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Applications of inter-site spatial archaeology in eastern Languedoc (France) to cast light on the history of the system of settlement from the Iron Age to the Middle Ages.

Marie-Jeanne OURIACHI¹ and François FAVORY²

Abstract:

We report here on studies of the system of settlement in eastern Languedoc (France), all of which have given precedence to inter-site spatial analysis. We evoke statistical and geostatistical analyses applied to establishments, then typologies and the computation of hierarchical scores by correspondence factor analysis: those computations were used in a simple gravity model to construct networks of establishments. Next we turn to the environment and the development of farmland. This approach allows us to define two typologies: one for infield/outfield farming, the other for topographical environments. The micro-regional profiles established in this way provide information about the development of the physical settings of habitat. This analysis has been supplemented for the Vaunage by a study of off-site artefacts that are indicative of farmed areas. For the same region and for the Lunellois, archaeological data were cross-matched with the remains of centuriations. Thirdly we look at epigraphic data that provide valuable indications about the society of the time. There again we have given precedence to spatial processing of data: mapping of citizens and peregrines, distribution of Latin or indigenous names, and analysis of spatial dynamics affecting aristocratic families.

Key words: archaeology, epigraphy, establishment, off-site artefacts, system of settlement, network of establishments, pedological and topographical setting, centuriation, citizens, peregrines, *gentes*.

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The programme we present first began in the mid 1980s and pertains to the occupation of geographical space in eastern Languedoc (France) (fig. 1), from the Iron Age until the Middle Ages (Durand-Dastès *et al.* 1998; Favory *et al.* 1994a and b; Nuninger 2002; Ouriachi 2009; Raynaud 2003; 2007).

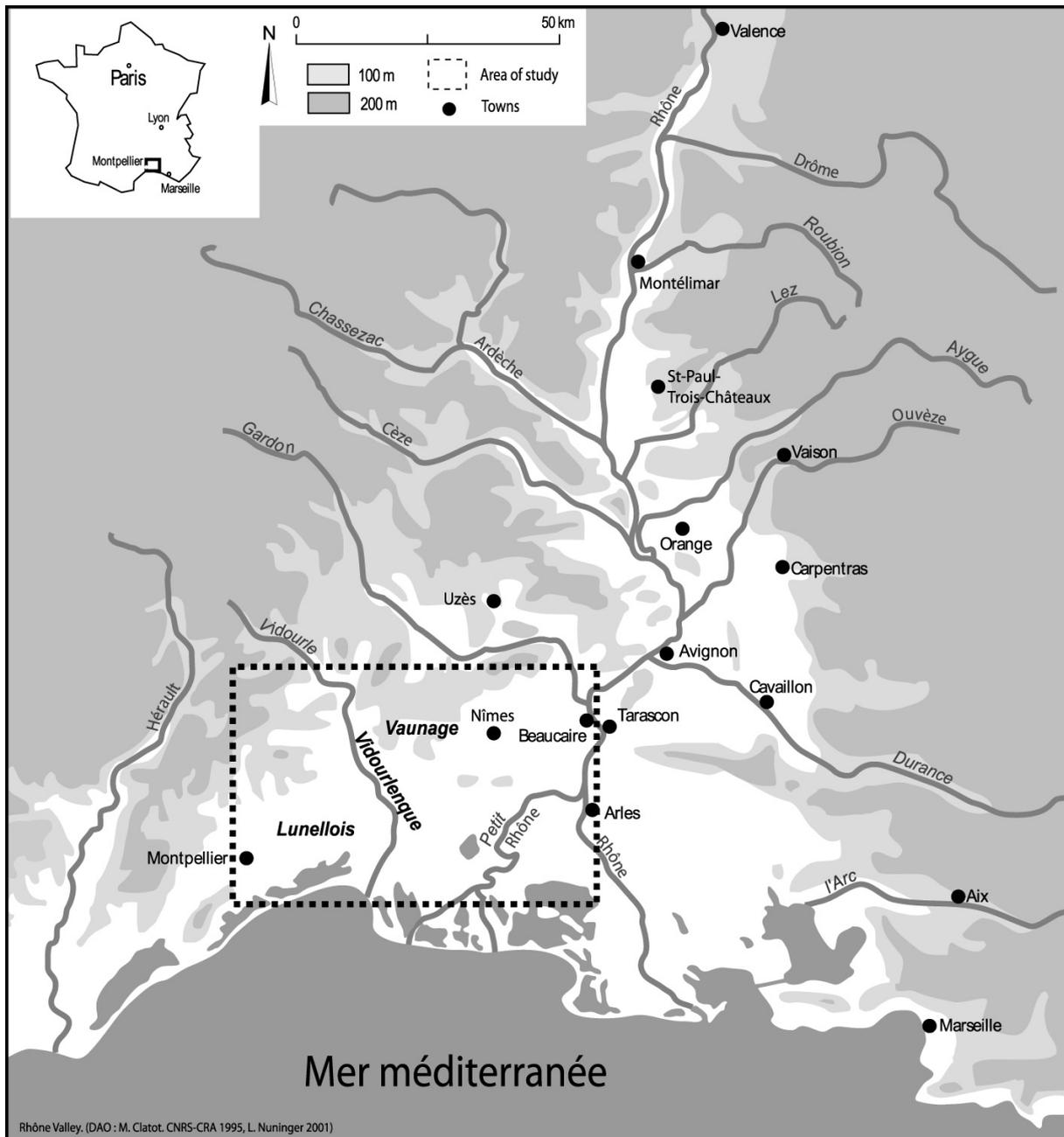


Fig. 1. Location of the study area (Eastern Languedoc) – CAD M.-J. Ouriachi, background map: M. Clatot, CRA CNRS).

To characterize the pattern of settlement, we have selected several indicators with which to locate the habitat by systematic ground prospection and by excavations (figs 2 and 3). We attempt to characterize the habitat with respect to the surrounding environment (topography, hydrography, pedology) and with respect to the network of roads and tracks; to describe the relations of each of the habitat units with contemporary habitat; and lastly to identify the activities of its occupiers. The objective is to try to characterize the development in time and space of clustered or scattered rural habitat and to understand the forms that development took: increase

in the number of establishments, hierarchy of components of the system of habitat, structuring of the system of habitat (relations among the various categories of habitat units on the local and micro-regional scale), contraction of the system of habitat, spatial mobility of habitat units, etc. In this perspective, the aim was to measure the respective proportions of (attractive, dissuasive?) environmental and social factors (cooperation, competition, dependence or subordination among habitat units on different spatial scales) in the differentiated patterns of development of dispersed and clustered establishments (Van der Leeuw, Favory and Fiches (eds) 2003).

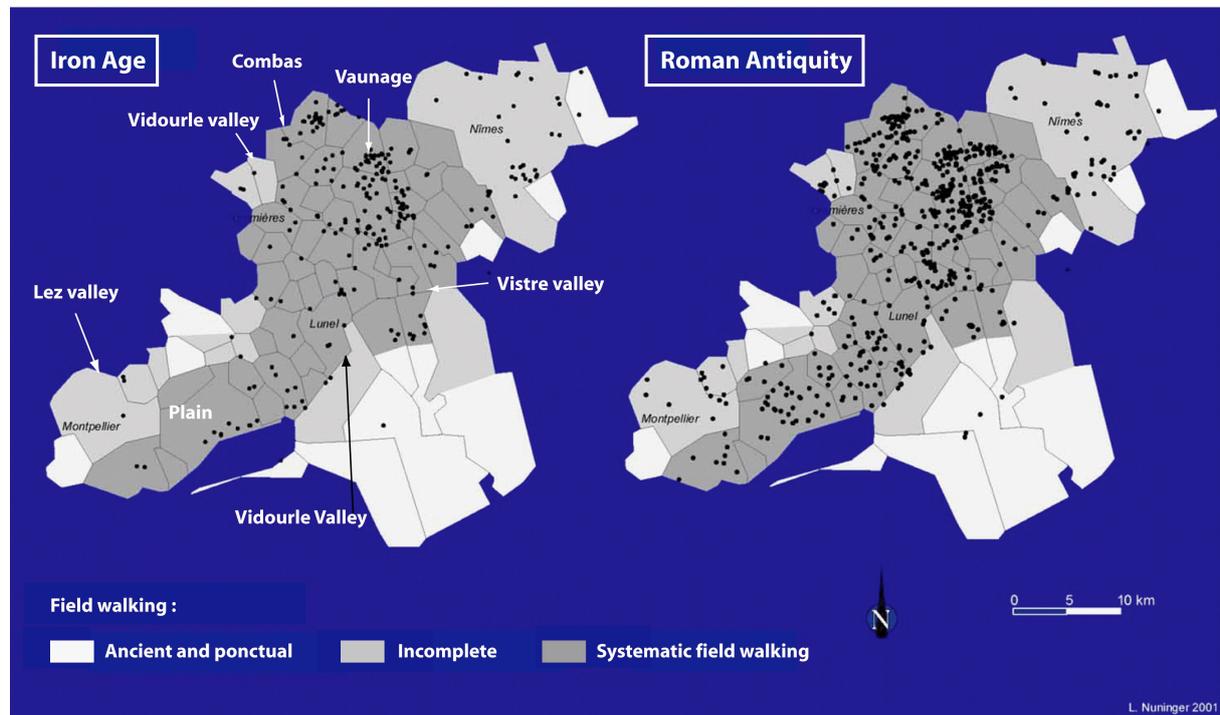


Fig. 2. Systematic field walking (evaluation 2001) – GIS & CAD L. Nuninger.

Recently, thanks to the PhD thesis by one of the authors (Ouriachi 2009), we have been able to supplement our approach to habitat and agro-pastoral, craft and commercial activities with legal-political, social, cultural and religious information yielded by Latin inscriptions from the 1st century BC to the early 3rd century AD (fig. 4). Even if the map of scattered Gallo-Roman establishments only rarely coincides with the map of epigraphic discoveries, the testimony of inscribed stones makes it possible to identify individuals who may have lived and worked in the establishments of which archaeological vestiges have been found. The territory of Nîmes to which the micro-region under study belonged during ancient times is interesting as it was a Latin colony where Roman citizens rubbed shoulders with peregrines of Latin law, who enjoyed a highly specific status: access to Roman citizenship for a peregrine worthy having held a magistracy only applied for a position held in Nîmes itself, the chief-town. This provision gave a special place to the *oppida* 'attributed' to the capital, which polarized ambitions and attracted the elites.

So as to better compare and contrast the archaeological and epigraphic material, we give precedence to the period for which the two sets of information supplement one another, that is, from the second half of the 1st century BC to the first half of the 3rd century AD (fig. 5). These three centuries alone are sufficient time to perceive the transition between the Protohistoric and Gallo-Roman systems of settlement, and to observe how the Gallo-Roman system of settlement evolved. This does not preclude us from going back as far as the 2nd century BC, when the

Protohistoric expansion of scattered settlement kicked in, and from continuing through to the 4th and 5th centuries AD, when the system of settlement offset in part the sudden downturn in the number of establishments recorded in the 2nd and 3rd centuries AD (Raynaud 1996). Our approach concentrates on the micro-region between Montpellier and Nîmes, corresponding to the coastal plain of Languedoc between the Rivers Lez and Vidourle, and from the lagoon to the limestone hills.

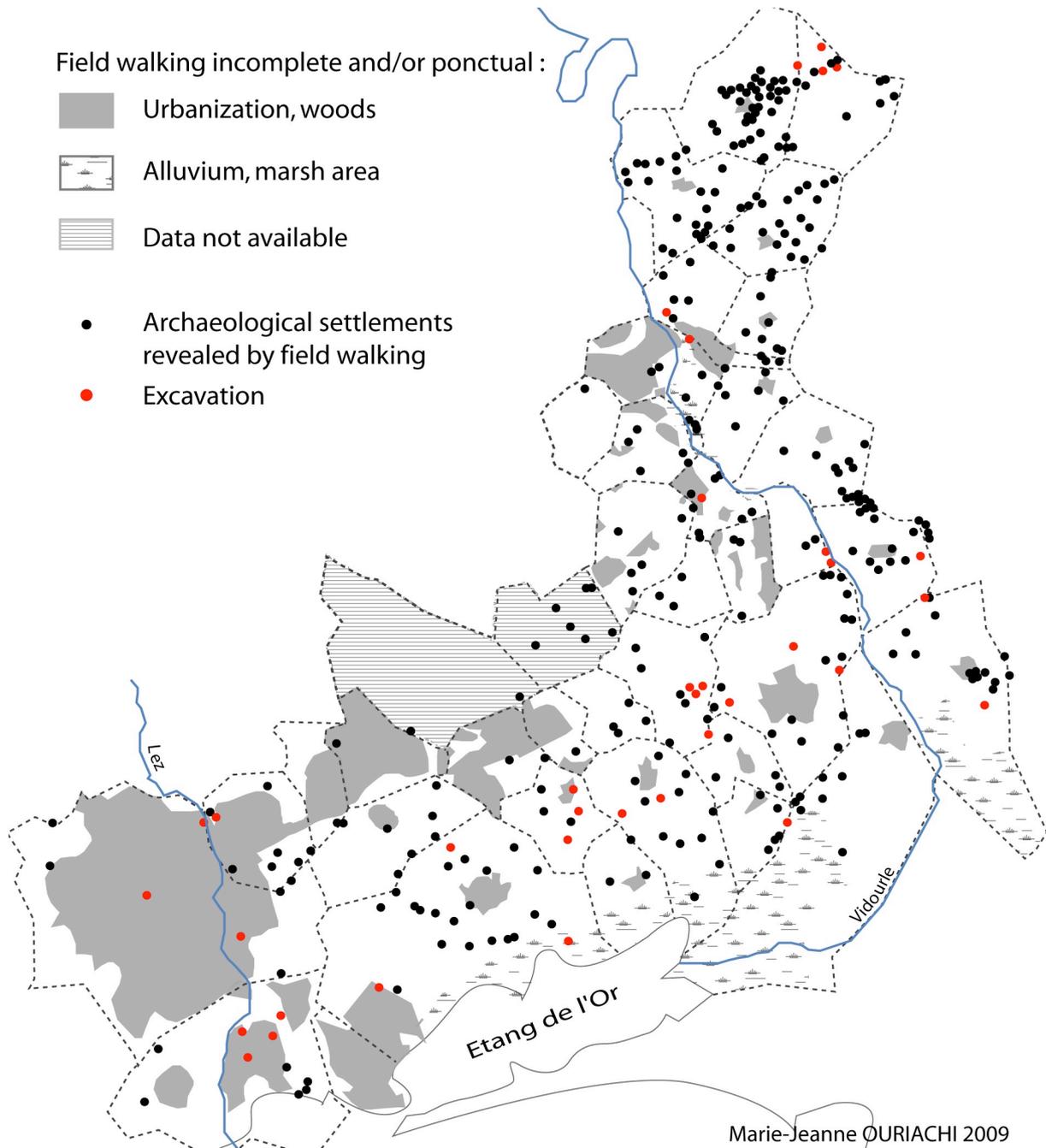


Fig. 3. Data location (evaluation 2008) – CAD M.-J. Ouriachi.

