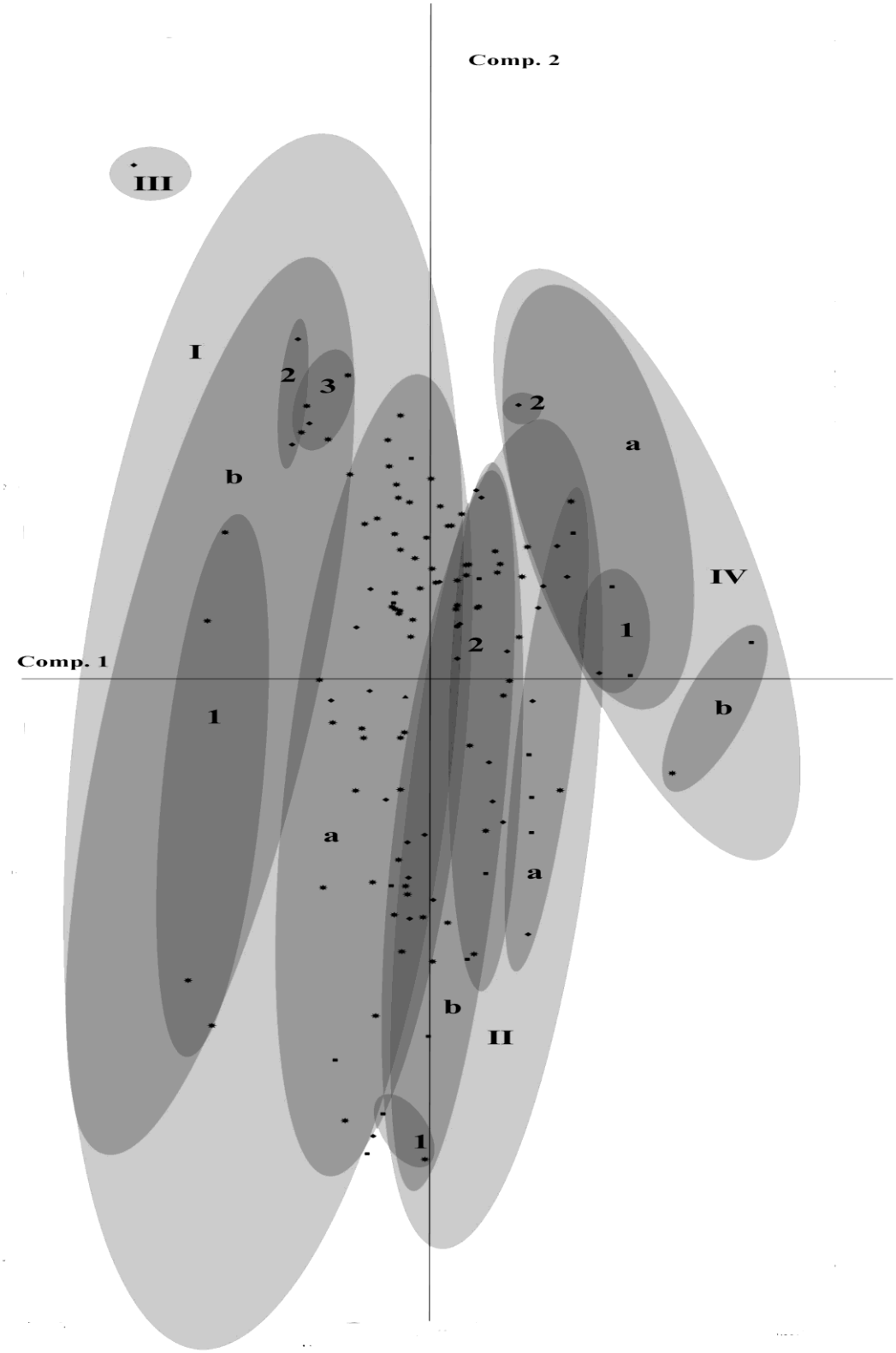

Fig. 9 - Principal Components Analysis, using relation among 250 m and 1 km geomorphologic area Gradient and Relative Height Indexes. 1º and 2º Components Graphics.

‘e Ghistala; 4) Southern area with Sutta-terra. 5) Problems arise in relation to the north-western area where we find Dorgali municipality limits before Isalle River ends.

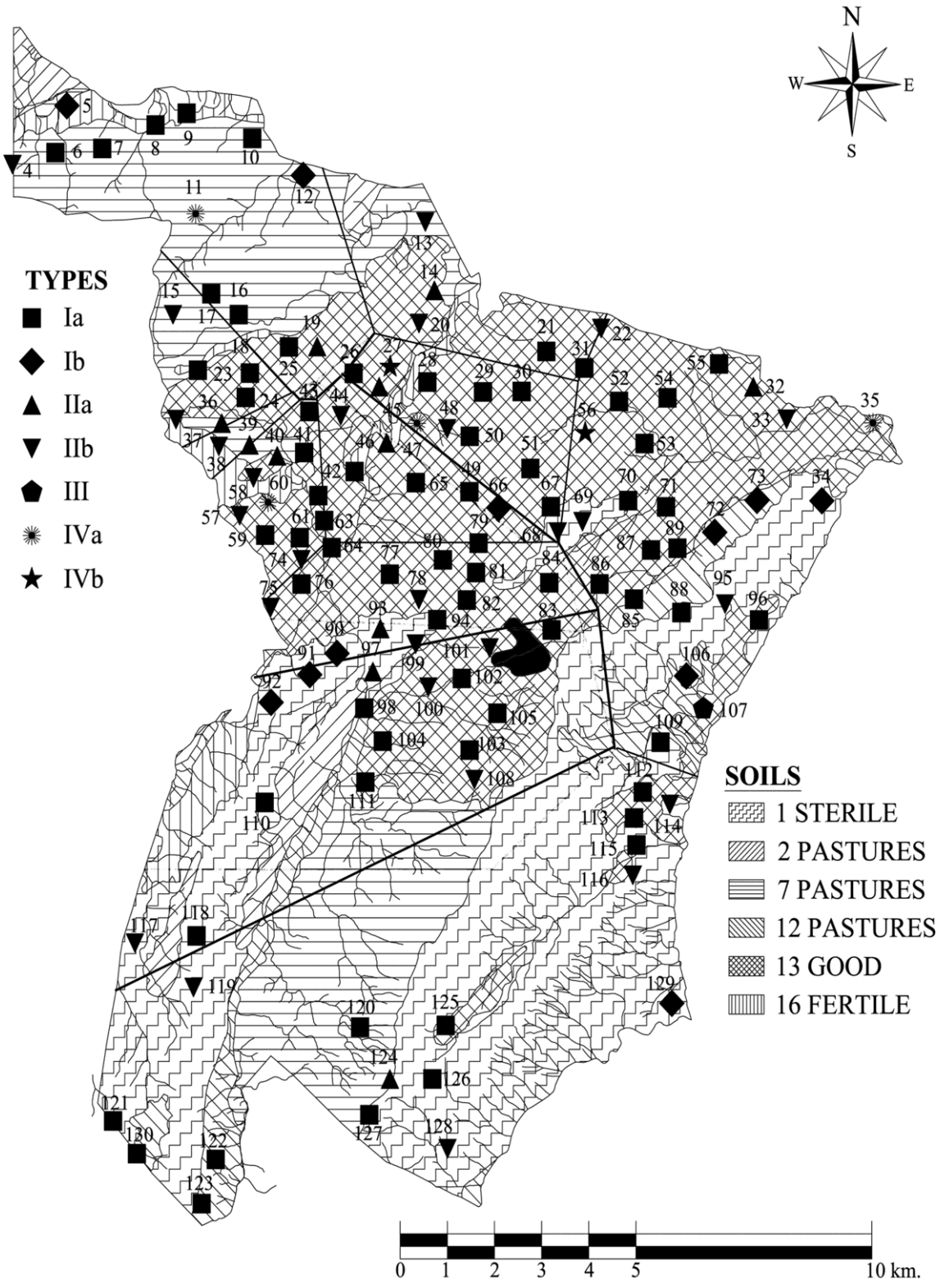

Fig. 10 - Type IIa sites Hypothetical Influence Areas in relation to soils types in Dorgali.

in Cedrino River, but the Isalle area can be defined in spite of them, as we have proved by regional analysis (Spanedda 2007).

Other problems have been found in discovering the relation between Dorgali Plateau and Cedrino Valley, while Cala Fiuli-Cala Gonone coastal sites can be strongly related to two inland areas, depending on Coazza-Corallinu and Suttaterra, where valleys provide a narrow pass from the coast to inland areas.

This information can be related to edaphologic data and it can thus be said that hierarchical sites are not directly linked to better lands, as have been shown in other Sardinian areas (Webster 1996, p. 150, 2001, p. 125), although they are situated near them, looking for a non-direct control in ecotons which offer different resources

This situation is especially visible in the middle Cedrino River where an arc of defensive and strategic *nuraghi* are located around the best agricultural lands as shown by Lottoniddu-Su Casteddu-Abba Noa-Santu Nicola and Biristeddi-Neulè-Ruju-Chidera groups.

If we use these data in relation to agrarian capacity, we will find a certain coincidence with respect to soil types in three great areas: north-western, central and southern (including coast). In any case the most interesting results are obtained by examining the relation between each site, especially hierarchical ones, and surrounding lands.

Non-fertile soils are frequent in the southern area (cartographic units 7 and 11) but sites tend to look for the best lands near rivers (surface soils such as those found in cartographic unit 13) especially in the coastal area, where, however, Suttaterra prefers to emphasize strategic control between the Flumineddu basin and other small rivers that flow towards the coast. In any case this important site is located on the border between two soil types, which may facilitate the use of different resources.

In Dorgali Plateau non-fertile soil types are the most frequent and are mainly used as pastures (cartographic units 2 and 13). The exception is found on the eastern edge (cartographic unit 16) which is useful for farming and has no monuments, because they are in the Oliena municipality, not on lands with good soil but rather in places that offer the possibility of controlling them. In any case most sites in Dorgali Plateau search for the best lands, and although Coazza and Corallinu dominate a transition zone between different soils, Corallinu is situated in a craggy area with poor soils. In fact most boundary sites are located over these types of soils.

Inside the north-eastern Osalla River area, sites are concentrated in the areas where vast expanses of good soils can be found (cartographic unit 13), such as in Su Barcu. Coastal control and farming interests are emphasized by Golunie (located on type 16 soil), but locating sites on edaphologic unit limits is common, suggesting the search for ecotons.

Finally we must mention the considerable *tombe di giganti* concentration around these groups that exerts non-direct control over the best lands in Cedrino area. In fact, the only two examples of three tombs near each settlement come from Santu Nicola and Biristeddi, and in the first of them eight graves can be seen if we count all the sites in the group (Lottoniddu-Su Casteddu-Abba Noa-Santu Nicola). The most interesting characteristic is, however, the frequency of complex *nuraghi* (Taramelli 1929; Spanedda 1994-95; Manunza 1995; Moravetti 1998) inside our strategic groups, especially in the Cedrino area: Biristeddi, Abba Noa and Ruju, and others such as S'Ulumu and Poddinosa included in our type IIb, or Noriolo referred to in our first analysis.