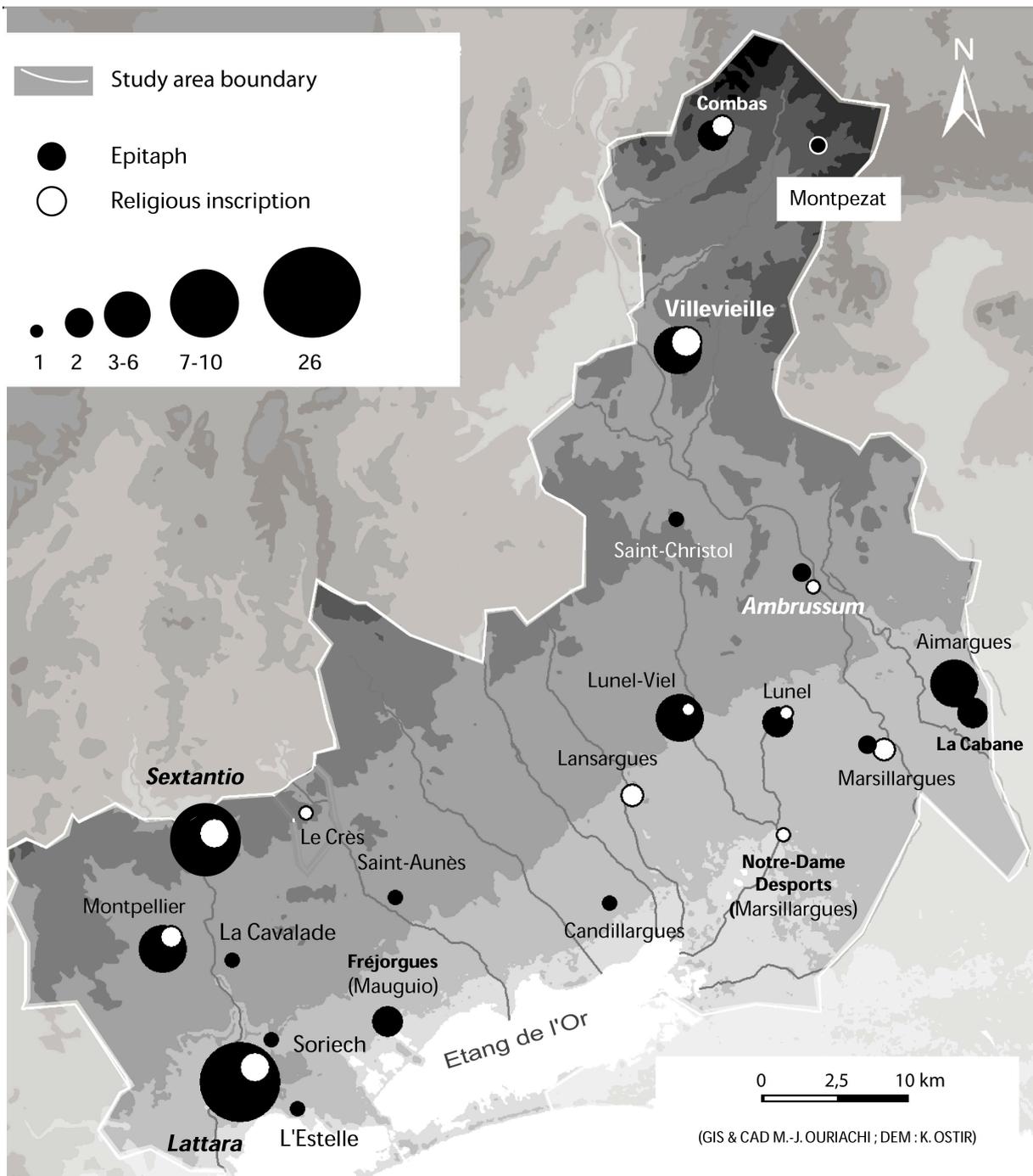


Fig. 4 : Distribution of the inscriptions between the Rivers Lez and Vidourle.
GIS & CAD M.-J. Ouriachi.

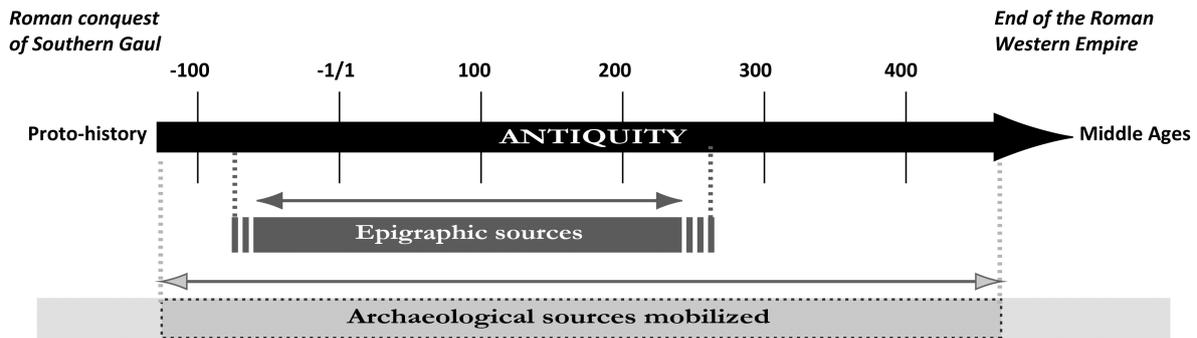


Fig. 5 : Chronological framework. CAD M.-J. Ouriachi.

1. From the establishment to the network of establishments

For the Ancient period, the study of population rests on the analysis of archaeological establishments which make up our primary information; an image of the settlement pattern is provided by mapping the establishments: this approach is unsatisfactory because it assumes a match between the surface area of the establishment and the population settled on one site, but there is no alternative to this (Nuninger 2002: 90).

The first level of analysis provides an outline of the development of settlement in eastern Languedoc century by century through the construction of collections of graphs with time on the *x*-axis and establishments (surface area and length of occupation) on the *y*-axis (fig. 6). By summarizing the information yielded by these graphs, the pattern of development is revealed: settlement at the end of the republican period, characterized by scant creations, was dominated by the Protohistorical *oppida*, hence the occupied area was clearly greater than the percentage of establishments observed. The 1st century benefited from this sound proto-urban framework; the arrangement was supplemented by the creation of a large number of short-lived establishments and the emergence of a few longer-lasting ones. This observation may be put into perspective, however, by considering the weighted area. After the low-ebb of the 2nd–3rd centuries, the late Ancient World, although deprived of any large pre-Roman agglomerations, formed a new and decisive stage in the pattern of settlement: besides the few sites inherited from the Early Empire, it saw the birth of a large number of points of occupation, called on to play an important role during the Middle Ages and even thereafter. We shall zoom in on the region between the Rivers Lez and Vidourle, but specifying beforehand that the pattern of settlement, considered in terms of the number of establishments and the area occupied, was fully consistent with the pattern found for eastern Languedoc generally. Let us consider this conformation in spatial terms for now: our first job is to examine the scatter of establishments and describe its behaviour. To help us in this we employ geostatistical techniques that can be readily mobilized using a GIS.

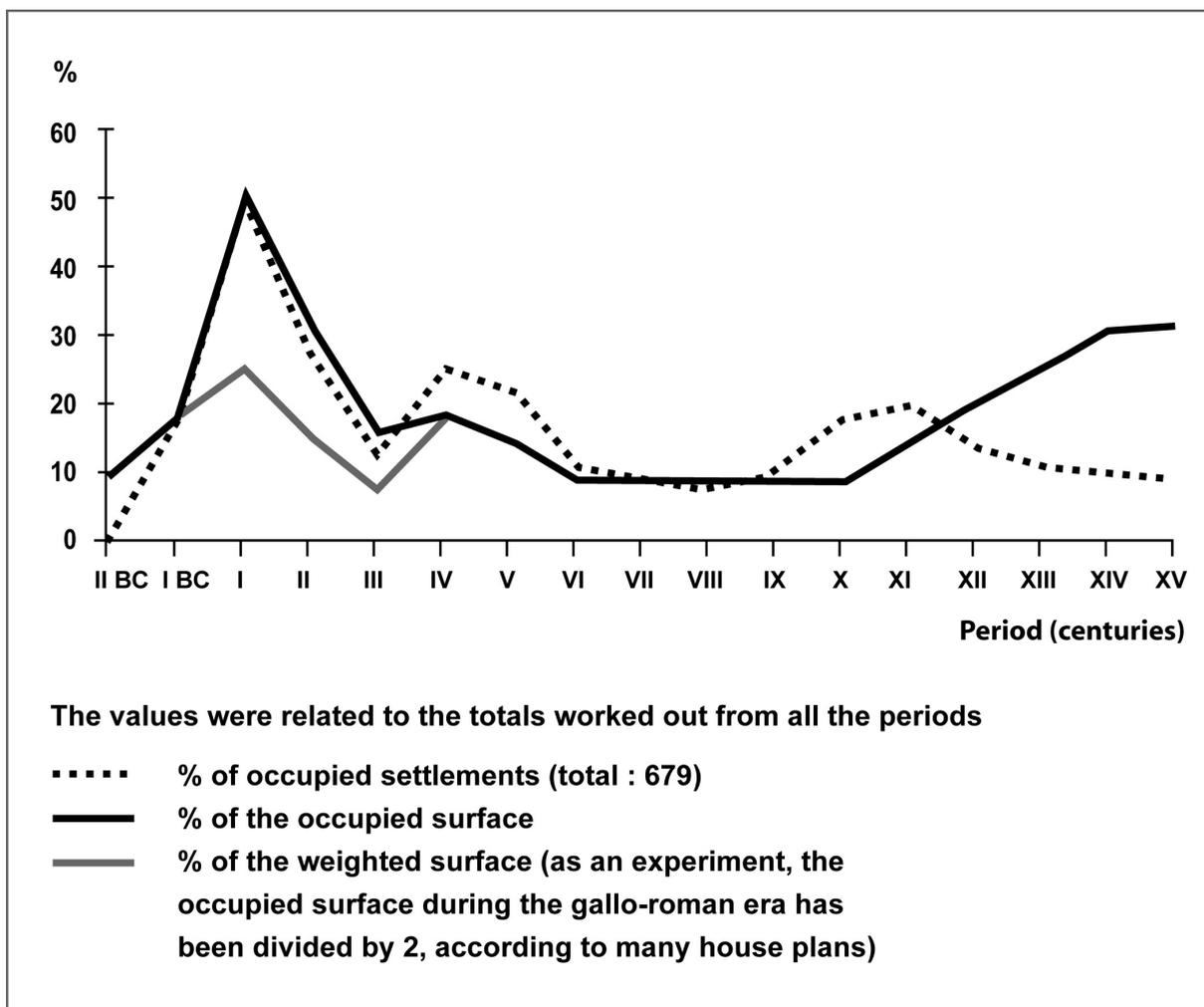


Fig. 6. Curves of occupations from 2nd c. BC to 16th c. AD.
CAD C. Raynaud 1998, 166 & M.-J. Ouriachi.

Figure 7 provides an important datum, the location at different dates of salient points such as the median point (for which the sum of distances to all other points is lowest) and the centre of gravity (which minimizes the sum of the squares of the distances between the centre and the other elements in the scatterplot: in this figure we have weighted each point by integrating the surface area of the establishment). It reveals a southward shift of the median point between the onset of the 2nd century BC and the late 3rd century AD because of the creation of a large number of establishments on the lowlands and along the coast, especially in the 1st century AD; this tendency did not outlive the 3rd century AD because of a north-eastward shift at the very end of Ancient times. This picture given by the median point is not confirmed by the centre of gravity, which it will be recalled takes into consideration the surface area of establishments, and therefore records the disparities affecting this variable. In the early 2nd century BC, the centre of gravity was located close to the River Lez and owed much to the weight of the major agglomerations of Lattes and *Sextantio*; at that same date, *Ambrussum* alone offset their influence. The centre of gravity then shifted north-eastwards, reflecting the substantial development of habitat in the Vidourle Valley with the agglomerations of Villevieille and *Ambrussum*, but also on the left-bank of the river with the establishments in the area of Aimargues. In late Antiquity, the trajectory of the centre of gravity was more complex: initially, breaking off its north-easterly migration, it moved southwards when the large centres in the middle Vidourle Valley disappeared while densities were sustained in the Lez Valley and a

string of clustered habitats was set up across the plain; thereafter, it headed north-eastwards anew because of the recovery of the balance between the Lez, the coastline and the Vidourle. The median point and the centre of gravity lay close together from then on, indicating less imbalance in the size hierarchy of the establishments.

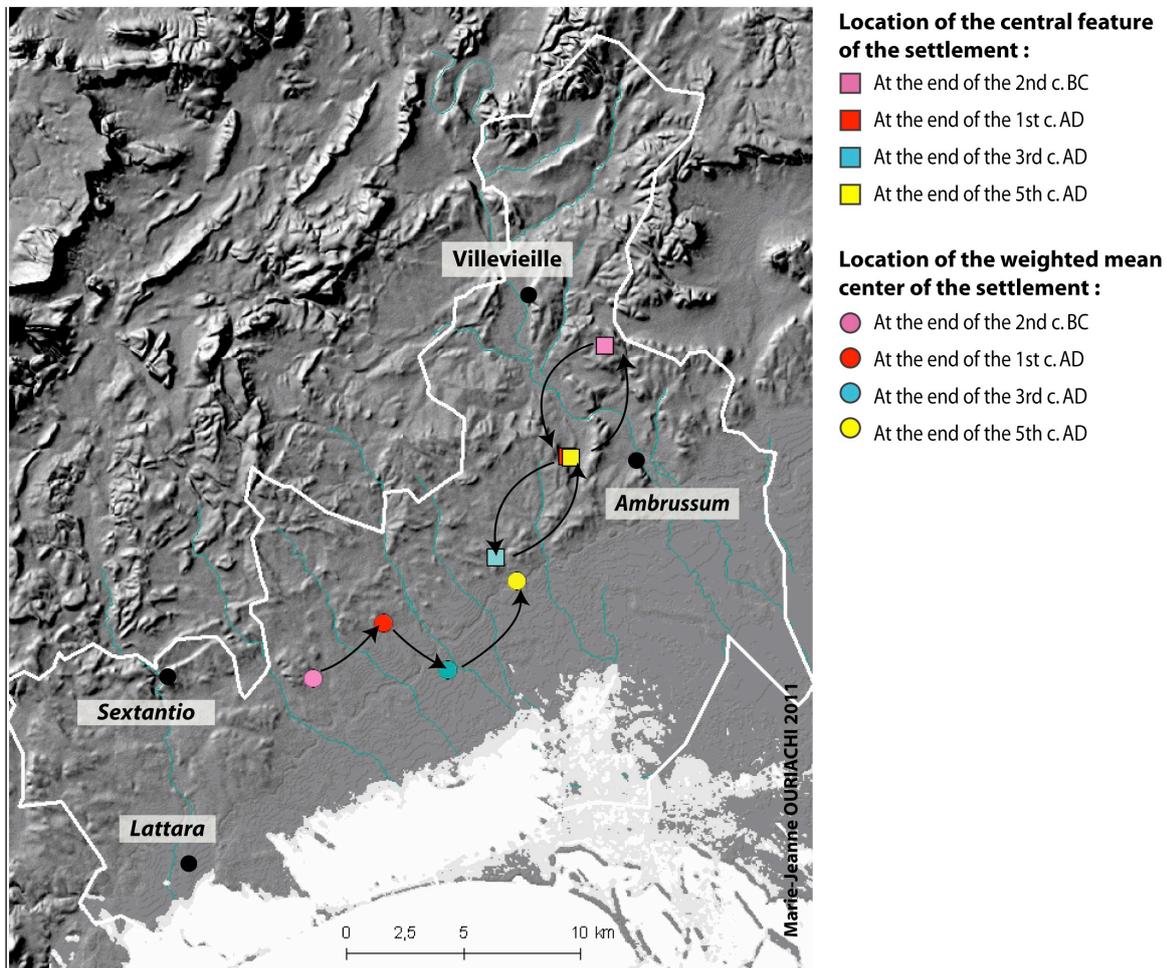
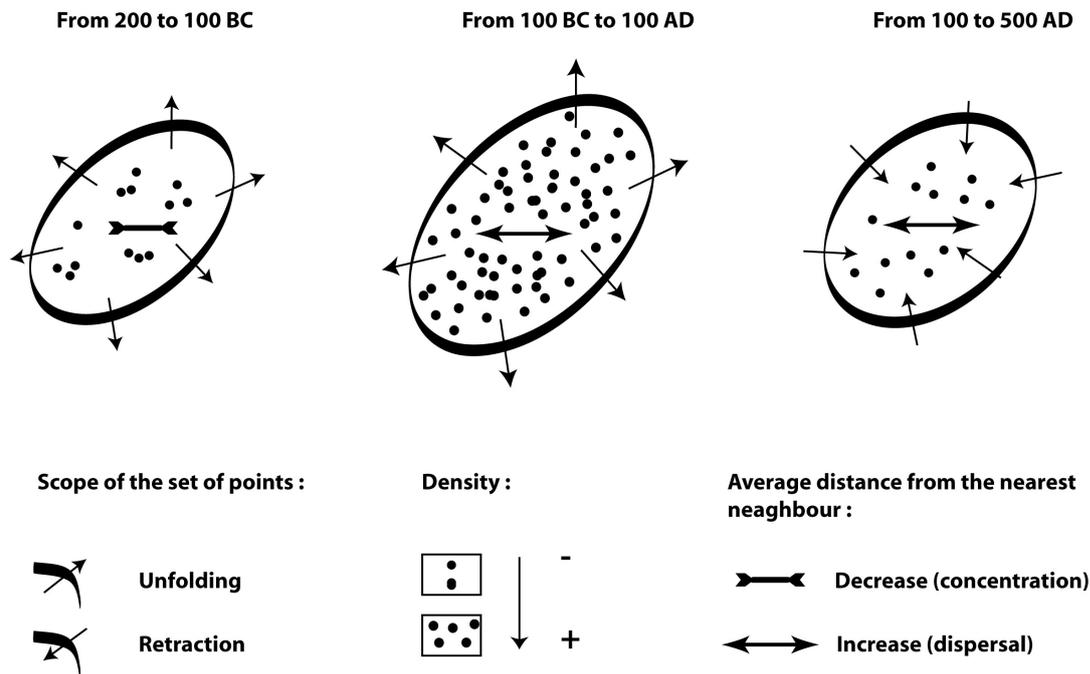