In conclusion, we would highlight the following:

1. The presence of strategic sites in every area of the Dorgali municipality (groups II and IV).
2. The demographic concentration around these sites, at least in the Cedrino River and

in the southern area, as shown by Nuragic towers and village association, although in northern areas we cannot always find villages and towers in proximity.
3. Possible evolutionary changes such as the one seen in the presence of a *protonuraghe*, Su Barcu, in north-western Osalla River area, and in the strategic position of Funcudunue village around Dorgali, possibly at a later date.

Each of these points can be found in different Sardinian areas. System antiquity can be seen in other areas, such as Guspinese (Medio Campidano), where links among simple and complex *protonuraghi* and villages have been proposed from the beginning of the Middle Bronze Age, around 1900 B.C. (Ugas 1998, pp. 532-534). Similar arguments can be set forth in relation to the Ottana area (Nuoro), where association between villages and Nuragic towers is more frequent if we talk about *protonuraghi* (Tanda 1990, p. 35). *Protonuraghi* location on more strategic points can also be argued in Logudoro-Meilogu (Sassari) (Foddai 2003, pp. 179-180), in Campidano (Ugas 2006, p. 78), and in Flumendosa River (Manca 2007, pp. 74-75). More similarities between our study area and Tirso River (Sedilo, Oristano) can be established because *protonuraghi* are aimed at controlling different areas, even external ones, from the plateau edge (Depalmas 1998a, pp. 45, 52-53, 1998b, p. 22; Marras 1998, pp. 24-25; Tanda 1998, p. 103).

Different defensive lines can also be found in areas such as Villaperuccio (Carbonia-Iglesias) (Melis M.G. 2000b, p. 52) or Isili basin (Nuoro) where simple Nuragic towers tend to surround valley areas. In the latter, complex *nuraghi*, villages with or without Nuragic towers and other simple towers are found (Navarra 1997, p. 336). These simple towers are always connecting the main sites (Manunza 1987-88, p. 352; Bartoloni 1989, p. 15; Contu 1990, p. 87; Webster 1991, p. 842). In Giara (Medio Campidano) area simple *nuraghi* are located in plateau areas whereas complex ones are situated in the slopes from the valley to the plateau (Puddu 2001, p. 76). The first simple towers would have a boundary function not very different from marking river basin limits in our area.

Anyway, social interpretations, in our opinion, fail to consider all the implications of these systems. Cantonal organisation is very often referred (Usai 2005; Ugas 2006; Cicilloni and Migaleddu 2008; Puggioni 2009). Even as defined political units are large, dominated areas are considered restricted in order not to define state organization (Bonzani 1992; Trump 1992; Navarra 1997; Contu 1998; Depalmas 1998a-b; Alba 2000; Blake 2001; Cicilloni and Migaleddu 2008) and differences inside villages (Phillips 1978; Webster 1991, 2001) are not considered relevant enough to talk about hierarchical order even when aristocracy, tribute and domain are present (Ugas 1998, 2006; Bernardini 2000; Webster 2001; Kolb 2005). Only a few exceptions (Cámara 1998; Lilliu 2006; Stiglitz 2006; Spanedda 2007) have defended state-like organization.

The only way to prove it in Sardinian Prehistory must take into account data about the whole of productive system but strategical political organization is a good clue as have been even said by processual archaeologists (Rothman 2004). In order to refer state organization, several levels in settlement hierarchization (three or four) are looked for. We think that these levels can be found in Bronze Age sites distribution inside Dorgali municipality (political centres, isolated towers aimed to control and farming settlements), although chronological problems must not be hidden.

Anyway concepts as “chiefdom” or “increasing complexity”, very often used in Sardinian Prehistory (Bonzani 1992; Usai 1995, 2006; Navarra, 1997; Depalmas 1998a-b; Blake 2001; Webster 2001; Dyson and Rowlands 2007), must be avoided, because of their evolutionary character, which drives to integrate even tributary and aristocratic societies. They are not only

unadequate for Nuragic Sardinia (Perra 2009) but for all the societies (Feinman and Neitzel 1984; Nocete 1984; Yoffee 1993).

Other problems can be found in the definition of state boundaries in every chronological period, especially as excavation data are so scarse. We have proposed five main areas in Dorgali municipality for the Middle Bronze Age and transition to Late Bronze Age, although two of them (northwestern and southern) can't be clearly defined because of their situation at Dorgali municipality limits. Some chronological changes can be suggested, mainly linking the Dorgali northern areas (Isalle, Cedrino and Osalla) before Final Bronze Age, but only a study on wider areas can help to get hypothesis about the real dimensions of Sardinian Bronze Age communities. In this sense Orosei Gulf analysis (Spanedda 2007) have suggested that real northern boundaries must be searched between Orosei and Siniscola municipalities, while southern territories can remain as have been previously suggested (Dorgali plateau and southern areas as two political entities, last of them probably linked to Baunei area).

Finally, we think that the results presented in this paper show: hierarchical territorial organization, the important role of sea and river connections, differential control of land resources not directly exerted by political centres, and a great extension of political entities. Each of these conclusions contributes to the argument in favour of state organization of Nuragic Sardinia, although basic evidence comes from differences in ritual and domestic consumption as shown by the Warriors' Tomb (Decimoputzu, Cagliari) (Ugas 1990) at a surprisingly early date and by Duos Nuraghes project and Arrubiu (Orroli, Nuoro) data about consumption and storage differences (Webster and Webster 1998; Perra 2009), among other examples. Masking by collective burial has also been referred (Perra 2009, p. 364), a typical feature of a hierarchical society (Cámara 2001). If this society isn't tribal (communitary) (Perra 2009, pp. 361, 363) can be only considered as a state one.