Fig. 7. Central feature and weighted mean centre of the settlements from 100 BC to 500 AD. GIS and CAD M.-J. Ouriachi.

Figure 8 summarizes the information about the behaviour of the scatterplot defined by the standard distance—or dispersion around the centre of gravity—and by overall dispersion—or the mean of distances to the nearest neighbour; the deviation between the observed overall dispersion and what would be expected in the event of random dispersion yields the R index, which characterizes the evolution of the scatter. Within the bounds of the study region, the standard distance increased between 200 and 100 BC: the point cloud spread while at the same time the number of establishments grew. The mean distance to the nearest neighbour was divided by more than four: the increasing number of establishments entailed growing concentration of points in space. The denser settlement again entailed a reduction in the mean distance between 100 BC and 100 AD, but the increased number of sites was concomitant with a redeployment of the scatter, giving rise to new peripheral settlements. R increased slightly; there was a tendency towards dispersion. In late Antiquity, the scatter contracted slightly, which was concomitant with a slight increase

in the mean distance to the nearest neighbour, because of the disappearance of the cohort of small short-lived establishments that had arisen in the 1st century AD.



Marie-Jeanne OURIACHI 2009

Fig. 8. Standard distance and Average nearest neighbour. CAD M.-J. Ouriachi.

In the foregoing analyses, the establishments were considered to be undifferentiated individuals, except for the calculations allowing for their surface areas. In order to take account of the specific features of the establishments and go beyond the idiographic approach, a typology had to be drawn up. To this end, the data were subjected to factor analyses bearing on their principal characteristics. Habitat was thus described by various archaeological indicators: surface area, building materials, artefacts, material signs of the functional and symbolic status of the habitat (fortification, place of worship, tomb) (figs 9–12). Added to this were variables for evaluating the settlement conditions of habitat units either on green-field sites or on previously occupied sites, so as to differentiate between opportunistic and pioneering settlements. Lastly the insertion of habitat was taken into account by measuring the rate and intensity of connection to the network that linked habitats (Durand-Dastès *et al.* 1998). The choice of correspondence factor analysis was based on the occurrence of qualitative variables; it was also related to the objective set, namely to bring out the combinations of variables and classify archaeological objects in terms of those interrelations (Sanders 1989). In this way a typology of habitat was established associated with a hierarchical classification (fig. 13). This typology was taken into account in implementing a model of spatial organization into networks radiating out from establishments of high hierarchical status (Favory *et al.* 1994b) (fig. 14).

TECHNICAL AND FUNCTIONAL DESCRIPTORS	Number of sites	Relative frequency
Building materials:		
lack of materials (lightweight architecture)	47	7
mud and tile	46	7
rubble or rubble and tiles	354	52
+ mortar, broken tile, brick, painted plaster	65	10
+ mosaic, decorative elements (comice, molding)	167	25
Artefacts:		
containers (amphorae, dolium, silos)	10	1
+ dishes	543	80
+ sculpture (in the round, capital, decorated frieze), epigraphy	126	19
Activity:		
no evidence	622	92
storage (over 50% of dolium or amphora)	27	4
craft industry	30	4
Function:		
with necropolis	47	7
without necropolis	492	72
place of worship (as evidenced by vestiges, text, hagiotoponym*)	107	16
fortified settlement	33	5
Area:		
less than 0.1 ha	189	28
less than 0.3 ha	185	27
less than 0.5 ha	48	7
less than 1 ha	158	23
less than 2 ha	52	8
less than 5 ha	32	5
5 ha and more	15	2

*: Hagiotoponym: toponym based on a holy name: for example, Saint-Laurent-d'Aigouze.

Fig. 9. Descriptive statistics: variables (1). Technical and functional descriptors.
Favory and Raynaud, 1998, 255.

CHRONOLOGICAL DESCRIPTORS	Number of sites	Relative frequency
Settlement date (half-century divisions):		
Before the Roman conquest	42	6
from the conquest to 50 BC	36	5
from 50 to 1 BC	27	4
from 1 to 50 AD	71	10
from 50 to 100	233	34
from 100 to 150	1	0
from 150 to 200	0	0
from 200 to 250	7	1
from 250 to 300	1	0
from 300 to 350	38	6
from 350 to 400	50	7
from 400 to 450	19	3
from 450 to 500	3	0
<hr style="border-top: 1px dashed black;"/>		
Settlement date (century divisions. Half-century divisions currently being impossible for the Middle Ages):		
Before the Conquest and 1st century BC	105	15
1st century AD	304	45
2nd century	1	0
3rd century	8	1
4th century	88	13
5th century	22	3
6th century	6	1
7th century	4	1
8th century	3	0
9th century	26	4
10th century	52	8
11th century	33	5
12th century	21	3
13th century	2	0
14th century	3	0
15th century	0	0
16th century	1	0

Fig. 10. Descriptive statistics: variables (2). Chronological descriptors.
Favory and Raynaud, 1998, 256.

CHRONOLOGICAL DESCRIPTORS	Number of sites	Relative frequency
Duration of occupation:		
less than a century	307	45
from 1 to 2 centuries	132	19
from 2 to 3 centuries	48	7
from 3 to 4 centuries	41	6
from 4 to 5 centuries	21	3
from 5 to 10 centuries	72	11
from 10 to 15 centuries	40	6
more than 15 centuries	18	3
Previous occupation:		
unspecified	51	8
none	484	71
in the century before the creation of the site	17	3
before the century preceding the creation of the site	127	19
Value of the previous occupation (legacy in a radius of 500 m):		
unspecified	62	9
no legacy	409	60
less than 5 centuries	133	20
from 5 to 10 centuries	68	10
from 10 to 20 centuries*	7	1
Status in the 18th century (Cassini national map):		
establishment missing	545	80
farm, farmhouse, noble landed property, tower, castle**	25	4
hamlet	6	1
chapel, ruined chapel or chapel and castle***	13	2
ruined parish	12	2
active parish	59	9
smallmarket town	13	2
town	6	1
Status in the current landscape:		
no trace in the landscape	501	74
toponym related to habitat other than hagiotonym	25	4
plot and / or landscape anomaly	20	3
building, isolated monument (including religious)	4	1
toponym related to habitat and abnormality and / or building	15	2
habitat maintained, dispersed	38	6
habitat maintained, clustered (hamlet, village, town)	76	11

* It was unnecessary to add other classes.

** Settlements put together to avoid the splitting in several units of the scattered forms of perpetuation of a previous settlement. All these codes have been encountered in the survey.

*** What is at stake here is the existence of the chapel as a possible form of perpetuation of an ancient town parish.

Fig. 11. Descriptive statistics: variables (3). Chronological and situational descriptors.
Favory and Raynaud 1998, 257.

SITOLOGICAL AND SITUATIONAL DESCRIPTORS	Number of sites	Relative frequency
SITOLOGICAL DESCRIPTORS:		
Land and soil:		
plain, thick brown calcareous soils	235	35
plain, slightly leached fersiallitic soils	32	5
plain, highly leached fersiallitic soils	22	3
coastline, thick brown calcareous soils	31	5
coastal alluvial soils	46	7
slope, fersiallitic soils	17	3
slope, thin brown calcareous soils and erosional soils	266	39
alluvial valley, alluvial soils	9	1
top, erosional soils associated with other soils	21	3
lithosols		
Altitude:		
SITUATIONAL DESCRIPTORS:		
Distance to road:		
crossed by a road	134	20
beside a road	237	35
less than 100 m from a road	262	39
over 100 m from a road	46	7
Number of paths leading to the site:		
none	254	37
1	15	2
2	158	23
from 3 to 5	117	17
more than 5	135	20
Linear relationships with other sites:		
none	416	61
1	92	14
from 2 to 5	103	15
more than 5	68	10

Fig. 12. Descriptive statistics: variables (4). Sitological and situational descriptors
Favory & Raynaud 1998, 258.

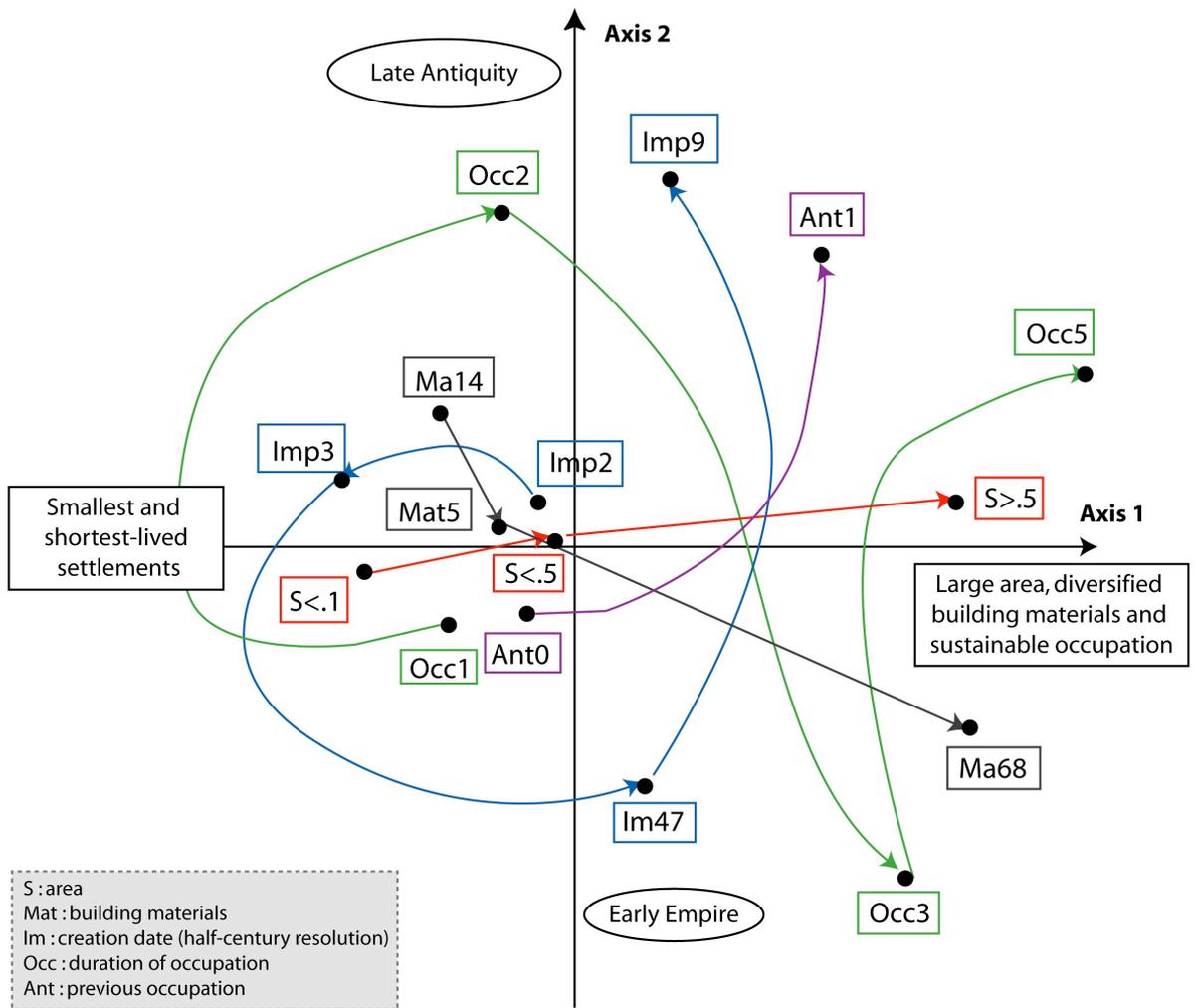


Fig. 13. Multicriteria analysis (1). M.-J. Ouriachi 2009, I, 236.