What kind of state is it, will be a necessary question. Characteristics referred by the most of authors will give the essential features, a tributary one, but specific characteristics must be analysed in detail: centralization degree, ways of inheritance, role of exchanges, existence of other class relations, persistence of communitary relations, etc. Complex and diverse social relations in a state society explain archaic features in Nuragic society (collective burial for example) and references to communitary relations (Usai 2006; Perra 2009).

REFERENCES

ALBA E. 1998, *The distribution of Nuraghi in the Nurra in relation to the geomorphologic aspects of the territory*, in *Papers*, pp. 72-83.

ALBA E. 2000 (2003), *Nota preliminare sullo studio delle comunità nuragiche della Sardegna nord-orientale*, SS XXXIII, pp. 55-98.

ALBA E. 2003, *Il territorio di Porto Torres prima dei romani*, in *Studi*, pp. 147-171.

ALBA E. 2005, *La organización del territorio en la Edad del Bronce y del Hierro en Cerdeña nororiental (Italia)*, Arqueología y Territorio 2, pp. 31-46.

ALBA E. 2009, *Métodos de análisis territorial aplicados a la ocupación de la zona de Alghero (Cerdeña, Italia) durante la Edad del Bronce*, Tesis Doctoral, Universidad de Granada, Granada (http://0-hera.ugr.es.adrastea.ugr.es/tesisugr/18157270.pdf).

ANTONA A. 2005, *Il complesso nuragico di Lu Brandali e i monumenti archeologici di Santa Teresa di Gallura*, Sardegna Archeologica. Guide e Itinerari 37, Carlo Delfino Editore, Sassari.

ATTI SENORBÌ - AA.VV. 2008, *La civiltà nuragica. Nuove acquisizioni II*, Atti del Convegno, Dolianova.

BADAS U. 1992, *Il nuraghe Bruncu Madugui di Gesturi: un riesame del monumento e del corredo ceramico*, QSACO 9, pp. 31-76.

BARTOLONI P. 1989, *Monte Sirai*, Sardegna Archeologica. Guide e Itinerari 10, Carlo Delfino Editore, Sassari.

BASILDO R.M., GUTIÉRREZ J., RUIZ-GÁLVEZ M. 2005, *Generación de un sistema de información geográfica*, in RUIZ-GÁLVEZ M., ed., *Territorio nurágico y paisaje antiguo. La Meseta de Pranemuru (Cerdeña) en la Edad del Bronce*, Complutum Anejos 10, pp. 133-168.

BERNARDINI P. 2000 (2002), *La Sardegna e gli altri: elementi di formazione e di sviluppo*, QSACO 17, pp. 69-92.

BLAKE E. 2001, *Constructing a Nuragic Locale: The Spatial Relationship between Tombs and Towers in Bronze Age Sardinia*, AJA 105, 2, pp. 145-161.

BONZANI R.M. 1992, *Territorial boundaries, buffer zones and sociopolitical complexity: a case study of the*

Nuraghi on Sardinia, in *Sardinia in the Mediterranean*, pp. 210-220.

BURILLO F., PICAZO J.V. 2001, *Prospección arqueológica y Edad del Bronce: una experiencia en la serranía turolense*, in RUIZ-GÁLVEZ M., ed., *La Edad del Bronce, ¿Primera Edad de Oro de España? Sociedad, economía e ideología*, Crítica, Barcelona, pp. 87-120.

CÁMARA J.A. 1998, *El control del territorio en la Edad del Bronce. Una comparación entre las situaciones sarda y andaluza*, in *Papers*, pp. 67-71.

CÁMARA J.A. 2001, *El ritual funerario en la Prehistoria Reciente en el Sur de la Península Ibérica*, BAR 913, Oxford.

CÁMARA J.A., LIZCANO R., CONTRERAS F., PÉREZ C., SALAS F.E. 2004, *La Edad del Bronce en el Alto Guadalquivir. El análisis del patrón de asentamiento*, in HERNÁNDEZ L., HERNÁNDEZ M.S., eds., *La Edad del Bronce en tierras valencianas y zonas limítrofes*, Ayuntamiento de Villena, Instituto Alicantino de Cultura Juan Gil-Albert, Villena, pp. 505-514.

CAMPUS F. 2008, *I sistemi territoriali dell'altopiano di Pran'e Muru*, in *Paesaggio*, pp. 97-108.

CAMPUS F., LEONELLI V. 2000, *La tipologia della ceramica nuragica. Il materiale edito*, BetaGamma Editrice, Sassari.

CASTIA S. 2003a, *Territorio e società nella Sardegna nuragica. Il sistema insediativo dell'Alta e Bassa Gallura*, in CASTIA S., CAMPUS F., LEONELLI V., a cura di, *Terra e fuoco. Economia di sussistenza e organizzazione sociale nella Sardegna preistorica e protostoria: l'età nuragica*, Cronache di Archeologia 4, Sassari, pp. 8-103.

CASTIA S. 2003b, *Il sistema insediativo nuragico dell'alta Gallura*, AttiIIPP XXXV, pp. 973-975.

CICILLONI F. 2007, *Il nuraghe Cuccurada di Mogoro (OR) nel contesto archeologico dell'alta Marmilla*, in *Ricerca e confronti*, pp. 35-41.

CICILLONI R. 2009, *L'archeologia del paesaggio pre-protostorico in Sardegna*, AttiIIPP XLIV, I, pp. 293-303.