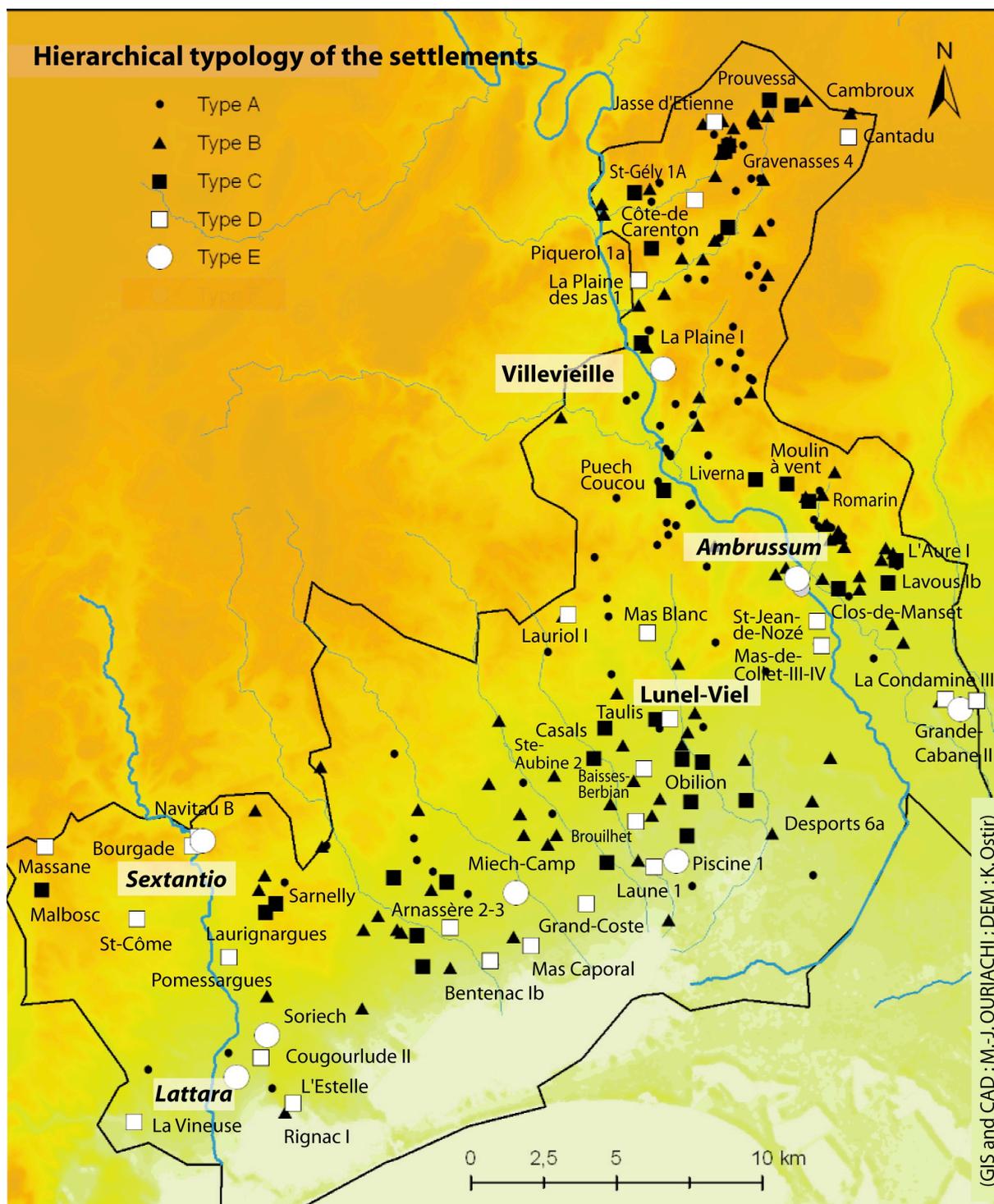


Fig. 14. Location of settlements in 1st c. AD (hierarchical typology).
GIS and CAD M.-J. Ouriachi.

These large, comfortable and lasting establishments that were well connected with the network of local and regional roads, were subjected to a new correspondence factor analysis by which they were ascribed a hierarchical score (fig. 15); in the gravity model used here, the influence of the poles was calculated by dividing their score by the square of the distance between that pole and each of the other establishments (score/distance ij^2).

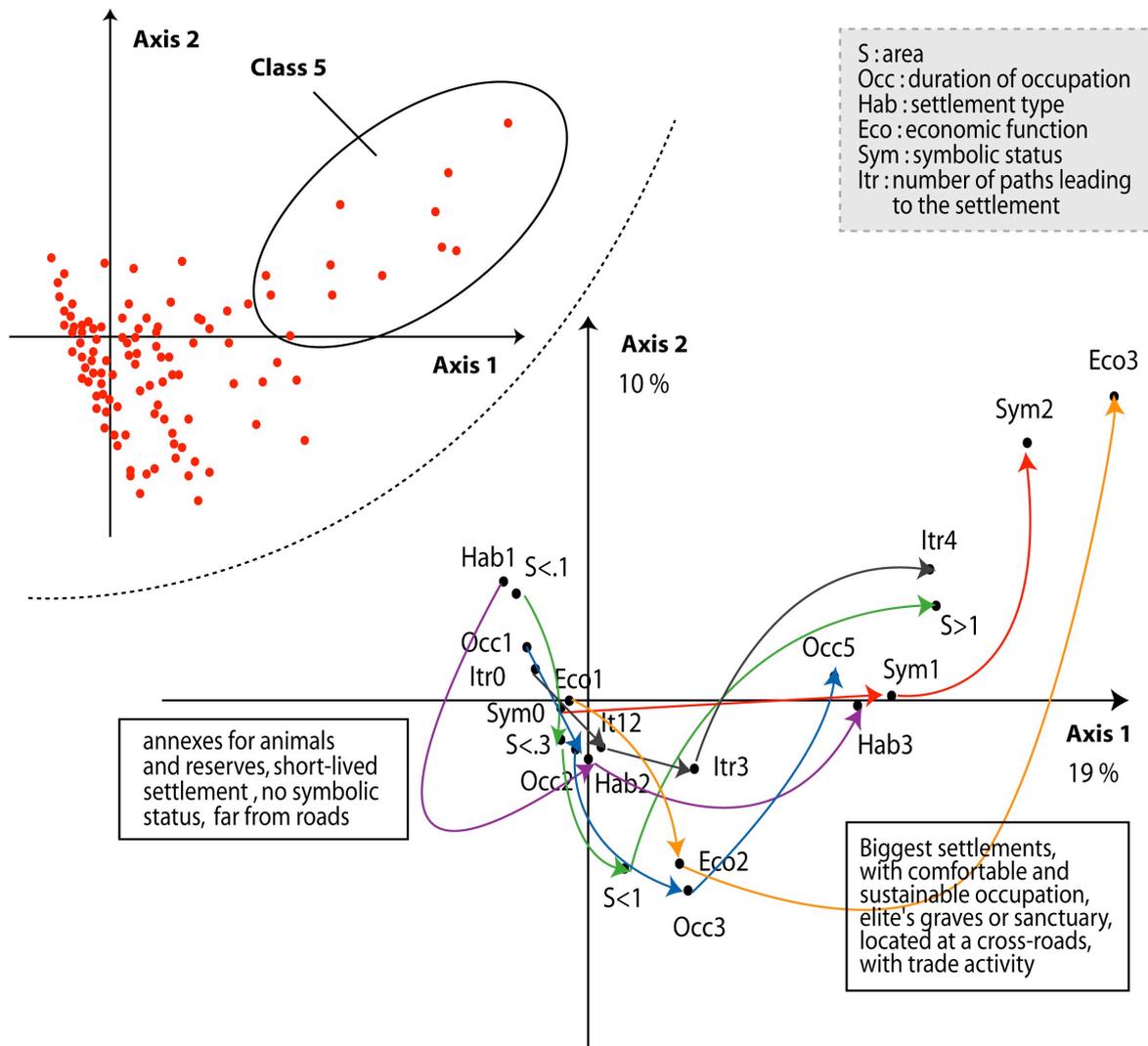
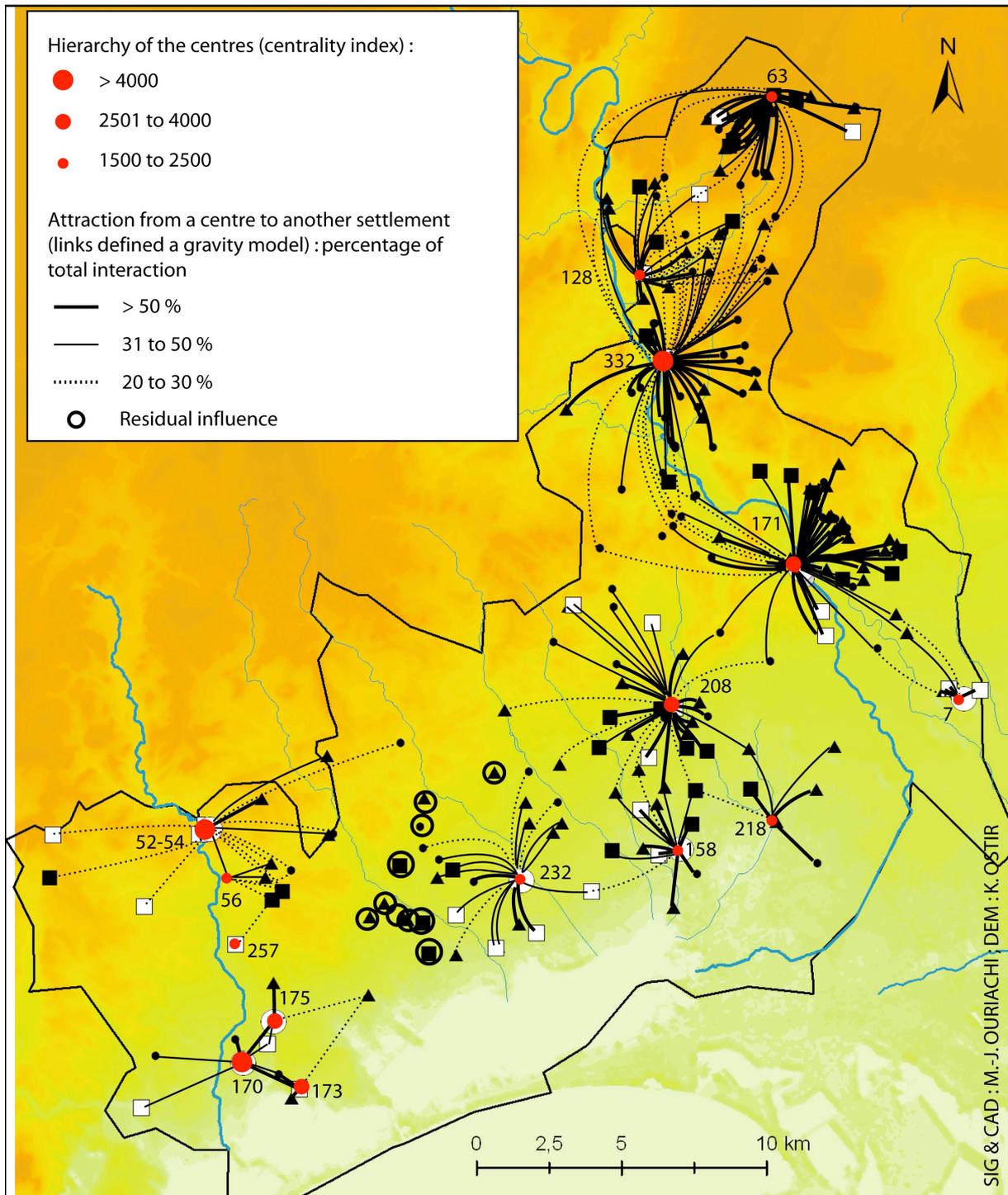


Fig. 15. Multicriteria analysis (2: hierarchical and functional descriptors).
M.-J. Ouriachi 209, II, 233, annexe 18.3.

We present here a proposal to reconstruct networks for the late 1st century AD (fig. 16). At that date, the Protohistoric *oppida* had lost their political autonomy to Nîmes. It was the eastern part of the study zone that had the densest networks. The Vidourle Valley saw the formation of a large number of establishments: Villevieille played a leading role whereas around *Ambrussum*, the decline of the *oppidum* was offset in part by the development of the road station whose presence seemed to give fresh impetus to the surrounding area. For the Lez Valley, the extreme concentration of population in the two major agglomerations of Lattes and *Sextantio* gave way to a renewed configuration in which centres of lesser rank emerged: the image that arises is one of two networks arranged along the River Lez. That being so, the area was more balanced and remained less densely occupied than the Vidourle Valley. Lastly, in the sector between the hills and the coast, radial networks formed including the one centred on Lunel-Viel. However, the image given by the network map includes, by the River Salaison, an area that geographers would characterize as an intermediate space—located outside of the areas of influence of the major agglomerations—or fragmented spaces, standing apart and not densely populated, that might result from its status as a pioneering front: it included a few habitats of very small size or storage buildings, in a halo in the north and to the west of a

secondary pole (n° 232), giving the image of population being disseminated out from a centre.



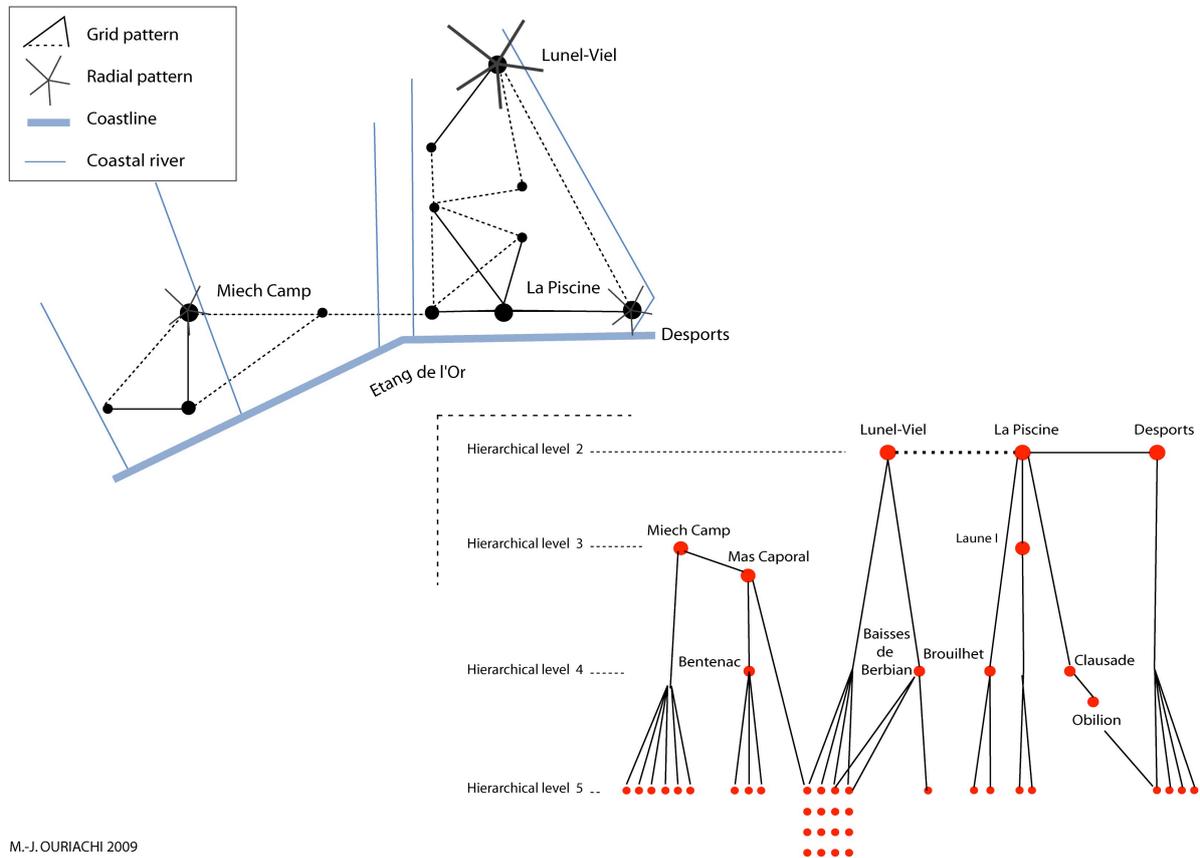
7 : Grande Cabane ; 52-54 : *Sextantio*/Bourgade ; 56 : Pompignane ; 63 : Prouvessa ; 128 : La Plaine des Jas ; 158 : La Piscine
170 : Lattes ; 173 : L'Estelle ; 175 : Soriech ; 208 : Lunel-Viel ; 218 : Desports ; 332 : Sommières-Viellevieille ; 371 : *Ambrussum* II

Fig. 16. Networks of settlements in 1st c. AD. M.-J. Ouriachi 2009, I, 287, fig. 75.

The model (fig. 17) suggests incomplete networks in this sector, since some relations between poles were of low intensity. As the tree of hierarchical relations shows, this configuration arose from the co-existence of several poles of equivalent weight, that were more or less well-connected, and that exerted an influence on other

establishments, some of which fell under the sway of two poles. The distribution of establishments along the coastal rivers fostered complementarity among land types—of the coastline, the plain and the hills—while the coastline induced a linear development of the networks.

This last points reveals the importance that must be attributed to environmental data in these approaches.



M.-J. OURIACHI 2009

Fig. 17. Networks of the plain in 1st c. AD. M.-J. Ouriachi 2009, I, 301, fig. 78 ; 302, fig. 79.

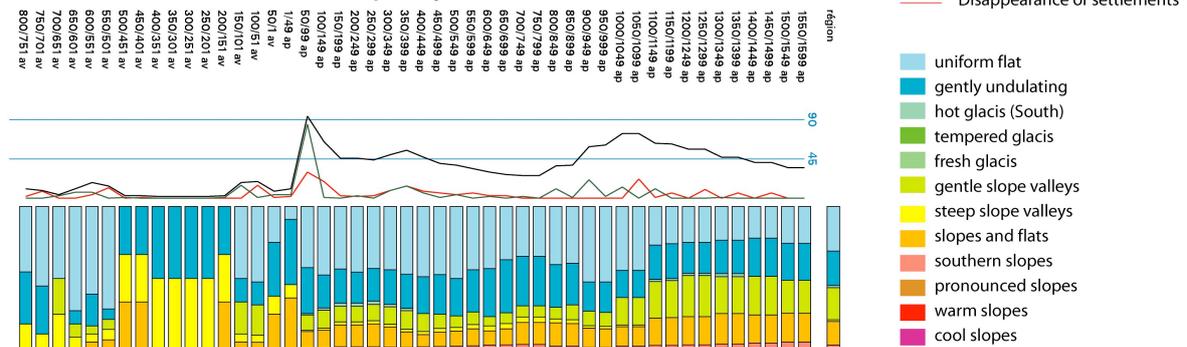
2. Establishments, networks of establishments, environment and development of land types

Consideration of the topographical, environmental and pedological setting of establishments has yielded other information about the conditions under which they were formed, maintained and abandoned (fig. 18). This research was conducted as part of the European *Archaeomedes* II programme by F.-P. Tourneux, then a geomatics engineer with UNISFERE (Favory *et al.* 1999). Archaeologists asked him to characterize a number of topographical indicators from a digital elevation model within a radius of 1000 m around each establishment occupied between 800 BC and 1600 AD. He calculated the slopes and their orientation, the exposure to sunlight and shelter from the wind, and he drew up a typology of topographic settings. Likewise, he drew up a typology of infield/outfield systems around the establishments, taking into account the proportion of soil categories represented within a radius of 1000 m around the establishments. The results were synthesized in micro-regional profiles that accounted for the evolution of the physical context of habitat over the twenty-four

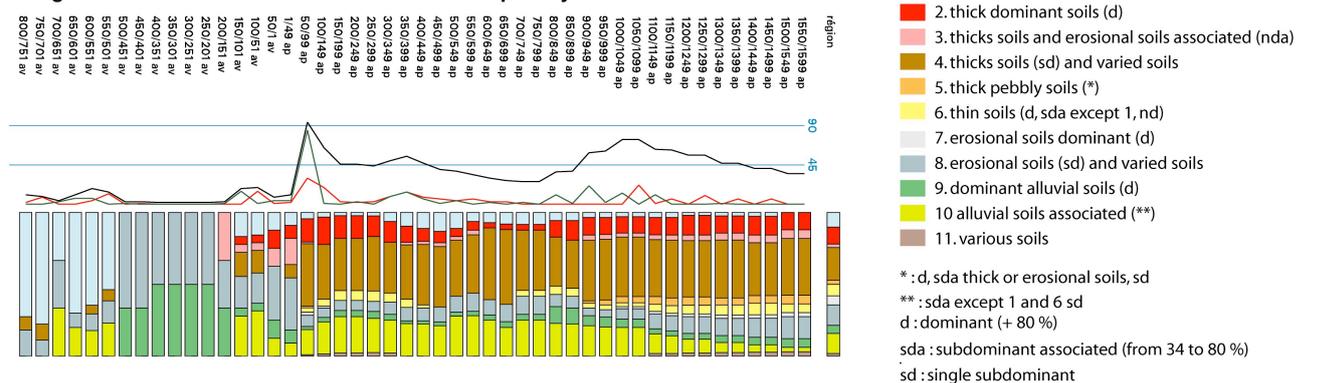
centuries in question, divided into fifty-year phases. Each phase was described by the proportion of 12 types of topographical environment and 11 types of pedological context or 'finage' recorded around the establishments occupied during the period in question. Above the stack of histograms, the regional profile allows us to measure by comparison the way the available topographic or pedological potential was used. On the side, the plots representing the formation, occupation and disappearance of establishments indicate the phases of boom and bust of habitat.

Lunellois (littoral)

Relief : environment of the sites occupied by half-centuries



Finage : association of soils around the sites occupied by half-centuries



Archaeomedes - Unisfère
F. Favory & F.P. Tourneux 1999, coordination S.E van der Leeuw

Fig. 18. Typology of environmental contexts. Characterization of dominant topographical and pedological environments, in Lunellois-Montpelliérais, Eastern Languedoc. F. Favory & F. P. Tourneux 1999, *Archaeomedes II* ; F. P. Tourneux 2000, 292.

The evolution of the settlement system in the micro-region of the Montpelliérais and the Lunellois shows a more marked occupation of the lowland from the middle of the 1st century AD, at the time of the rapid growth in the number of establishments that was characteristic of the 1st century AD. The choice of settlement distinguished the behaviour of the occupants of imperial times from that of the occupants during late Antiquity, who, while opting massively for the lowland, preferred the plain close to the scarp such as the Côte lunelloise. In the Middle Ages, from the 12th century onwards, the profiles occupied were similar to the regional profile, illustrating the more even geographical distribution of habitat. The changing pattern of occupation of the available 'finages', characterized by the dominant soils (more than 80% of the environment), sub-dominants (34–80%) and other soils (less than 34%) show, from 50 AD onwards, that Gallo-Roman establishments were set up by preference among (1) the plain finages, with predominantly thick soils (fersiallitic soils and brown

calcareous soils), with a very marked choice for finages with complementary potentialities, associating thick soils and other soils; and (2) plain finages with alluvial soils associated with other soils, characteristic of alluvial valleys, which were also favoured throughout Antiquity and the early Middle Ages, until the 11th century. The multivariate analysis graph of spatio-temporal dynamics of habitat settings illustrates the modes of occupation of all the agrological potentialities of the plain where thick soils dominated (fig. 19).

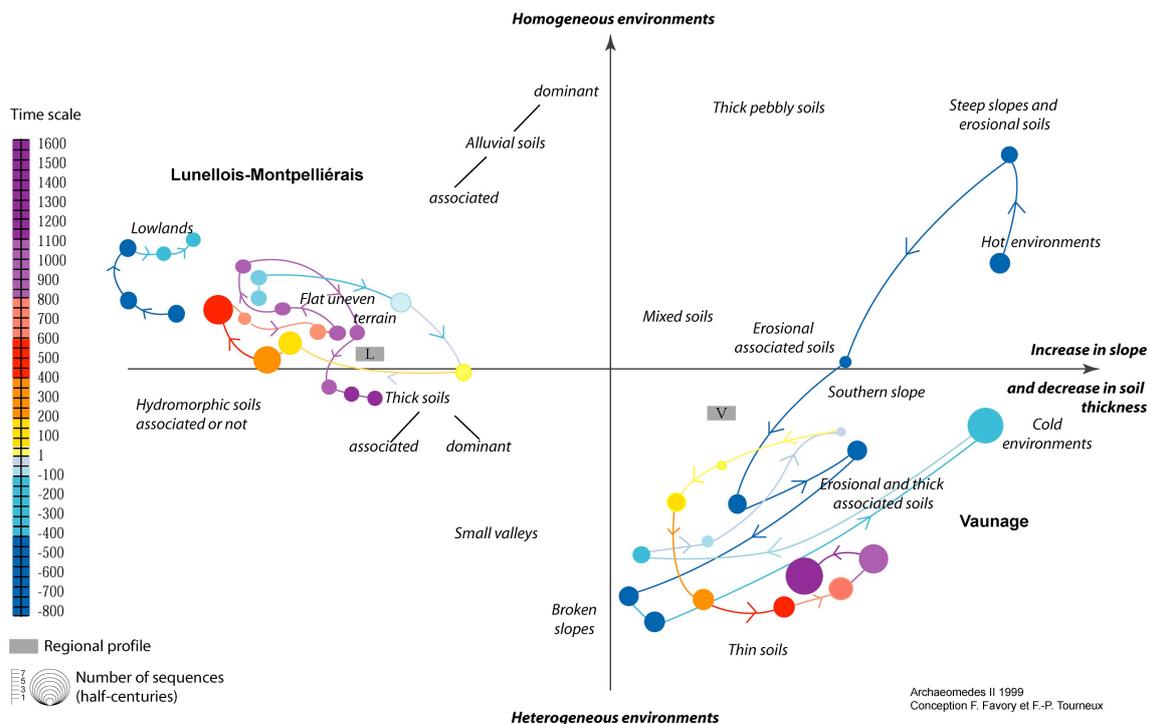


Fig. 19. Modeling and synthesis. Modeling the spatiotemporal evolution of the occupation of the natural environment in the Lunellois-Montpelliérais and Vaunage, Eastern Languedoc. F. Favory & F. P. Tourneux 1999, *Archaeomedes II* ; F. P. Tourneux 2000, 294, fig. 3.3.2.

This initial approach to the general and spatio-temporal behaviour of the settlement system has been refined in certain test areas by including off-site artefacts to try to identify the cultivated areas around establishments. The assumption investigated is that such artefacts were spread during animal and domestic manuring from agro-pastoral establishments. Rather than studying the relationship of each habitat unit with the manured areas, we have studied the ratio of habitat networks with those land types. This approach was tested in a micro-region close to the Lunellois, in Vaunage, between the River Vidourle and the district of Nîmes. Laure Nuninger has successfully dated the collections of off-site artefacts and mapped, for each of the century-long phases of Protohistory, the land types with shards (Nuninger 2002, 159-174; 2003; fig. 20). The map of areas presenting this type of scattered, very broken, eroded, worn material, provides us with a map of the most intensely manured areas fertilized by organic matter for the period in question. Their spatial connection with the networks of habitats is highly significant. As concerns the period described here, it will be noted that from the 2nd century BC onwards, the system of settlement of Vaunage was polarized by two *oppida*, Mauressip and Nages, and that the agricultural area was conquered by dispersed habitats swarming from these two agglomerations across the fertilized land (*infield*).

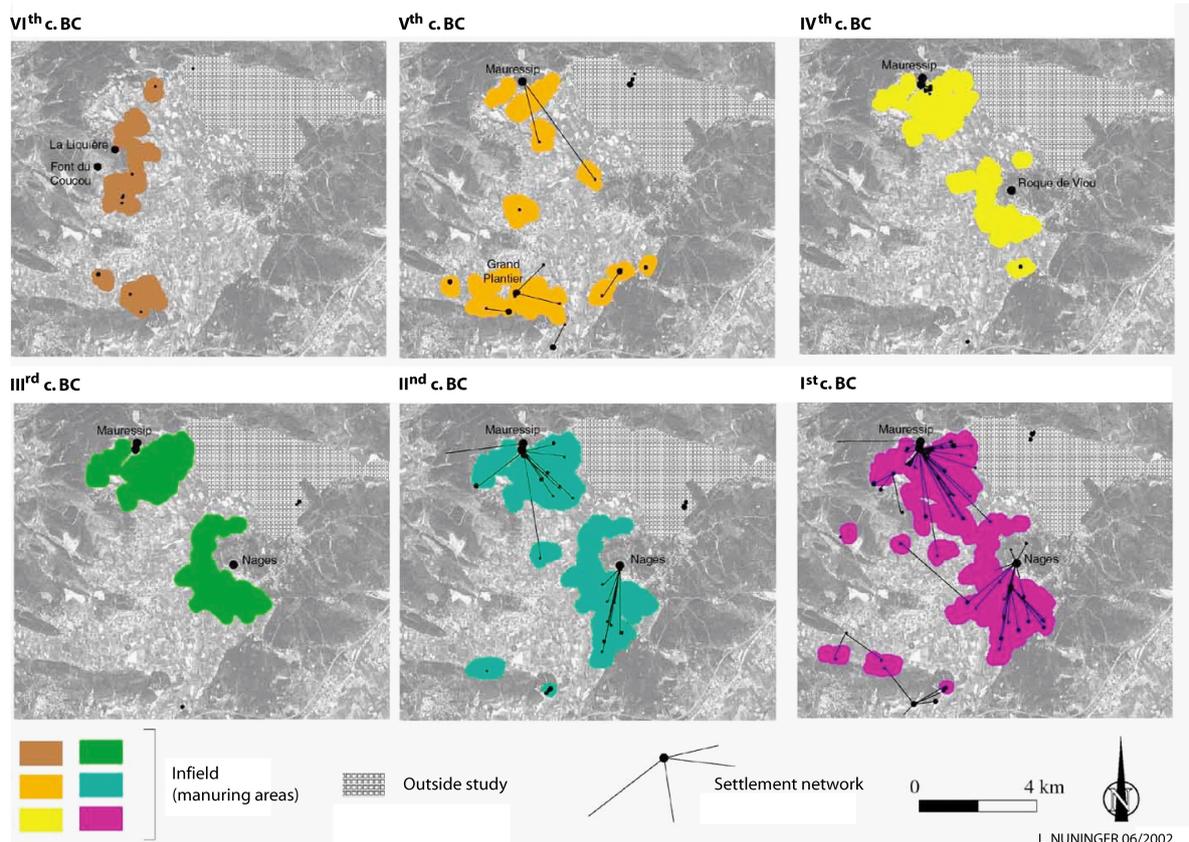
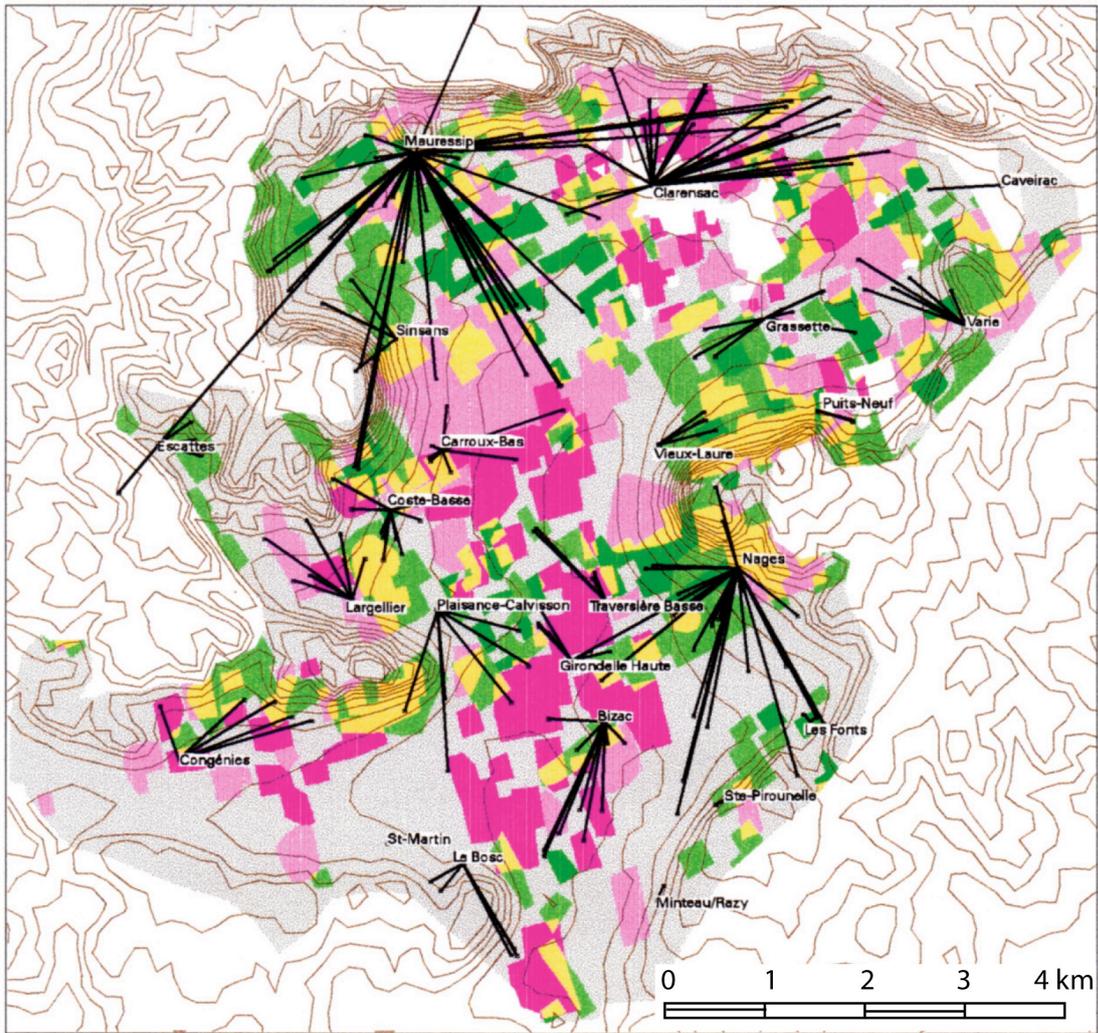