CICILLONI F., MIGALEDDU M. 2008, *Monumenti nuragici in territorio di Teulada (CA): note preliminari*, in *Atti Senorbì*, pp. 443-448.

CONTU E. 1990, *Il nuraghe*, in ATZENI E., BARRECA F., BERNARDINI P., CONTU E., FADDA M.A., FERRARESE CERUTI M.L., LO SCHIAVO F., MORAVETTI A., SANGES M., SANTONI V., TRONCHETTI C., UGAS G., a cura di, *La civiltà nuragica*, Electa, Milano, pp. 35-99.

CONTU E. 1998, *La Sardegna preistorica e nuragica*, Chiarella, Sassari.

COSSU T., PERRA M. 1998, *Two contexts of the Bronze Age in the Nuraghe Nolza of Meane Sardo (Nuoro)*, in *Papers*, pp. 97-109.

COSSU T., PERRA M. 2008, *I sistemi territoriali della Barbagia-Mandrolisai e della Marmilla*, in *Paesaggio*, pp. 119-130.

DEPALMAS A. 1990, *Saggio di analisi del territorio*, in *Ottana*, pp. 131-166.

DEPALMAS A. 1995, *I monumenti e l'ambiente. Saggio di Site Catchment Analysis*, in TANDA G., a cura di, *Progetto Iloi, Sedilo 1. I monumenti. T. I. I monumenti situati nell'area del progetto*, Antichità Sarde. Studi e ricerche 3, I-III, Sassari, pp. 33-58.

DEPALMAS A. 1998a, *Organizzazione ed assetto territoriale nella regione di Sedilo durante i tempi preistorici*, in *Sedilo 3*, pp. 33-76.

DEPALMAS A. 1998b, *Il territorio di Sedilo durante i tempi preistorici*, in SPADA A.F., a cura di, *Sedilo. La Storia*, Senorbì, pp. 11-41.

DEPALMAS A. 2009a, *Il Bronzo medio della Sardegna*, AttiIIPP XLIV, I, pp. 123-130.

DEPALMAS A. 2009b, *Il Bronzo recente della Sardegna*, AttiIIPP XLIV, I, pp. 131-140.

DEPALMAS A. 2009c, *Il Bronzo finale della Sardegna*, AttiIIPP XLIV, I, pp. 141-154.

DYSON S.L., ROWLANDS R.J. 2007, *Shepherds, Sailors & Conquerors: Archaeology and History in Sardinia from the Stone Age to the Middle Ages*, University of Pennsylvania, Museum of Archaeology and Anthropology, Philadelphia.

ENGELS F. 1884 (1986), *El origen de la familia, la propiedad privada y el Estado*, Planeta, Barcelona.

ESQUIVEL J.A., PEÑA J.A., RODRÍGUEZ M.O. 1999, *Multivariate Statistic Analysis of the Relationship between Archaeological Sites and the Geographical Data of their Surroundings. A Quantitative Model*, in DINGWALL L., EXON S., GAFFNEY V., LAFLIN S., VAN LEUSEN M., eds., *Archaeology in the Age of the Internet. CAA 97. Computer Applications and Quantitative Methods in Archaeology*, Proceedings of the 25th Anniversary Conference, BAR 750, Oxford.

FADDA M.A. 1980, *Nuraghe Mannu*, in AA.VV., *Dorgali. Documenti Archeologici*, Chiarella, Sassari, pp. 199-205.

FADDA M.A. 1990, *Villaggio nuragico di Serra Orrios - Dorgali (NU)*, in LO SCHIAVO F., DE MONTIS S., VILLANI F., a cura di, *Archeologia e Territorio*, Sassari, pp. 149-152.

FADDA M.A. 1993 (1996), *Dorgali (Nuoro). Località Serra Orrios. Villaggio nuragico*, BdArch 19-20-21, pp. 168-169.

FADDA M.A. 1994, *Dorgali (NU). Villaggio nuragico di Serra Orrios*, QSASN 19, pp. 85-89.

FADDA M.A. 1997, *Nuraghe Mannu*, Archeologia Viva 61, pp. 38-43.

FADDA M.A. 1998, *Operazione Nuraghe Mannu 4. Una sequenza abitativa dall'età nuragica all'alto Medioevo*, Archeologia Viva 67, pp. 76-77.

FADDA M.A. 2000, *Operazione Tiscali 1. Nel mito della Barbagia resistenziale*, Archeologia Viva 79, pp. 66-67.

FADDA M.A., PRUNETI P. 1997, *Nuraghe Mannu*, Archeologia Viva 61, pp. 38-43.

FEINMAN G., NEITZEL J. 1984, *Too many types: An overviewof pre-state societies in the Americas*, in SCHIFFER M.B., ed, *Advances in Archaeological Method and Theory* 7, Academic Press, New York, pp. 39-102.

FODDAI L. 1998, *The distribution of Nuraghi in "Logoduro-Meilogu" in relation to geomorphologic aspects of the territory*, in *Papers*, pp. 84-96.

FODDAI L. 2003, *Modelli d'insediamento nel "Lodudoro-Meilogu" fra l'Età del Bronzo e la prima Età del Ferro*, in *Studi*, pp. 173-199.

FORCI A. 2008, *Note sul paesaggio archeologico del Gerrei: l'esempio di Silius tra Bronzo Medio e Bronzo Recente*, in *Atti Senorbì*, pp. 417-430.