Fig. 20. Conquest of the countryside from the hill forts (6th–1st c. BC) in the Vaunage.
L. Nuninger 2002, 176, fig. 48.

A second approach was undertaken to measure the relationship between the networks of establishments and the ancient centuriations identified in eastern Languedoc (Favory 1988; 1997; Favory *et al.* 1993). This was another way of studying how the settlement system was traced in a rural space structured to accommodate cultivation and grazing.

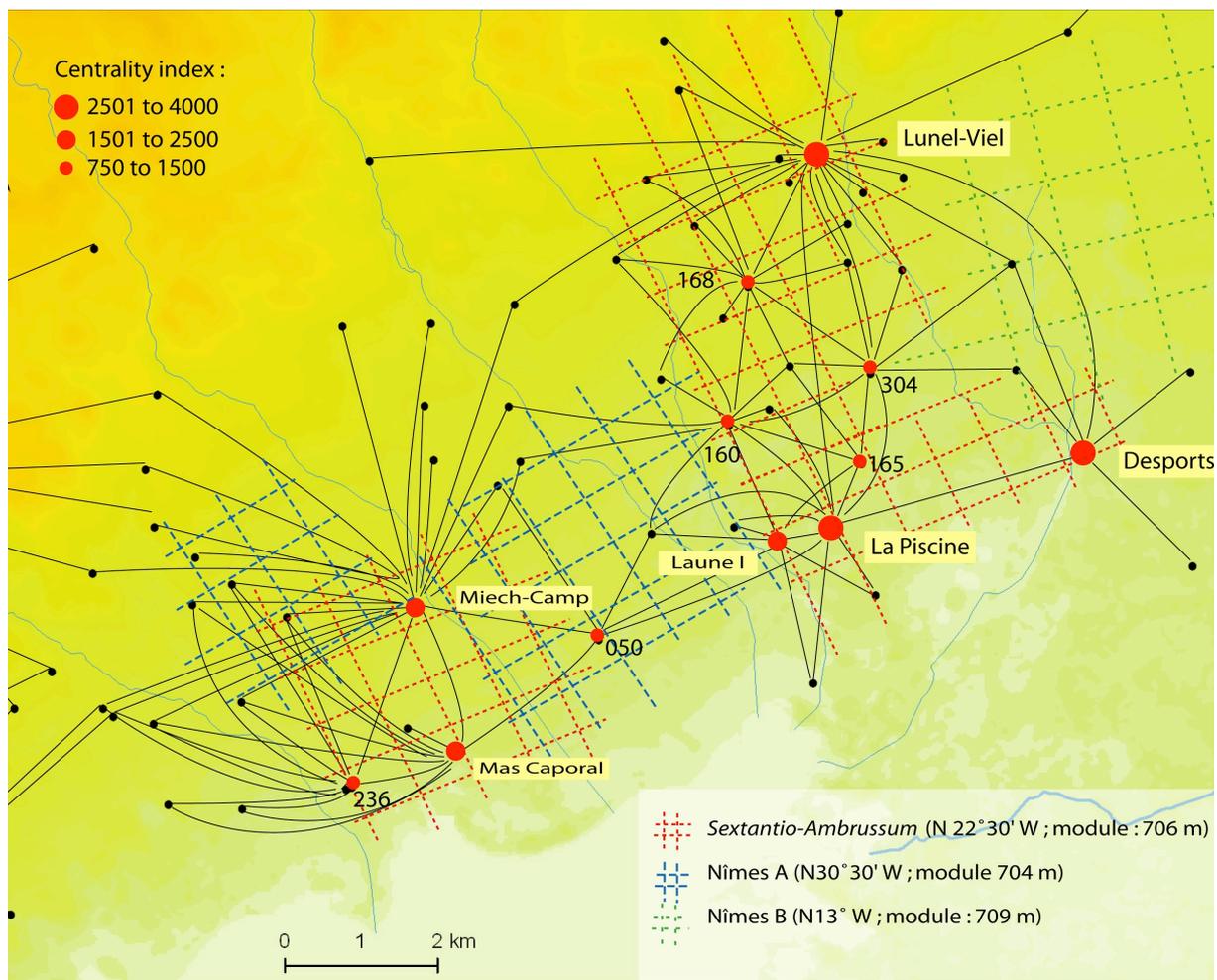
The plots currently structured by the shape of the ancient centuriations (angle of arable alignments, structuring of blocks, arable land metrology) inform us as to their forms of resilience. The study was conducted in Vaunage, in the north-east of the study region (Tourneux 1999), and in the coastal plain south-east of Montpellier (Favory and Poupet 1992; Ouriachi 2009; figs 21 and 22). This approach provided a relative chronological indicator with which to try to date the centuriations associated with any particular swathe of habitat. Thus in Vaunage, the land divisions influenced by the Nîmes A centuriation, which was considered the earliest, maintained a closer tie with the habitat networks of the 1st century AD radiating from the *oppida* of Mauressip and Nages. In the 1st century AD, the Nîmes B centuriation supplemented the Nîmes A centuriation and the habitat networks fitted in with the two regular land division systems. On the lowland, the *Sextantio-Ambrussum* network extended into the structured areas via the major poles and by the early establishments whereas the Nîmes A centuriation organized the intermediate space, that was less densely occupied and was characterized by the presence of soils with a marked hydromorphic character. In terms of relative chronology, the *Sextantio-Ambrussum* network predated Nîmes A, which corresponded to a second surveying phase, aimed at bringing into use land that was difficult to cultivate, after the partial failure of the first operation.



F. Favory, F.-P. Tourneux
CNRS - Unisfere 1998



Fig. 21. Relationships between Gallo-Roman settlement networks and Roman Nîmes A and Nîmes B centuriations in the Vaunage. Tourneux 1999 ; Boyer 2003, 333, fig. 7.



050 : La Grand Coste ; 160 : Brouilhet ; 165 : La Clausade de Bayonne ; 168 : Baisses de Berbian ; 236 : Bentezac ; 304 : Obilion

Fig. 22. Settlement network and Roman centuriations on the coastal plain between Mauguio and Lunel Viel. M.-J. Ouriachi 2009, I, 322, fig. 85.

3. Social networks and settlement dynamics

The analysis has finally been enriched by the use of another type of source: epigraphic documents that provide essential data on population from a social, legal and cultural standpoint, especially if one takes into consideration both the text and the physical medium (Ouriachi 2009). The distribution of epigraphic monuments is already information in itself: it provides a measure of the spread of the 'epigraphic habit' (MacMullen 1982), so revealing the areas (and populations) that had adopted this form of expression that was typical of the Roman world. Analysis of epigraphic documents furthers our knowledge of local society or rather within that society of those—individuals and groups—who left evidence of their existence. The first level of information lies in the variety (and interleaving) of statuses in the context of the Roman law colony of Nîmes (fig. 23). The two main categories of population (in civic terms) are recognized by indications such as the *tria nomina*, line of descent, or the indication of the voting tribe (with variations over time) for Roman citizens, the single name (idonym) and patronym for peregrines. These were not Roman citizens but they did enjoy local citizenship and rights, in particular the *conubium*—or the right to lawfully marry a Roman citizen—and the *commercium*—conferred by Latin law. The first step was therefore to identify the status of each individual, using the

indications set out before; the second was to map the respective settlement of citizens and peregrines (figs 24 and 25).

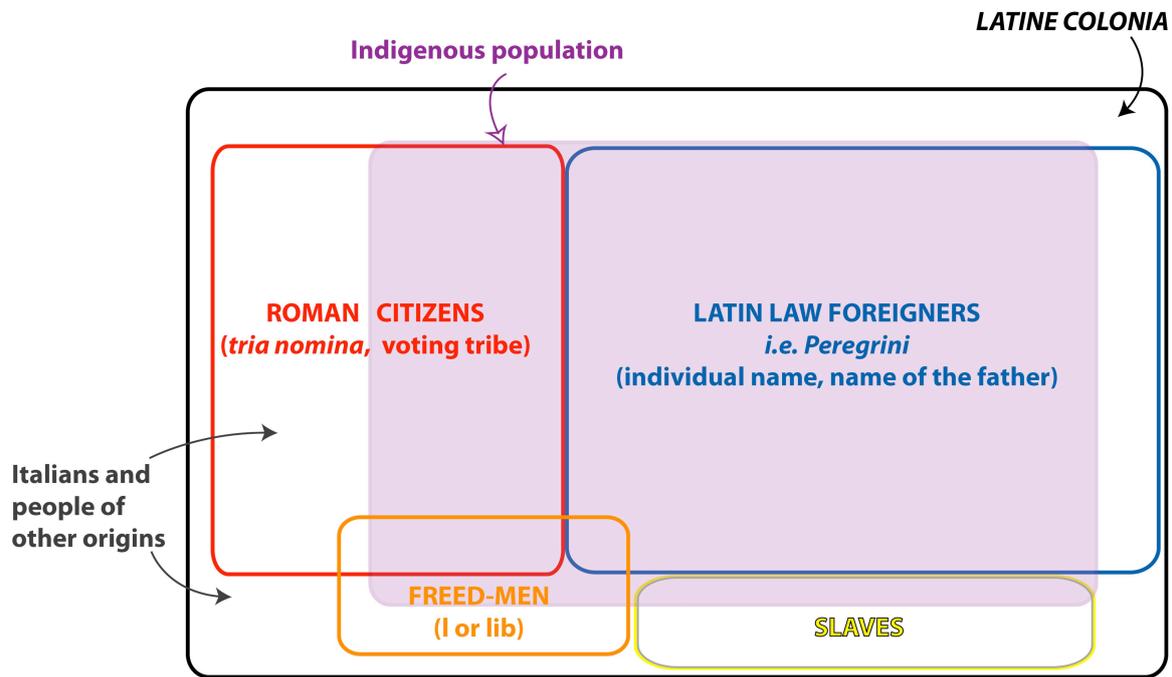


Fig. 23. The different statuses in the Latin colony *Nemausus* (Nîmes). CAD M.-J. Ouriachi.

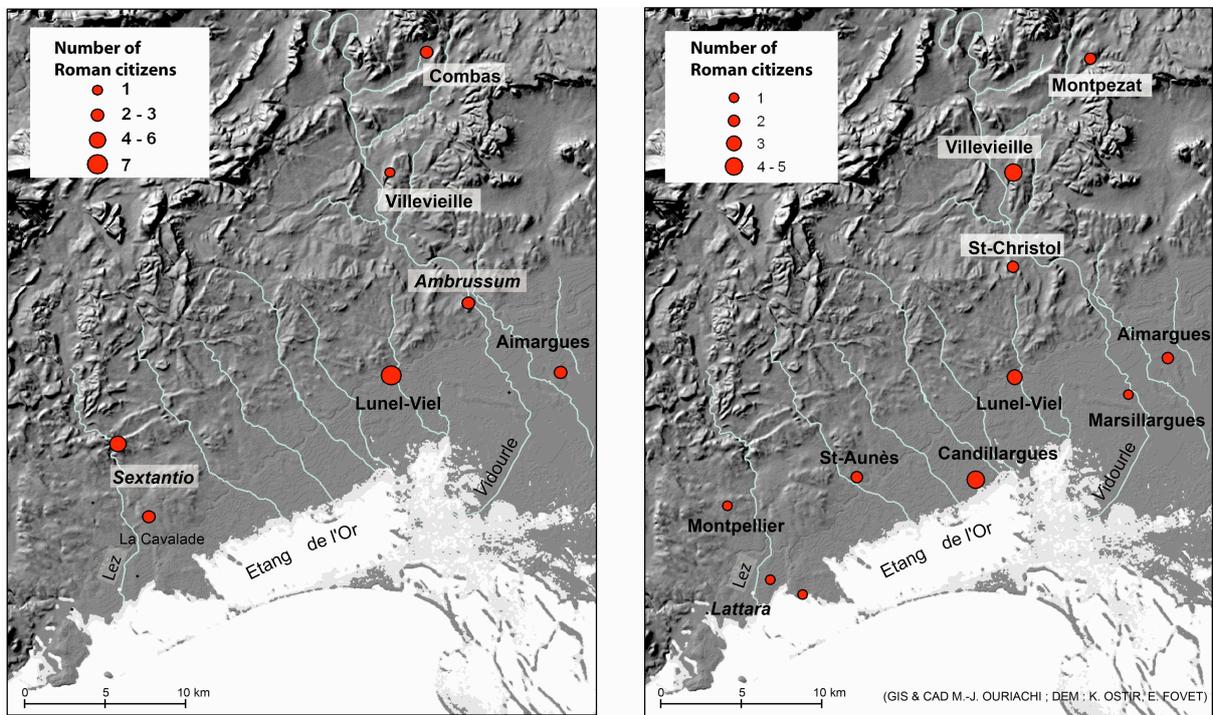


Fig. 24. Roman citizens among the local population between Montpellier and the Vaunage. GIS & CAD M.-J. Ouriachi.