KOLB M.J. 2005, *The Genesis of Monuments among the Mediterranena Islands*, in BLAKE E., KNAPP A.B., eds., *The Archaeology of Mediterranean Prehistory*, Blackwell Studies in Global Archaeology 6,

Blackwell Publishing, Malden, pp. 156-179.
LAI L. 2009, *Il clima nella Sardegna preistorica e protostorica: problemi e nuove prospettive*, AttiIIPP XLIV, I, pp. 313-324.
LEONELLI V. 2008, *I sistemi territoriali degli altopiani di Aguzzini, Tacquara e della piana di Isili*, in *Paesaggio*, pp. 109-118.
LILLIU G. 1947, *Dorgali (Nuoro): villaggio nuragico di Serra Orrios. Impressioni ed osservazioni*, SS VII, 1-3, pp. 241-243.
LILLIU G. 1982, *La civiltà nuragica*, Carlo Delfino Editore, Sassari.
LILLIU G. 1984, *La civiltà dei Sardi dalla preistoria alla fine del mondo antico*, in AA.VV., *I Sardi*, Cagliari, pp. 11-24.
LILLIU G. 1988, *La civiltà dei Sardi dal Paleolitico all'età dei nuraghi*, Nuova Eri Edizioni RAI, Torino.
LILLIU G. 2006, *Sardegna nuragica*, Il Maestrale, Nuoro.
LILLIU G., ZUCCA R. 1988, *Su Nuraxi di Barumini*, Sardegna Archeologica. Guide e Itinerari 9, Carlo Delfino Editore, Sassari.
LLOBERA M. 2007, *Reconstructing visual landscapes*, in LAKE M., ed., *Viewing Space.* World Archaeology 39, 1, pp. 51-69.
LO SCHIAVO F. 1978, *Voragine di Tiscali, Oliena*, in AA.VV, *Sardegna Centro-Orientale dal Neolitico alla fine del Mondo Antico*, Dessì, Sassari, pp. 95-96, tav. XXXI.
LO SCHIAVO F., SANGES M. 1994, *Il Nuraghe Arrubiu di Orroli*, Sardegna Archeologica. Guide e Itinerari 22, Carlo Delfino Editore, Sassari.
MANCA G. 2007, *Il nuragico arcaico e il Nuraghe Òrgono*, Iskra, Ghilarza.
MANCA L., DEMURTAS S. 1984, *I protonuraghi. (Nuovi dati per l'Oristanese)*, in WALDREN W.H., CHAPMAN R., LEWTHWAITE J., KENNARD R-C., eds., *The Deya Conference of Prehistory. Early settlement in the Western Mediterranean Islands and their Peripheral Areas. Part II*, BAR 229, 2, Oxford, pp. 629-669.
MANUNZA M.R. 1985, *Il patrimonio archeologico del comune di Dorgali (Nu)*, in AA.VV., *10 anni di attività nel territorio della provincia di Nuoro*, Nuoro, pp. 14-16.
MANUNZA M.R. 1987-88 (1990), *Censimento archeologico in territorio di Baunei (Nuoro)*, RSP XLI, pp. 351-357.
MANUNZA M.R. 1995, *Dorgali. Monumenti antichi*, Oristano.
MARRAS G. 1998, *I monumenti e i dati morfologici e altimetrici*, in *Sedilo 3*, pp. 21-32.
MELIS M.G. 1997, *Indagini territoriali a Capoterra (CA). Tracce di insediamento preistorico in località Tanca di Nissa*, QSACO, pp. 3-19.
MELIS M.G. 2000a, *L'età prenuragica*, in *Villaperuccio*, pp. 26-35.
MELIS M.G. 2000b, *L'età nuragica,* in *Villaperuccio*, pp. 48-55.
MELIS M.G. 2003, *Aspetti insediativi nel Sulcis tra Neolitico ed Eneolitico: il territorio di Villaperuccio*, in *Studi*, pp. 83-95.
MELIS M.G. 2007, *Ricognizioni archeologiche a Capoterra (Cagliari): il ruolo di un ecosistema complesso nel popolamento e nell'uso del territorio*, in *Ricerca e confronti*, pp. 77-89.
MELIS P. 1998, *Carta archeologica del comune di Sedini (SS)*, ArchStSard XXXIX, pp. 35-76.
MELIS P. 1999-2000 (2001), *Emergenze archeologiche nel territorio di Florinas (Sassari). Notizia preliminare*, RSP L, pp. 375-412.
MELIS P. 2003, *Civiltà nuragica*. Carlo Delfino Editore. Sassari.
MELIS P. 2004, *La ricerca preistorica e protostorica in Sardegna: nuovi sviluppi*, in DEIANA L., *Architetture della Sardegna preistorica. Nuove ipotesi e ricerche*, Atti del Convegno, Nuoro, pp. 30-43.
MELIS R.T. 1998, *La ricostruzione paleoambientale come strumento di indagine archeologica*, in *Sedilo 3*, pp. 9-20.
MORAVETTI A. 1986 (1990), *Nota preliminare agli scavi del Nuraghe S. Barbara di Macomer*, NBAS 3, pp. 49-113.
MORAVETTI A. 1992, *Sui Protonuraghi del Marghine e della Planargia*, in *Sardinia in the Mediterranean*, pp. 185-197.
MORAVETTI A. 1998, *Serra Orrios e i monumenti archeologici di Dorgali*, Sardegna Archeologica. Guide e Itinerari 26, Carlo Delfino Editore, Sassari.
MORAVETTI A. 2000, *Ricerche archeologiche nel Marghine-Planargia II*, Carlo Delfino Editore, Sassari.
MORAVETTI A. 2006, *La preistoria: dal paleolítico all'età nuragica*, in AA.VV., *Storia della Sardegna 1. Dalle origini al Settecento*, Laterza, Roma-Bari, pp. 3-20.
MORENO M.A., CONTRERAS F., CÁMARA J.A. 1991-92 (1997), *Patrones de asentamiento, poblamiento y dinámica cultural en las tierras altas del sureste peninsular. El pasillo Cúllar-Chirivel durante la Prehistoria Reciente*, Cuadernos de Prehistoria de la Universidad de Granada 16-17, pp. 191-245.
NAVARRA L. 1997 (1998), *Chiefdoms nella Sardegna dell'Età Nuragica? Un'applicazione della circumscription theory di Robert L. Carneiro*, Origini XXI, pp. 307-353.
NOCETE F. 1984, *Jefaturas y territorio. Una visión crítica*, Cuadernos de Prehistoria de la Universidad de Granada 9, pp. 289-304.
NOCETE F. 1989, *El espacio de la coerción. La transición al Estado en las Campiñas del Alto Guadalquivir (España). 3000-1500 A.C.*, BAR 492, Oxford.
NOCETE F. 1994, *Space as coercion: the transition to the state in the social formations of La Campiña, Upper Guadalquivir Valley, Spain, ca. 1900-1600 B.C.*, Journal of Anthropological Archaeology 13, pp. 171-200.
ONESTI D. 2002, *Il caso studio di Monte d'Accoddi (Sassari). Indagine territoriale e ipotesi di calcolo della forza-lavoro*, in CASTIA S., ONESTI D., a cura di, *Terra e fuoco. Organizzazione sociale ed economia di sussistenza nella Sardegna preistorica: l'Eneolitico. Il caso studio di Monte d'Accoddi (Sassari)*, Cronache di Archeologia 3, Sassari, pp. 11-58.
OTTANA - TANDA G., a cura di, 1990, *Ottana. Archeologia e territorio*, Amministrazione Comunale di Ottana, Ottana.
PAESAGGIO - CAMPUS F., COSSU T., LEONELLI V., LO SCHIAVO F., PERRA M., SANGES M., a cura di, 2008, *Il paesaggio nuragico sull'altopiano di Pran'e Muru*, Ortacesus.
PAIS E. 1911, *Tiscali nel Nuorese*, Rivista d'Italia XIV, pp. 250-263.
PAPERS - MORAVETTI A., PEARCE M., TOSI M., eds., 1998, *Papers from the EAA Third Annual Meeting at Ravenna 1997. III. Sardinia*, BAR 719, Oxford.