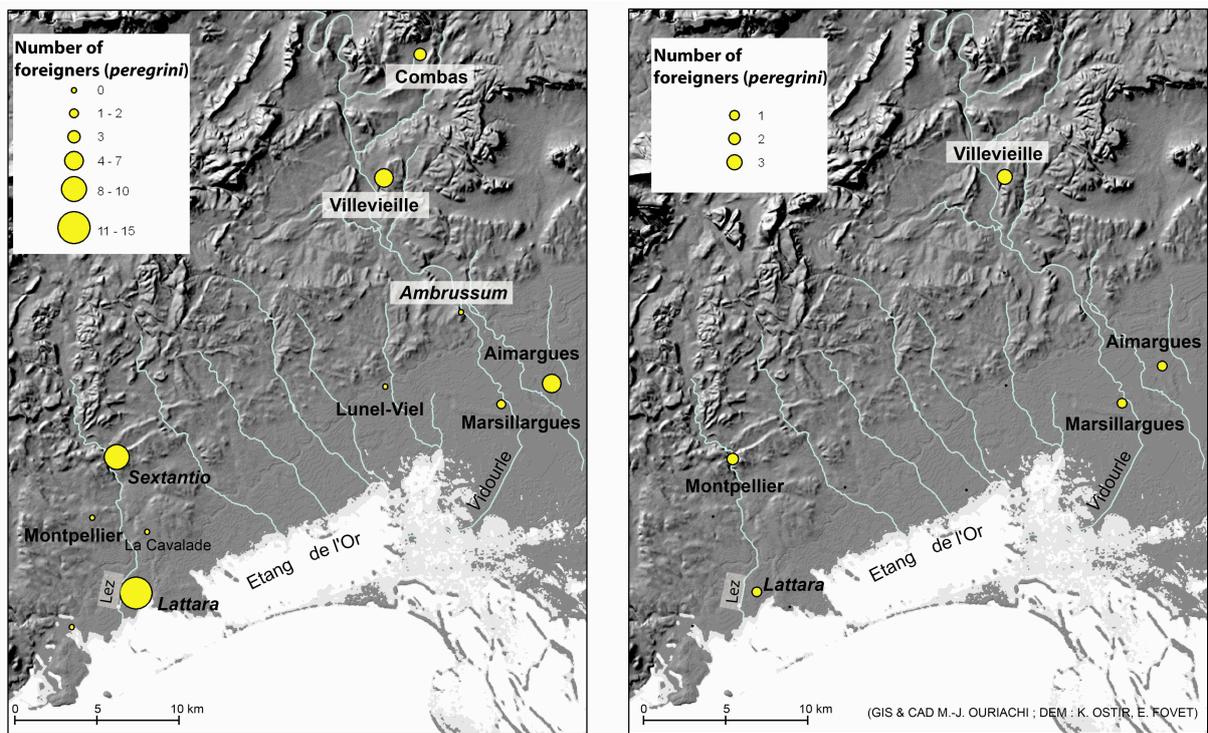


Fig. 25. Foreigners (*peregrini*) among the local population between Montpellier and the Vaunage. GIS & CAD M.-J. Ouriachi.

The maps of localization of Roman citizens reveals a marked upturn in their presence on the coast and in the plain in the 2nd century, which suggests they accompanied—or initiated—the development of these areas from the 1st century onwards. Conversely, very few peregrines left epigraphic traces. It should be specified that those documents about them were located mostly in the agglomerations in the Lez and Vidourle Valleys. Inscriptions also supply indications about the acculturation of local populations, especially through names (Latin or Celtic) (figs 26 and 27). This type of clue may be processed cartographically so as to measure the spread of Latin in the population. From this standpoint, while the localization of Latin names concerns all of the study zone, with a more marked presence on the coast and in the plain, no disappearance of Celtic names is noted, which tends to accredit the argument that the Celtic culture was maintained lastingly in the region.

From inscriptions we can also gain insight into the spatial behaviour of groups such as the *gentes* or aristocratic origin. We first looked at three great families that were well represented in the district of Nîmes, the *Antonii*, the *Pompeii* and the *Valerii*. Cartography—by type of establishment—of these names gives a first indication: those that were related mostly with agglomerated habitats while rural establishments were little concerned (fig. 28). This image must be clarified, though: for one thing citizens provided most of the evidence found in rural areas, probably because of their attachment to an estate that was the mainspring of their fortune and social position. Moreover, the chief-town of the *civitas* occupied a leading position, because it drew in the members of the elite who were eager to embark upon a career. The study of families must also be understood from the standpoint of their—differentiated—settlement across the territory (fig. 29).

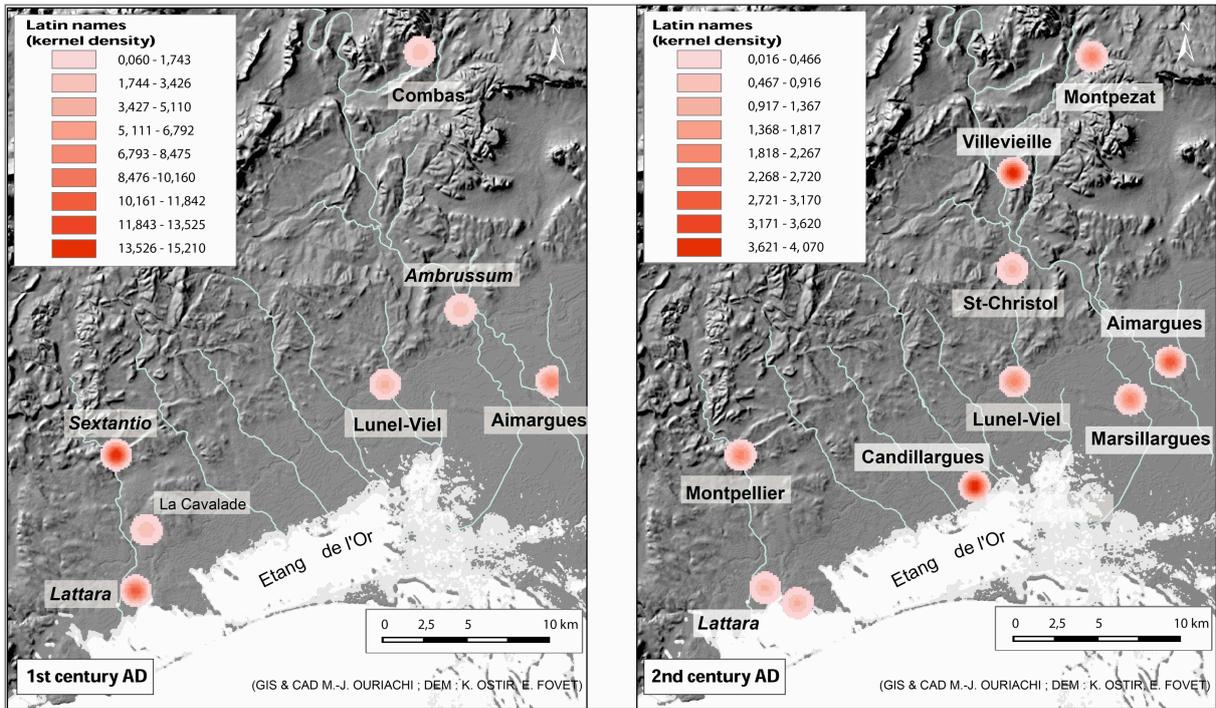


Fig. 26. Location of Latin names (kernel density) between Montpellier and the Vaunage.
GIS & CAD M.-J. Ouriachi.

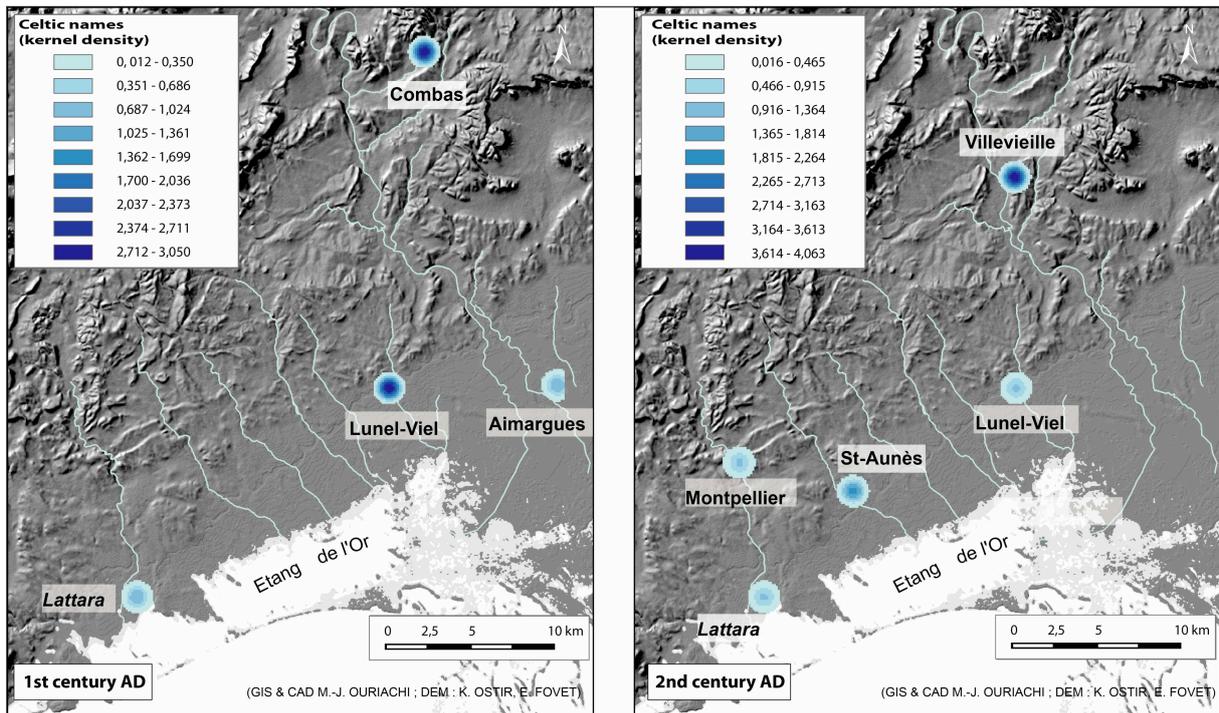


Fig. 27. Location of Celtic names (kernel density) between Montpellier and the Vaunage.
GIS & CAD M.-J. Ouriachi.

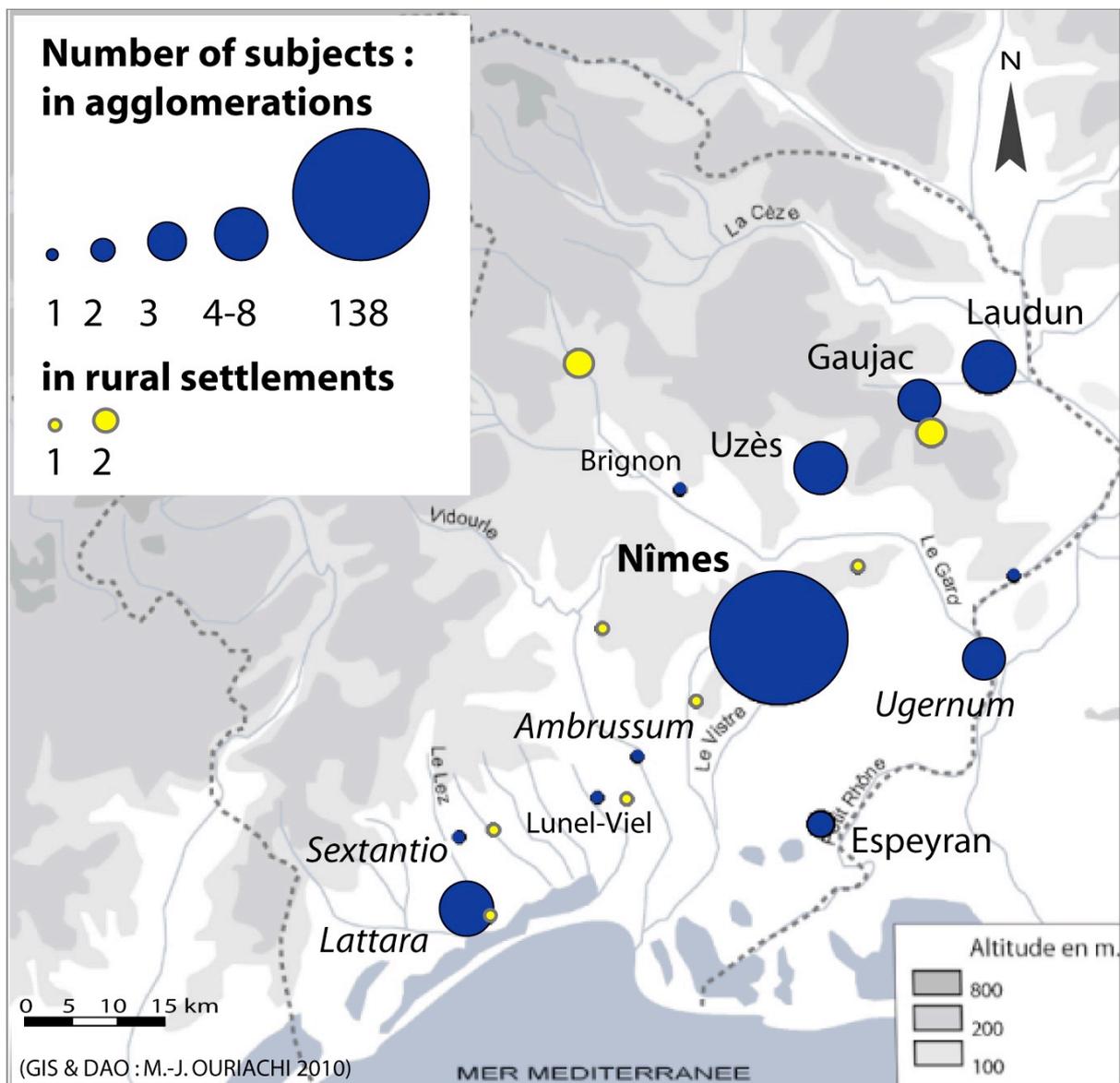
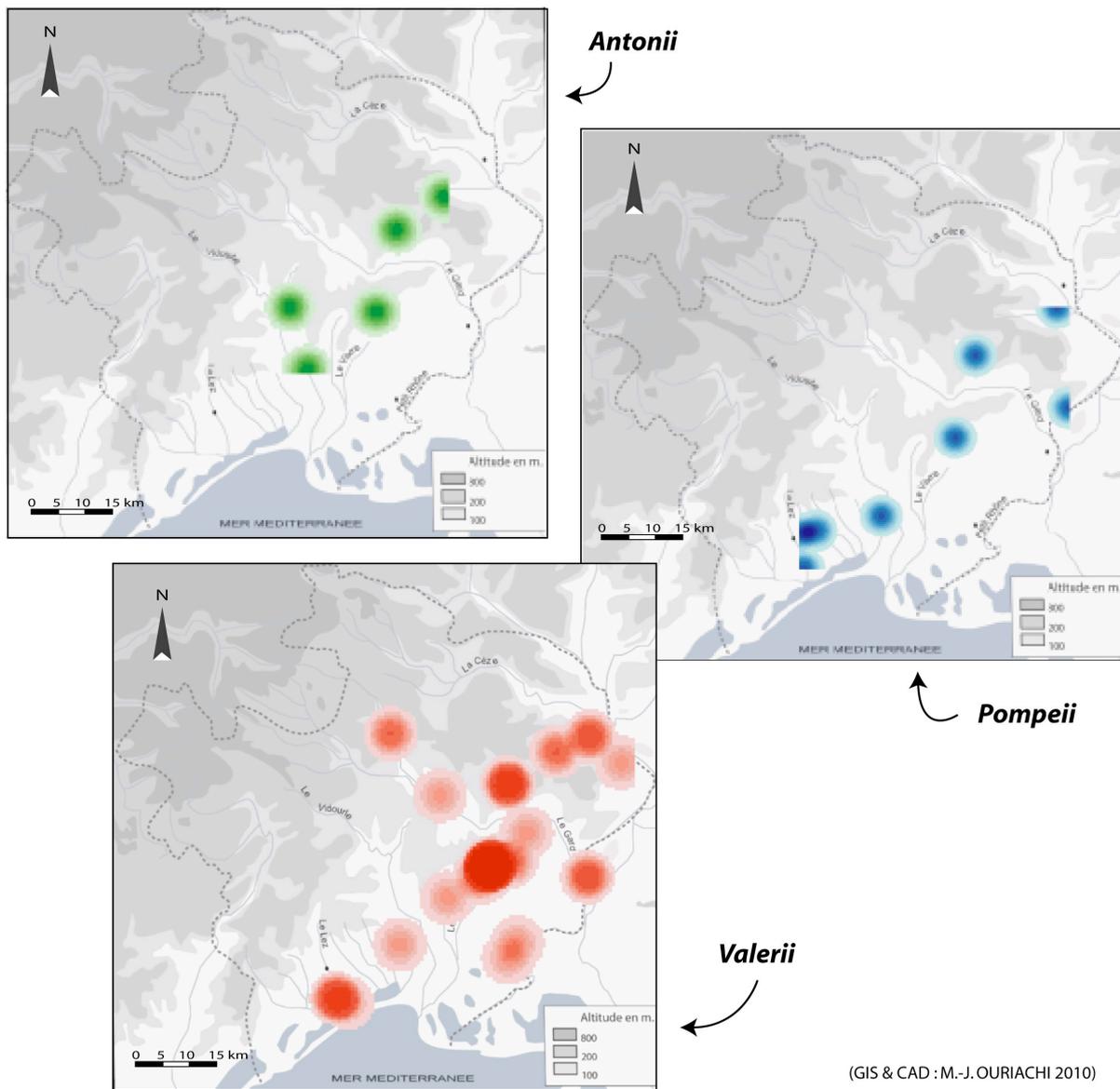


Fig. 28. Location of mentions of the names of three families (*gentes*) — the *Antonii*, *Pompeii* and *Valerii* — in the territory of Nîmes: distribution between agglomerations and rural settlements. GIS & CAD M.-J. Ouriachi.



(GIS & CAD : M.-J. OURIACHI 2010)

Fig. 29. The location of the three families in the territory of Nîmes (kernel density).
GIS & CAD M.-J. Ouriachi.

The analysis becomes fully meaningful when the time dimension is included: the evolution of the geography of the *Valerii* (more than 100 individuals were georeferenced) is related to their settlement of the Espeyran region and the reinforcement of their presence in the chief-town of the *civitas* (fig. 30). The study of all the families represented in our study zone and in the chief-town of the *civitas* — notably through magistrates—confirms this development of settlements in the plain and the shift towards Nîmes, which became increasingly attractive in the 2nd century. Thus epigraphy confirms the salient tendencies identified during the analysis of the settlement system (fig. 31).

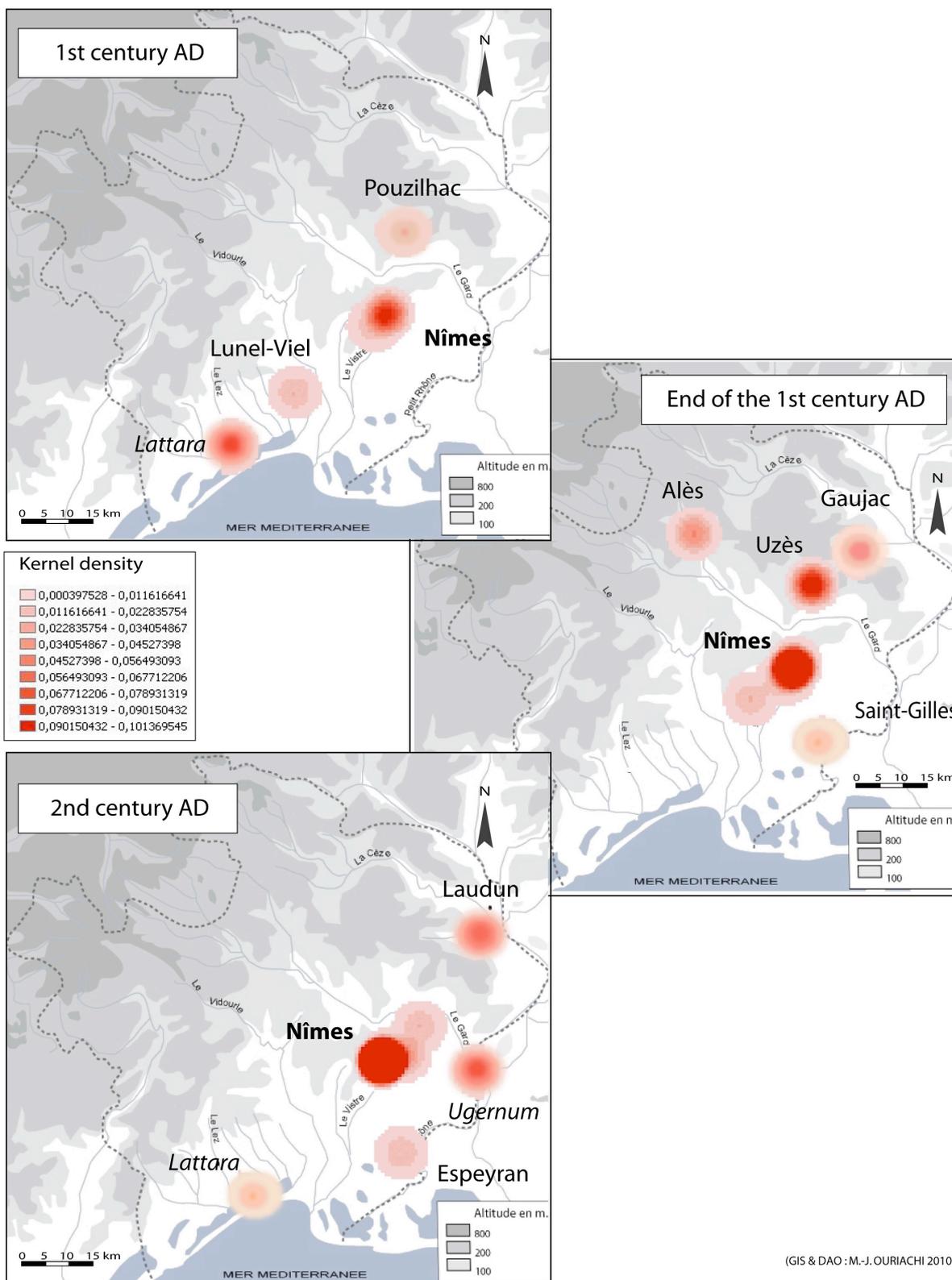


Fig. 30. The location of the *Valerii* (kernel density), from 1st c. AD to 2nd c. AD.
GIS & CAD M.-J. Ouriachi.

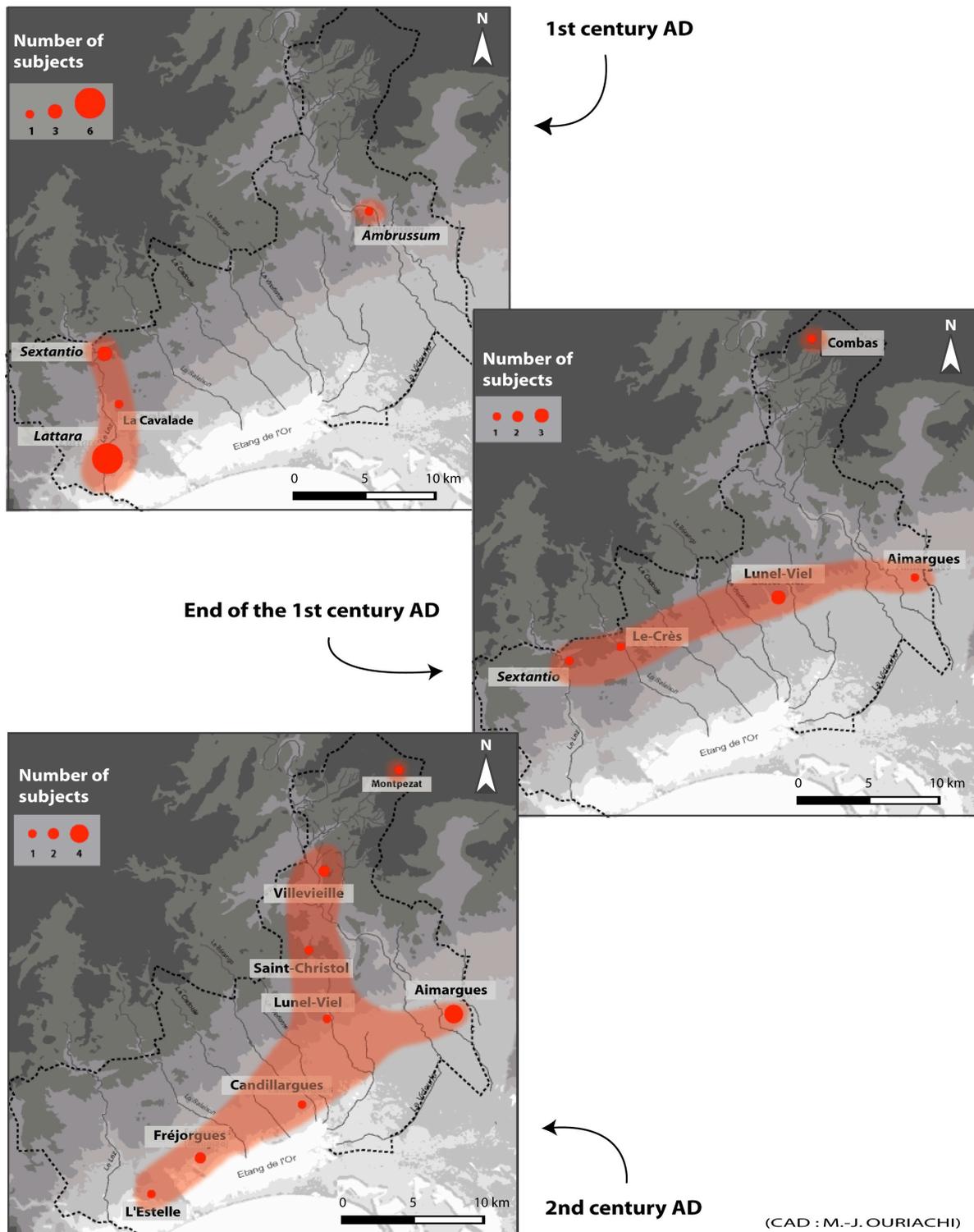


Fig. 31. The evolution of the location of other families of dignitaries in the western part of the territory of Nîmes. GIS & CAD M.-J. Ouriachi.

Figure 32 is an attempt to provide a finer articulation of both types of source, archaeological and epigraphic. The distribution of altars with foliage decoration, which were highly prized by the Romanized elite of the city of Nîmes (Sauron 1983), is compared and contrasted with the distribution of establishments with a luxurious decoration. Comparison of the two maps reveals matches, especially the presence in the two images of *Sextantio*, Mauguio or Lunel-Viel; however, it is the compounding

of the two items of information which matters, because both are indications of the presence of a well-to-do population, which probably played an important role in the development of the city. To be more accurate, the mapping of epigraphic monuments should contain all of the monuments whose fabrication suggests a substantial fortune. This is indicative of the importance of work to be done combining textual data and the physical medium (Ouriachi 2009).

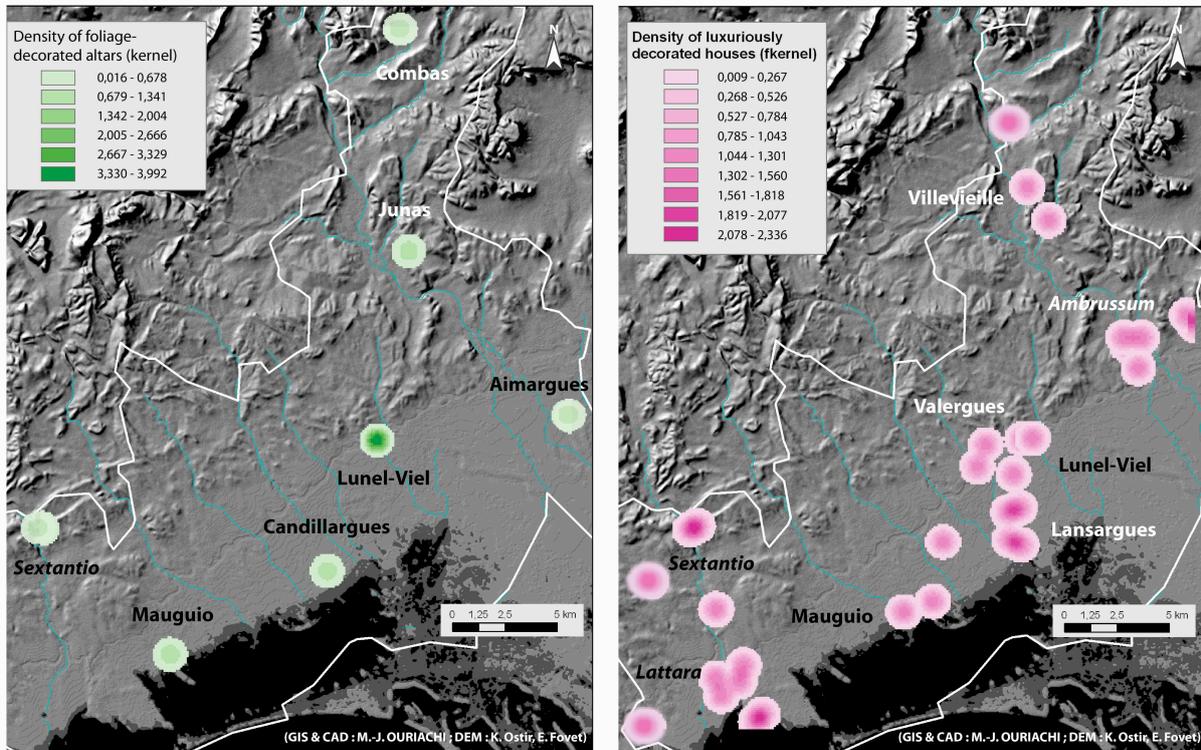


Fig. 32. Comparative spatial distribution of foliage-decorated altars and luxuriously decorated houses. GIS & CAD M.-J. Ouriachi.

Conclusion

The foregoing lines and the documents that go with them reveal the diversity and wealth of studies conducted by a group of researchers in archaeology, history, geography, computer science and environmental science in eastern Languedoc over almost three decades. Interdisciplinarity has been the engine behind the progress recorded in our knowledge of the settlement system grasped over the *longue durée*, in this region of southern Gaul. These studies are also special in that they very quickly put space at the heart of the archaeological and historical issues, so conferring on the spatial dimension a leading heuristic value. This approach first gave precedence to the archaeological record, and now continues by integrating epigraphic data; ultimately it is the confluence of these two types of source, understood in time and space, that should further our knowledge of Ancient societies.

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