PERRA M. 2008, *Un sistema territoriale nuragico nella Barbagia-Sarcidano e il nuraghe Nolza di Meana Sardo (Nuoro)*, in *Atti Senorbì*, pp. 659-670.

PERRA M. 2009, *Osservazioni sull'evoluzione sociale e politica in età nuragica*, RSP LIX, pp. 355-368.

PHILLIPS P. 1978, *Aspects of research in Sardinian Protohistory*, in BLAKE H.MCK., POTTER T.W., WHITEHOUSE D.B., *Papers in Italian Archaeology I:1*, BAR 41, I, Oxford, pp. 93-98.

PUDDU M.G. 2001, *La Giara*, in SANGES M., a cura di, *L'Eredità del Sarcidano e della Barbagia di Seulo. Patrimonio di conoscenza e di vita*, Blackwood & Partners, Sassari, pp. 75-77.

PUGGIONI S. 2009, *Patrones de asentamiento de la Edad del Bronce en el territorio costero e interior de la Cerdeña nororiental*, Tesis Doctoral, Universidad de Granada, Granada (http://0-hera.ugr.es.adrastea.ugr.es/tesisugr/18157750.pdf).

RICERCA E CONFRONTI - ANGIOLILLO S., GIUMAN M., PASOLINI A., a cura di, 2007, *Ricerca e confronti 2006. Giornate di studio di archeologia e storia dell'arte*, Quaderni di Aristeo, Università degli Studi di Cagliari, Cagliari.

ROTHMAN M.S. 2004, *Studying the Development of Complex Society: Mesopotamia in the Late Fifth and Fourth Millennia BC*, Journal of Anthropological Archaeology 12, 1, pp. 75-119.

RUIZ-GÁLVEZ M., GUTIÉRREZ J., TORRÉS M., GONZÁLEZ A., BASILDO R., LÓPEZ O., DÍAZ B. 2002, *Aproximación al paisaje de la Edad del Bronce en Pranemuru (Cerdeña)*, Complutum 13, pp. 259-280.

SANTONI V. 2009, *La cultura del Bronzo Antico I-II in Sardegna*, AttiIIPP XLIV, I, pp. 113-121.

SARDINIA IN THE MEDITERRANEAN - TYKOT R.H., ANDREWS T.K., eds., 1992, *Sardinia in the Mediterranean: a footprint in the sea. Studies in Sardinian Archeology presented to Miriam S. Balmuth*, Monographs in Mediterranean Archaeology 3, Sheffield Academic Press, Sheffield.

SEDILO 3 - TANDA G., a cura di, 1998, *Sedilo 3. I monumenti nel contesto territoriale comunale*, Antichità Sarde. Studi e Ricerche 3, I-III, Villanova Monteleone.

SPANEDDA L. 1994-95, *Archeologia del territorio. Emergenze archeologiche dal Paleolitico alla tarda età romana nei Fogli 195 e 208 dell'I.G.M.*, Tesi di Laurea, Università degli Studi di Sassari, Sassari.

SPANEDDA L. 2002, *La Edad del Bronce en el municipio de Dorgali (Nuoro, Cerdeña)*, Saguntum 34, pp. 75-90.

SPANEDDA L. 2007, *La Edad del Bronce en el Golfo de Orosei (Cerdeña, Italia)*, Tesis Doctoral, Universidad de Granada, Granada, (http://0-hera.ugr.es.adrastea.ugr.es/tesisugr/16526569.pdf).

SPANEDDA L., CÁMARA J.A. 2003 (2004), *Tombe e controllo del territorio. Un esempio di distribuzione spaziale a Dorgali (NU)*, RassA 20, A, pp. 163-182.

SPANEDDA L., CÁMARA J.A. 2009, *Il controllo del territorio nel comune di Lodè durante l'Età del Bronzo*, in MELIS P., a cura di, *Lodè, testimonianze archeologiche*, Comune di Lodè, Università degli Studi di Sassari, Sassari, pp. 31-50.

SPANEDDA L., CÁMARA J.A., NÁJERA T., TURATTI R. 2004, *Introducción al patrón de asentamiento de las comunidades nurágicas del municipio de Dorgali (Nuoro, Cerdeña, Italia)*, Arqueología Espacial 24-25, pp. 81-103.

SPANEDDA L., CÁMARA J.A., PUERTAS M.E. 2007, *Porti e controllo della costa nel golfo di Orosei durante l'età del bronzo*, Origini XXIX, pp. 119-144.

STIGLITZ A. 2006, *La bella età dei giganti di pietra*, in AA.VV., *Archeologia in Sardegna. Darwin Quaderni* 1, Roma, pp. 56-67.

STUDI - MELIS P., a cura di, 2003, *Studi in onore di Ercole Contu*, Università degli Studi di Sassari, Sassari.

TANDA G. 1990, *Sequenza culturale dal Neolitico all'età medievale*, in *Ottana*, pp. 35-85.

TANDA G. 1998, *I monumenti prenuragici e nuragici*, in *Sedilo*, pp. 79-115.

TANDA G. 2004, *Dalla preistoria alla storia*, in BRIGAGLIA M., a cura di, *Storia della Sardegna*, Edizioni della Torre, Cagliari, pp. 25-74 (Reed.).

TANDA G., DEPALMAS A. 1991, *Saggio di analisi del territorio nella Sardegna centrale*, in AA.VV., *Arte militare e architettura nuragica*, Proceedings of the First International Colloquium on Nuragic Architecture, Stockholm, pp. 143-162.

TARAMELLI A. 1929, *Carta Archeologica d'Italia al 100.000. Foglio 208, Dorgali*, Firenze.

TARAMELLI A. 1933, *Dorgali. Esplorazioni archeologiche nel territorio del Comune*, NSc LIV, pp. 347-380.

TRUMP D. 1992, *Militarism in Nuragic Sardinia*, in *Sardinia in the Mediterranean*, pp. 198-203.

TYKOT R.H. 1994, *Radiocarbon dating and absolute chronology in Sardinia and Corsica*, in SKEATES R., WHITEHOUSE R., eds., *Radiocarbon dating and Italian prehistory*, University of London, London, pp. 115-145.

UGAS G. 1990, *La tomba dei guerrieri di Decimoputzu*, Norax. Collana di studi archeologici 1, Edizioni della Torre, Cagliari.

UGAS G. 1998, *Centralità e periferia. Modelli d'uso del territorio in età nuragica: il Guspinese*, in KHANOUSSI M., RUGGERI P., VISMARA C., a cura di, *L'Africa romana*, Atti del XII Convegno di Studio, Editrice Democratica Sarda, Sassari, pp. 513-548.

UGAS G. 2006, *L'alba dei nuraghi*, Fabula, Cagliari.

USAI A. 1995, *Note sulla società della Sardegna nuragica e sulla funzione dei nuraghi*, in CHRISTIE N., ed., *Settlement and Economy in Italy 1500 BC to AD 1500. Papers of the Fifth Conference of Italian Archaeology*, Oxbow Monograph 41, Oxford, pp. 253-259.

USAI A. 2005, *Testimonianze prenuragiche e nuragiche nel territorio di Narbolia*, in ZUCCA R., a cura di, *Nurabolia-Narbolia. Una Villa di frontiera del Giudicato d'Arborea*, Nuoro, pp. 21-57.

USAI A. 2006, *Osservazioni sul popolamento e sulle forme di organizzazione comunitaria nella Sardegna nuragica*, in AA.VV., *Studi di protostoria in onore di Renato Peroni*, All'Insegna del Giglio, Firenze, pp. 557-566.

VILLAPERUCCIO - ATZENI E., MELIS M.G., a cura di, 2000, *Villaperuccio tra ipogeismo e megalitismo. Testimonianze archeologiche dalla preistoria all'età romana*, Comune di Villaperuccio, Università degli Studi di Cagliari, Villaperuccio.

WEBSTER G.S. 1991, *Monuments, mobilization and Nuragic organization*, Antiquity 65, pp. 840-856.

WEBSTER G.S. 1996, *A Prehistory of Sardinia 2300-500 BC*, Monographs in Mediterranean Archaeology 5, Sheffield Academic Press, Sheffield.

WEBSTER G.S. 2001, *Duos Nuraghes. A Bronze Age*

Settlement in Sardinia 1, BAR 949, Oxford.

WEBSTER G.S., WEBSTER M.R. 1998, *The Duos Nuraghes Project in Sardinia: 1985-1996. Interim Report*, JFA 25, 2, Boston, pp. 183-201.

YOFFEE N. 1993, *Too many chiefs (or safe texts for the '90's)*, in YOFFEE N., SHERRATT A., eds., *Archaeological Theory: Who Sets the Agenda*, Cambridge University Press, Cambridge, pp. 60-78.

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